Economics of E-cigarettes: Background, Theory, and Evidence

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Slides updated 9/16/2026. Click here for most up-to-date slides. Dr. Pesko's e-cigarette research summary is available here. Send corrections/suggestions to pesko@missouri.edu.

Dr. Pesko has no tobacco or commercial conflicts.

Combustible tobacco use is deadly

- Jha et al. 2013 uses National Health Interview Survey data and linked death certificate data to estimate the association between smoking and mortality.
  - Smoking is associated with at least one decade of life expectancy, as compared with those who have never smoked.
  - Cessation before the age of 40 years reduces the risk of death associated with continued smoking by about 90%.
  - Limitation: assumes smoking is randomly assigned.
- In contrast, using econometric modelling accounting for non-random smoking assignment, Darden, Gilleskie and Strumpf 2018 find smoking reduces life expectancy by 4.3 years.

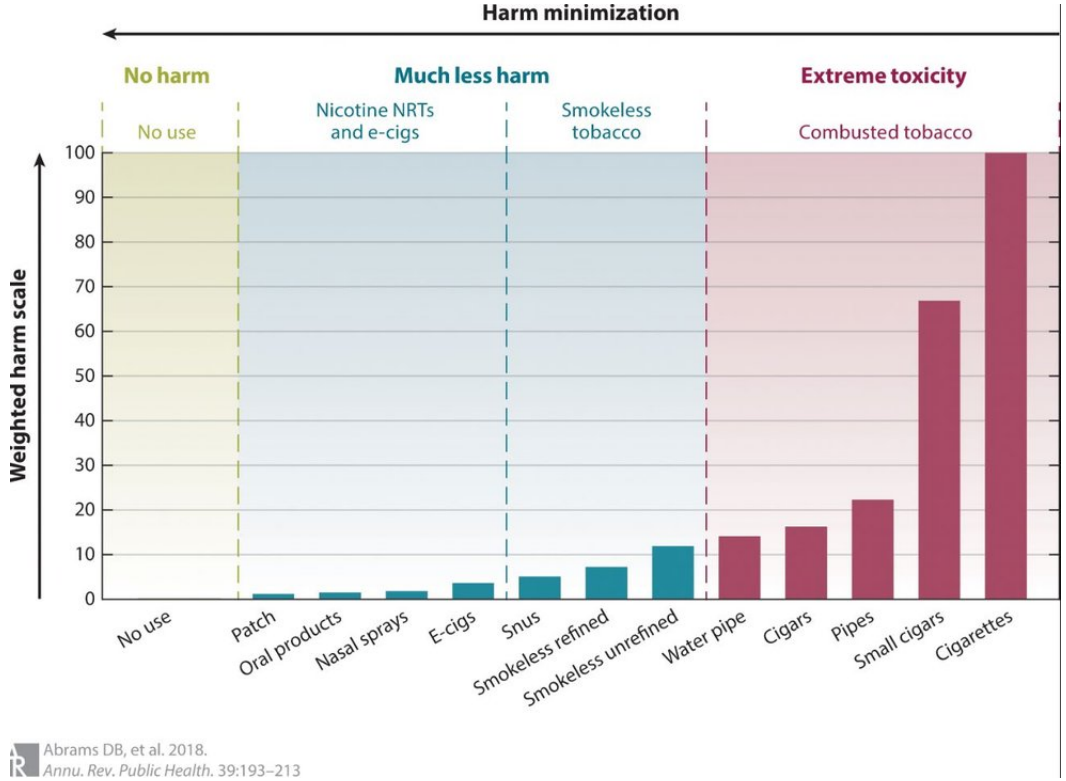
An alternative nicotine product

- E-cigarettes are part of a broader class of devices known as electronic nicotine delivery systems (ENDS).
  - Battery-powered devices that deliver an aerosol containing nicotine, propylene glycol and vegetable glycerin (the liquid base), flavorings, and generally low-level harmful byproducts created during unintended heating events.
  - E-cigarettes are “vaped” not “smoked.”
  - THC-only vapes should not be considered e-cigarettes, though some public health organizations do count these as e-cigarettes.

Tobacco harm reduction?

- Harm reduction is a standard part of public health policy, though its application to e-cigarettes is controversial.
- A harm reduction product mitigates risk from risky activities, whether by having no risk or lower risk.
  - Seat belts for automobile transit
  - Bicycle helmets for bicycle transit
  - Condoms for sex
  - Methadone for substance use disorder
  - E-cigarettes for nicotine addiction?

Are e-cigarettes a safer nicotine product?



Though our understanding of e-cigarettes has improved significantly from 2014 to today, Nutt et al. 2014 provides a useful starting point to think about dangers of different nicotine products (original figure modified by Abrams et al. 2018).

Are e-cigarettes a safer nicotine product?

- Two government-commissioned systematic reviews on the question:
  - The National Academies of Sciences, Engineering, and Medicine (2018) in the United States state that e-cigarettes are not without risk, but compared to combustible tobacco cigarettes they contain fewer toxicants and are likely to be far less harmful than combustible tobacco cigarettes.
  - The United Kingdom's Office for Health Improvement and Disparities (2022) report states that e-cigarettes risk are unlikely to exceed 5% of cigarette risks, at least over short-term and medium-term.

Are e-cigarettes a safer nicotine product?

- US government agencies offer limited statements supporting e-cigarettes being safer products.
  - The CDC states: E-cigarettes have the potential to benefit adult smokers who are not pregnant if used as a complete substitute for regular cigarettes and other smoked tobacco products.
  - The Food and Drug Administration does not believe that nicotine itself is harmful for non-pregnant adults besides causing addiction. The FDA states: “nicotine is what addicts and keeps people using tobacco products, but it is not what makes tobacco use so deadly.”

Are e-cigarettes a safer nicotine product?

- Surgeon General (2016) appears to be an outlier in terms of warning of health dangers of e-cigarettes.
  - "E-cigarette aerosol is not harmless. It can contain harmful and potentially harmful constituents, including nicotine."
  - "Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain."
    - Reviewed studies only document this relationship in rodents and do not show evidence for humans.
- Surgeon General (2018) declared youth e-cigarette use an "epidemic."
  - Unclear why, as an "epidemic" is the spread of a disease or a large number of patients in a small area, and e-cigarettes haven't been shown to cause either.

Are e-cigarettes a safer nicotine product?

Concerns about *e-cigarette or vaping product use-associated lung injury* (EVALI).

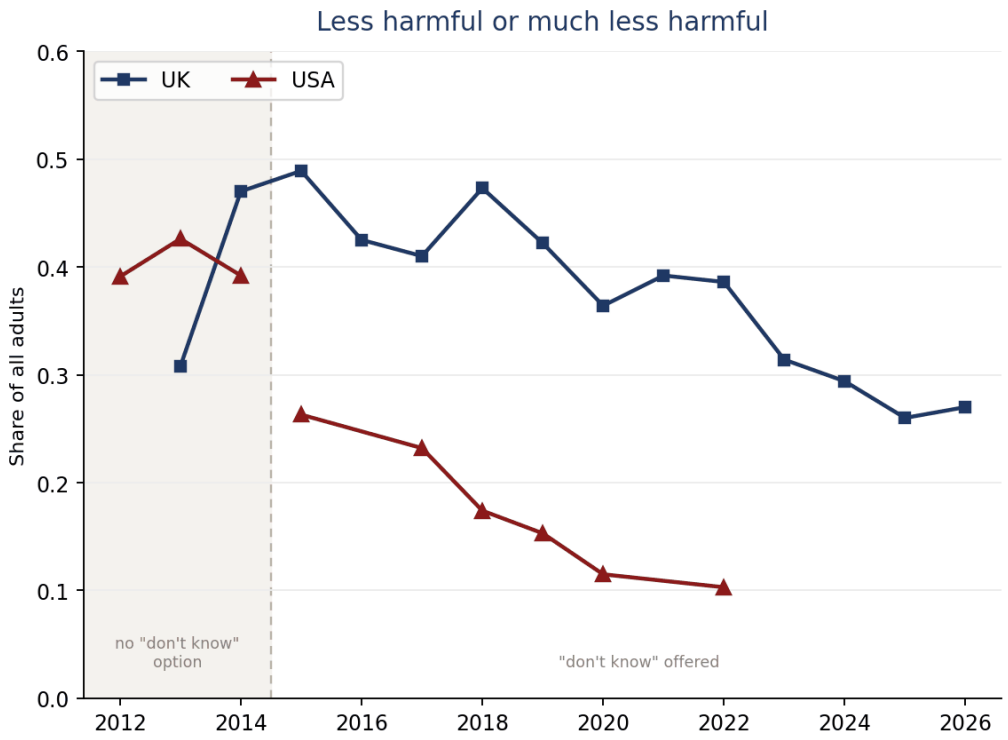
- Despite the name, mostly linked to vitamin E acetate from THC products.
- EVALI being initially wrongly attributed to e-cigarettes caused sharp increases in risk perception relative to cigarettes (Dave et al. 2020).
- Public risk perceptions of e-cigarettes are over-estimated, though not necessarily due to EVALI (Viscusi 2020).
- 75 experts asked the CDC to rename EVALI to more accurately communicate the dangers of THC products to the public, and so that individuals are not unnecessarily fearful of trying to quit cigarettes with e-cigarettes (Pesko et al. 2022).

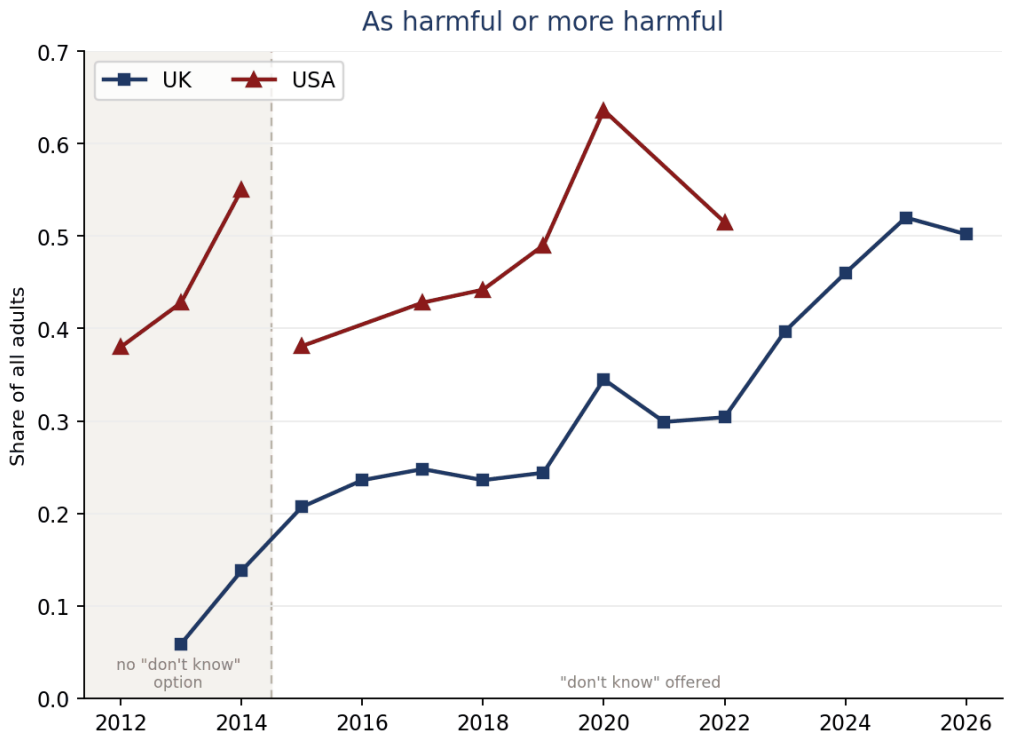
Are e-cigarettes a safer nicotine product?

Individuals on average believe e-cigarettes are more harmful than they are.

- 80% of U.S. physicians incorrectly believe that nicotine causes cancer (Steinberg 2020).
  - More physicians incorrectly believe that nicotine causes cancer than correctly believe that nicotine causes birth defects.

Differences in perceptions of the risk of e-cigarettes compared to cigarettes in the United States and United Kingdom



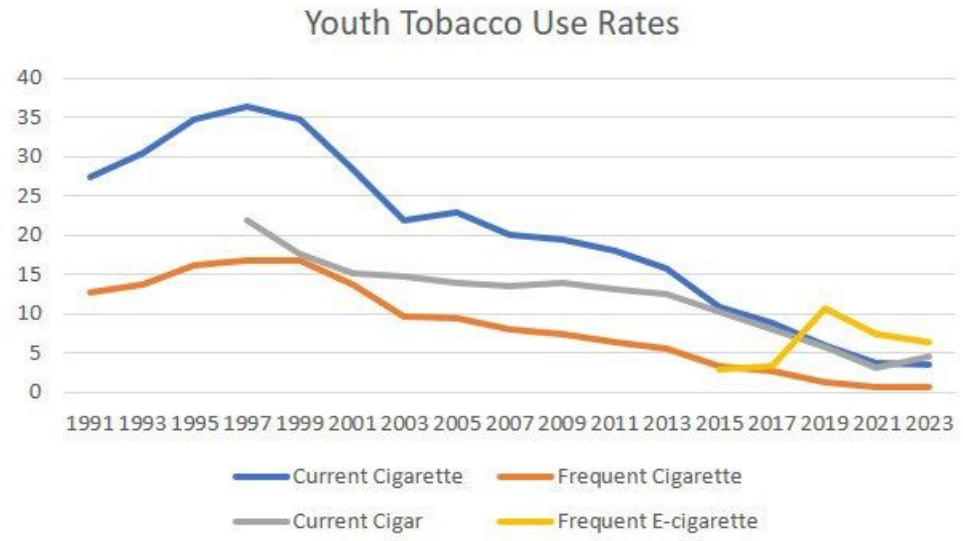


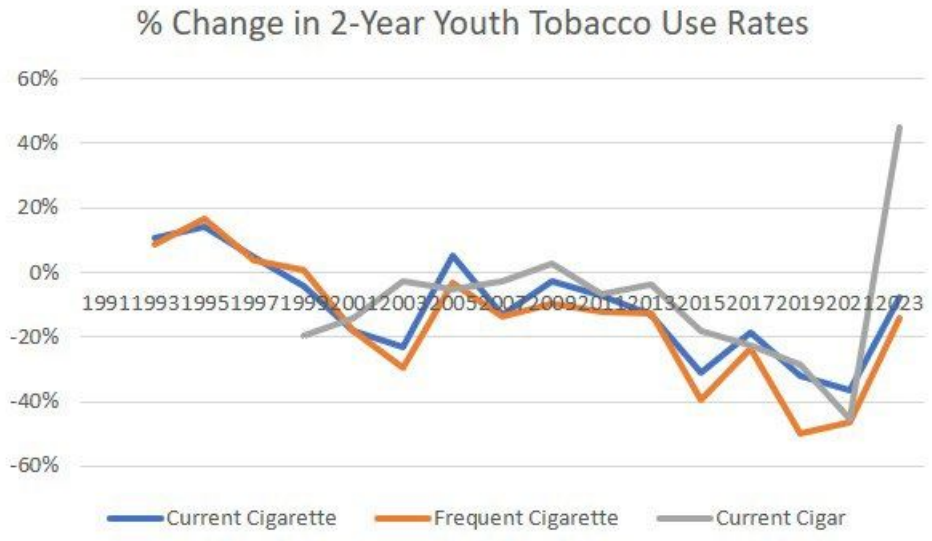
USA: HINTS, weighted with the full-sample person weight. Share of all respondents, with "never heard of e-cigarettes" and "don't know" counted in the denominator and item nonresponse dropped. 2015 uses HINTS-FDA Cycle 1; 2017 uses HINTS-FDA Cycle 2, not HINTS 5 Cycle 1, which offered no "don't know" option and gives 30.5% rather than 23.2%. Not fielded in 2016 or 2021; the relative-harm item was dropped from HINTS 7 (2024) onward.
UK: ASH Smokefree GB, Figure 21, published as a share of adults who have heard of vapes and multiplied here by the awareness share (Figure 21 base ÷ Figure 1 base, unweighted) to put it on an all-adults basis. Awareness imputed at 92% for 2024, where ASH split the sample on question wording, and 93% for 2026.
Break: the US series splits at 2015, when a "don't know" option was added to the questionnaire.

Are e-cigarettes effective smoking cessation products?

- A Cochrane review of the literature found that quit rates were higher in people randomized to nicotine e-cigarettes than to other nicotine replacement therapies, translating to approximately 4 extra quitters per 100 (Hartmann-Boyce 2022).
  - Click here for a presentation of this paper at the Tobacco Online Policy Seminar.
- One particularly strong study: A clinical trial of 886 smokers in England found that e-cigarettes are twice as effective in smoking cessation than other forms of nicotine replacement therapy (Hajek et al. 2019).

Prevalence



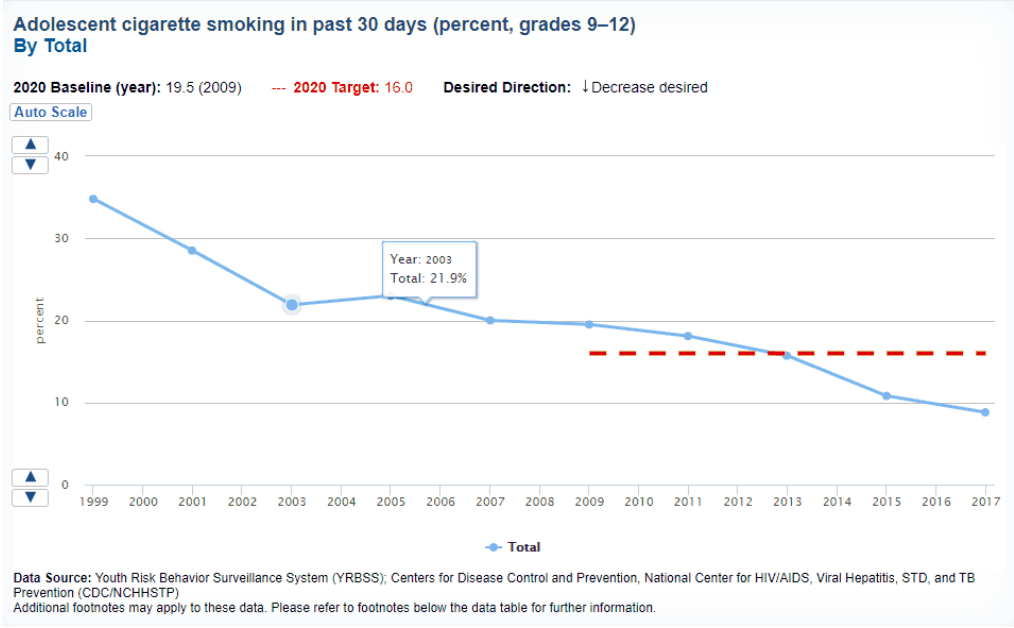


Link: [Youth Risk Behavior Surveillance System Online Tool]

- Youth smoking rates continue declining, contrary to gateway prediction.
- In 2019, 32.9% of youth used an e-cigarette over the past 30 days, but only 10.7% used e-cigarettes frequently (20 or more days over the past 30 days).
- Particularly large declines in smoking in 2015, 2019, and 2021.
  - Frequent cigarette smoking rates fell ≥40% in 2015, 2019, and 2021, compared to two years prior.
  - % change is a useful measure because it compensates for the hardening of smokers as levels fall.
  - E.g., It's easier to reduce smoking by 1 percentage point (pp) when the rate is at 15% than at 5%.

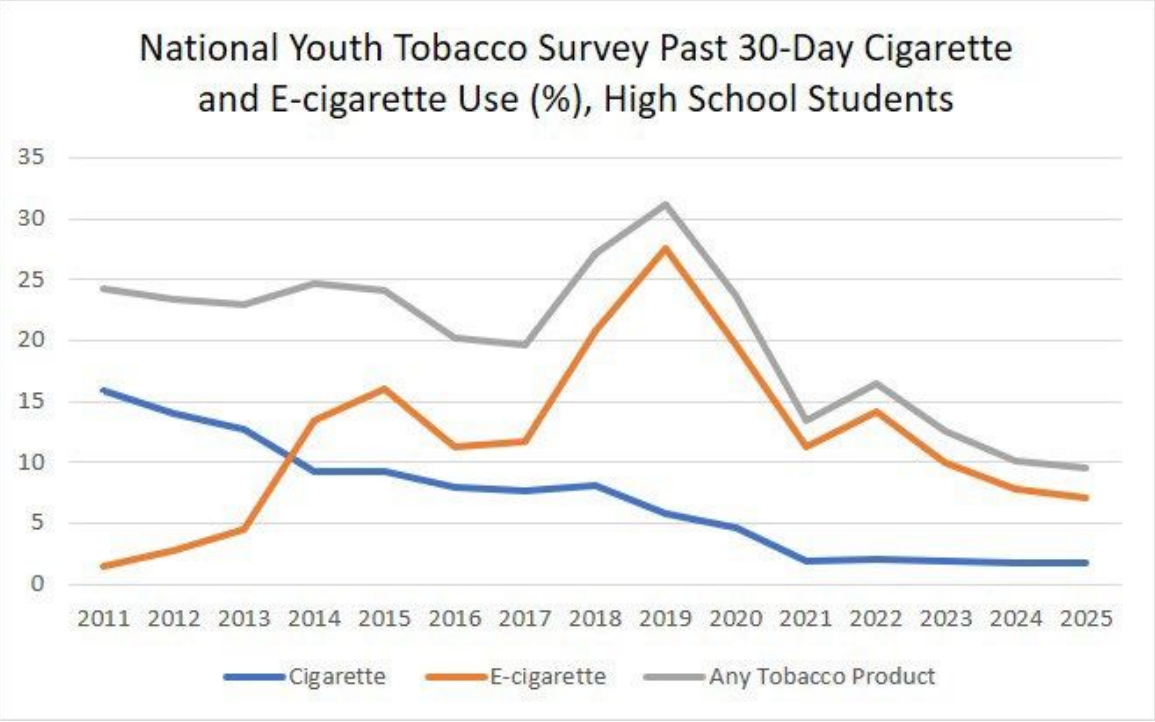
Prevalence

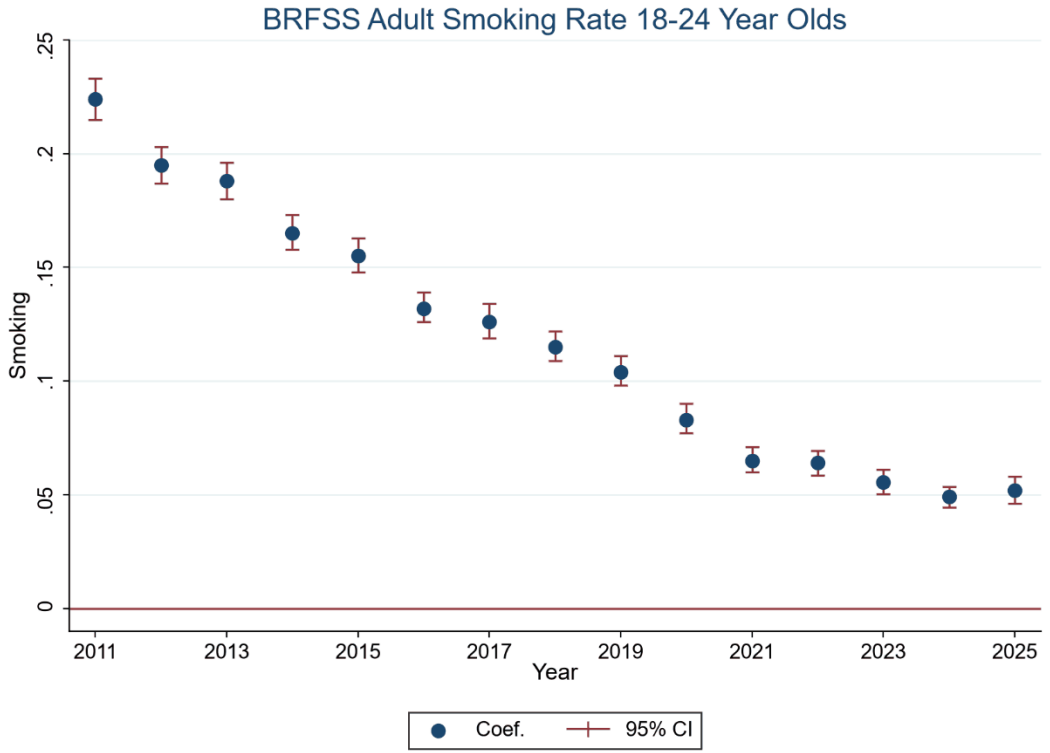
- Large and unexpected decline in youth cigarette use over the past decade since e-cigarettes have come to market.
- In the 2012 Surgeon General report, DHHS Secretary Kathleen Sebelius stated that "youth and adult smoking rates that had been dropping for many years have stalled."
- In 2009, public health leaders in the United States targeted a 16% youth current cigarette use rate as their Healthy People 2020 goal.
    - By 2019, the youth current cigarette use rate was 6%, thus surpassing the Healthy People 2020 goal by 386%.



Data Chart | Healthy People 2020

Prevalence





- Other data sources show the same thing: no youth increase in cigarette use by 2022 despite sizable youth e-cigarette use spikes in 2014-15 and again in 2019.

Prevalence

- The adult current cigarette use rate, which was at 11.5% in 2021, has declined by a more modest 32.4% between 2011 to 2021 compared to the more rapid 80.4% decline for youth.
  - Could higher e-cigarette use among adults translate into the larger reductions in cigarette use observed among youth?
- More recently though, e-cigarette use has been declining among youth and rising among adults. Among adults, current e-cigarette use reached 6.7% in 2025.
- E-cigarette use may be high among pregnant women smokers: In 2014-19, pregnant smokers were approximately 2x more likely to use e-cigarettes (28.9%) than non-pregnant reproductive age women smokers (12.5%) (Abouk et al. 2023).
  - Pregnant women appear to use e-cigarettes in high numbers for smoking cessation.

Gateway?

- So are e-cigarettes displacing cigarettes then?
- Surgeon General (2016) and National Academies of Sciences, Engineering, and Medicine (2018) suggest the opposite that e-cigarette use is strongly associated with the use of other tobacco products among youth and young adults.
  - But arguing a gateway relationship makes little sense since observed rates of cigarette use have continued their decline and accelerated as a percent of remaining smokers.
  - Quasi-experimental evidence (presented later) also generally supports the opposite conclusion that restricting e-cigarette availability increases cigarette use.

Gateway?

- The Surgeon General report only used studies of current e-cigarette use on future cigarette use, without using a source of experimental (or quasi-experimental) variation in current e-cigarette use.
  - Likely large omitted variable bias affecting youths' propensity to vape today and smoke tomorrow.
  - Pesko 2022 describes these methodological shortcomings and how quasi-experimental methods can produce correct, causal estimates.
    - Video discussion also available here.
  - Quasi-experimental studies published at the time of writing were not included in the report. Pesko and Warman 2022

How might we think about optimally regulating e-cigarettes?

- *New England Journal of Medicine* perspective pieces suggest:
  - "We believe that national, state, and local policymakers should consider an approach that differentially taxes nicotine products in order to maximize incentives for tobacco users to switch from the most harmful products to the least harmful ones" (Chaloupka, Sweanor, Warner 2015).
  - Concept reaffirmed in Sindelar 2020 and Balfour 2021.
- The Royal College of Physicians in England 2021 specifically recommends a 5% tax.

Perhaps this same reasoning can be extended to non-monetary regulations as well (e.g. e-cigarette flavors sold in adult-only stores).

How might we think about optimally regulating e-cigarettes?

- Lillard 2020 provides a theoretical model in which nicotine is the primary object demanded by e-cigarette consumers, though other factors such as health and convenience are demanded as well.
- Demand considerations:
  - The shadow price of nicotine actually delivered into the bloodstream from a particular device
  - Social costs (or benefits) of using a device
  - Mental or health degradation suffered when using a device

- Levy et al. 2021 provide an overview of structural aspects of the e-cigarette marketplace in the United States, particularly as it relates to Altria-JUUL deal. (video discussion)

How might we think about optimally regulating e-cigarettes?

- Economics approach to maximizing social welfare.
  - Used by the FDA in the federal rulemaking process:

  Social benefit of e-cigarette regulation =
  reduced externalities + reduced internalities - lost consumer surplus
  - increased enforcement costs

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  - Externalities are costs imposed on others, internalities are unrealized costs imposed on oneself.
    - Positive externalities/internalities may also exist, such as if e-cigarettes reduce cigarette use and/or are safer. These would be entered into the equation as a negative number.

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  - Consumer surplus is the price that individuals would pay for e-cigarettes beyond what they currently pay.
    - Concept: Consumer surplus monetizes "pleasure" that people receive from using e-cigarettes, which is reduced by regulation.

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  - Enforcement costs include youth undercover buyer sting inspection programs, tobacco surveillance activities, and tobacco tax audits.
    - These costs are generally small currently, though attempting to criminalize tobacco would likely result in exploding enforcement costs (e.g., police, jails).

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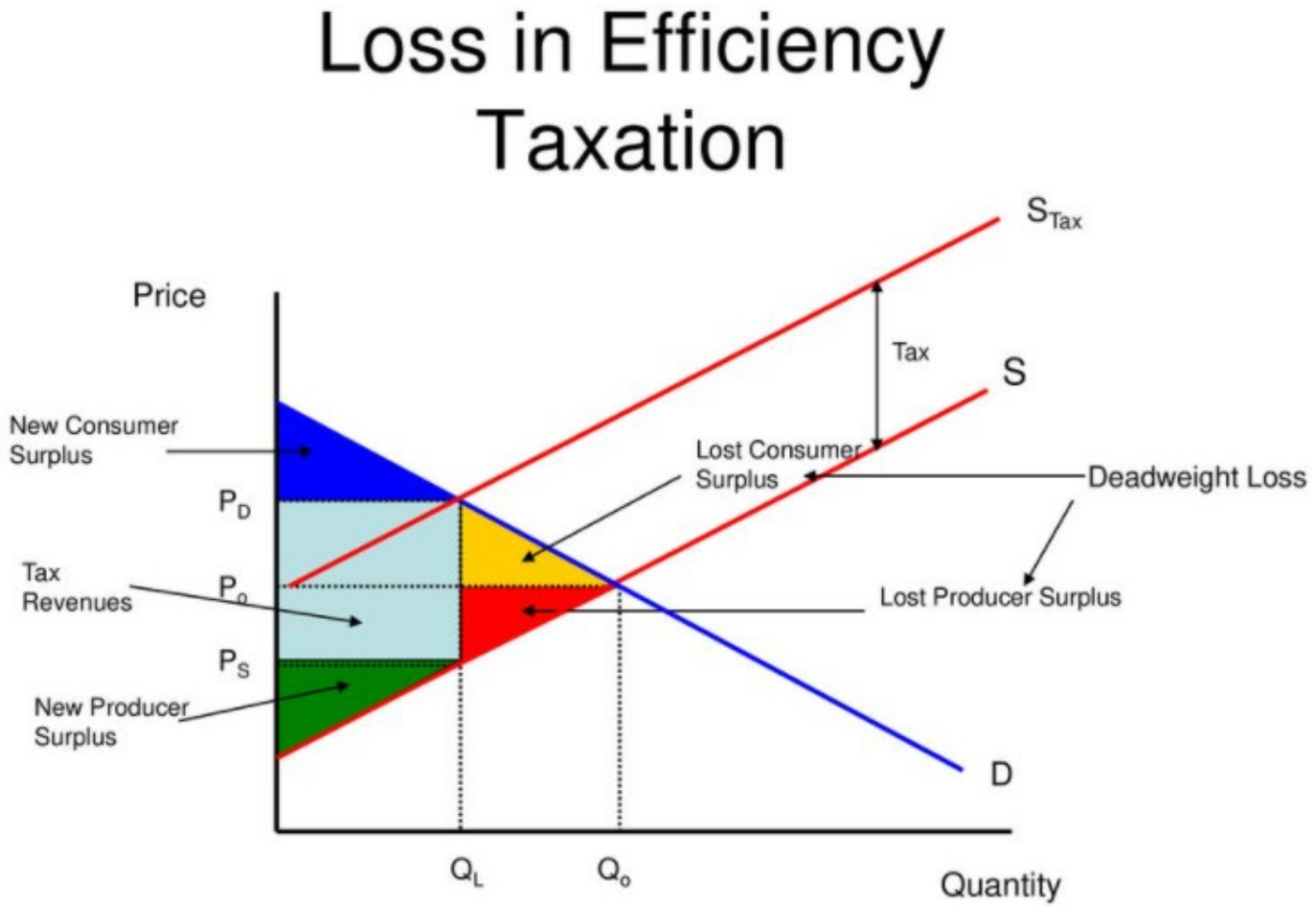
Social benefit of e-cigarette regulation =
reduced externalities + reduced internalities - lost consumer surplus - increased enforcement costs

  - If there is a negative social benefit of e-cigarette regulation, then the optimal policy is a subsidy rather than regulation.
    - Similar in concept to insurance paying for FDA-approved nicotine replacement therapy.

How might we think about optimally regulating e-cigarettes?



Slideplayer.com

History of E-cigarette Regulations in the USA

- August 2006: E-cigarettes first enter the United States market.
- March 2009: FDA declares e-cigarettes to be an unauthorized drug.
- June 2009: Food and Drug Administration's Center for Tobacco Products (FDA-CTP) established by Congress, with broad authority to regulate nicotine products "derived from tobacco."
- January 2010: District court sides with industry and rules that the FDA cannot regulate e-cigarettes as a drug and can only regulate e-cigarettes as tobacco products.
- March 2010: New Jersey implements the first e-cigarette minimum legal sale age (MLSA) and comprehensive e-cigarette indoor use ban (workplaces, restaurants, bars).
- August 2010: Administrative ruling in Minnesota results in the first e-cigarette tax in the nation.

History of E-cigarette Regulations in the USA

- April 2014: The FDA proposes new regulations to “deem” e-cigarettes and other tobacco products as subject to regulations by the FDA-CTP.
- June 2015: The Juul e-cigarette first introduced.
- May 2016: FDA-CTP issues a final rule that among other things requires e-cigarettes to carry a warning label and implements a national e-cigarette MLSA of 18.
- August 2016: Final rule comes into effect. Additionally, e-cigarettes on the market are eligible to submit a Pre-Market Tobacco Product Application (PMTA) by 2019 to become legally sold (later extended to 9/2020). These e-cigarettes must demonstrate “appropriateness for the protection of public health.” Enforcement discretion allows them to remain on the market until the PMTA application process is resolved.
- Sept. 2018: Juul reaches market share of 72% of all e-cigarette sales, coinciding with a sharp increase in youth e-cigarette use.
- Nov. 2018: The FDA requests that e-cigarette manufacturers not sell e-cigarettes online without strict age verification, limit bulk purchases of e-cigarettes, and remove flavored e-cigarettes from stores that minors can access. The FDA threatens to revoke enforcement discretion if e-cigarette companies are not compliant.

History of E-cigarette Regulations in the USA

- Oct. 2019: Under further scrutiny from the FDA and press, Juul voluntarily ceases selling flavors besides tobacco or menthol.
- Oct. 2019: The CDC introduces the term “E-cigarette, or vaping, product use-associated lung injury” (EVALI) in response to lung injuries primarily affecting THC vaping.
- Dec. 2019: Tobacco-21 law (covering all tobacco products including e-cigarettes) implemented nationally.
- Feb. 2020: FDA bans flavored, cartridge-based e-cigarette products (other than tobacco- or menthol-flavored products).
- July 2020: FDA orders Puff Bar and other disposable closed-system e-cigarette products off the market because they were not complying with FDA requests on flavors and were used in high numbers by youth.
- Sept. 2020: PMTA applications due that demonstrate appropriateness of e-cigarettes for public health.
- Feb. 2021: Puff Bar returns to the market with a synthetic “tobacco free nicotine” closed system product that puts them outside the regulatory authority of the FDA-CTP.

History of E-cigarette Regulations in the USA

- Oct. 2021: FDA grants marketing orders for three e-cigarette products, marking the first time e-cigarettes are legally sold in the United States.
- March 2022: Congress expands FDA-CTP's ability to regulate synthetic nicotine products: "made or derived from tobacco, or containing nicotine from any source"
- May 2023: Spree Bar launched that uses a synthetic nicotine analogue, "metatine." Advertised as being a similar compound to nicotine with the same psychoactive attributes.
- Oct. 2023: Oklahoma's vapor product directory takes effect, the first state PMTA "registry" law. Only products with an FDA marketing order or pending application may be sold.
- Sept. 2024: Tobacco-21 Final Rule published.
- July 2025 and Aug 2026: FDA authorizes Juul. On July 17, 2025, FDA authorized five Juul products — the device plus Virginia Tobacco and Menthol pods at 3% and 5%. On Aug 28, 2026, it authorized the JUUL2 device and tobacco and menthol pods at 18 mg/mL.

Literature on Minimum Legal Sale Ages

- Three studies use two-way fixed effect (TWFE) models and find that e-cigarette minimum legal sale age (MLSA) laws increase teen current cigarette use by approximately 0.8 to 1.0 percentage points (pp) (Friedman 2015; Pesko et al. 2016; Dave et al. 2019).
  - Friedman uses the National Survey on Drug Use and Health
  - Other studies use Youth Risk Behavior Surveillance System
- One study uses Callaway-Sant'anna estimator to find that e-cigarette MLSAs increase teen daily cigarette use by 0.6 pp (Pesko 2023).
  - Ever e-cigarette use decreases by 2.2 pp.

Literature on Minimum Legal Sale Ages

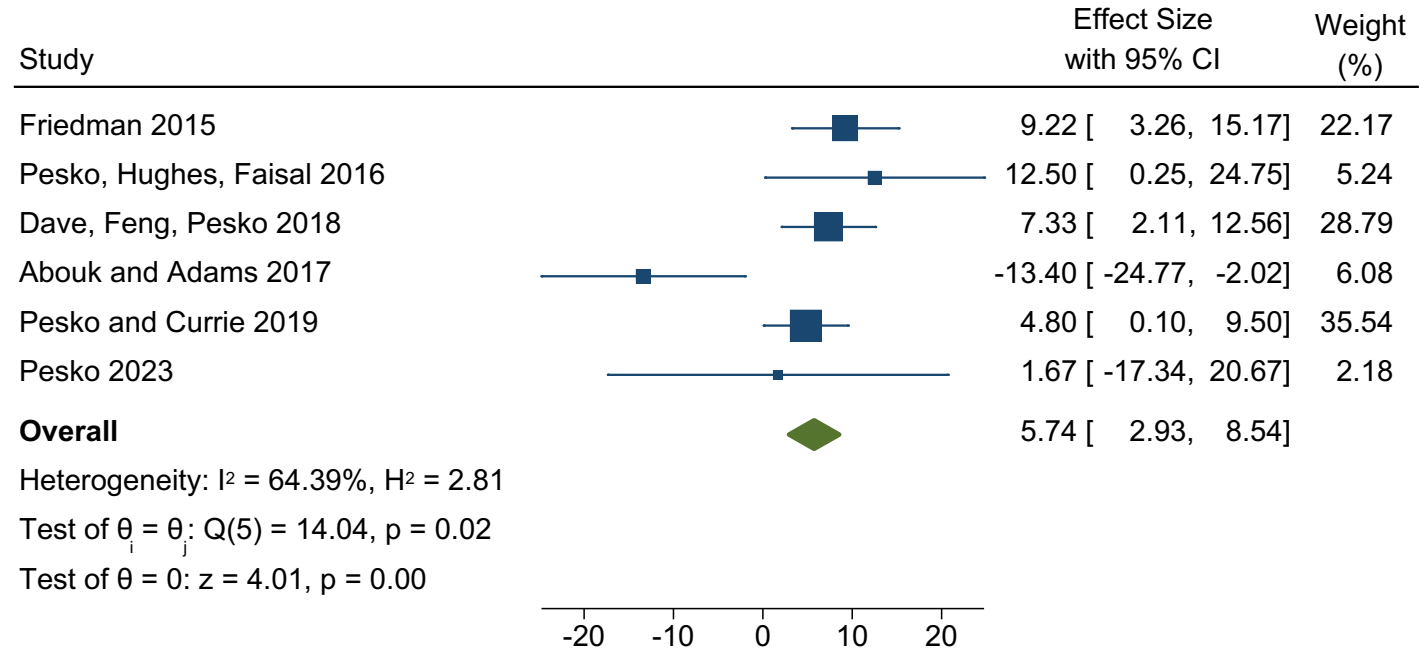
- Two studies estimate the effect of e-cigarette MLSA laws on subgroups of youth.
  - Using Monitoring the Future data and a TWFE model, e-cigarette MLSAs decrease high school senior current cigarette use by 2.0 pp (Abouk and Adams 2017).
  - Using an individual fixed effect model, e-cigarette MLSAs increase cigarette use by 0.6 pp among rural, underage pregnant teenagers (Pesko and Currie 2019).

Literature on Minimum Legal Sale Ages

- One study (Nguyen 2020) uses Canadian data on youth e-cigarette use from 2013-17 to study province-level e-cigarette MLSAs.
- Difference-in-differences models suggest MLSAs:
  - Reduce e-cigarette use among youth by 4.3 pp (more than halving the increase that would otherwise occur).
  - Reduce belief that regular e-cigarette use poses no harm by 2.6 pp.
  - Increase self-reported greater difficulty in obtaining e-cigarettes by 6.2 pp.
  - Study does not include cigarette use as outcome.
- Another recently published concurrent study finds that e-cigarette MLSAs reduce underage e-cigarette use for 12th graders using a regression discontinuity design (DeSimone, Grossman, and Ziebarth 2022).

Literature on Minimum Legal Sale Ages

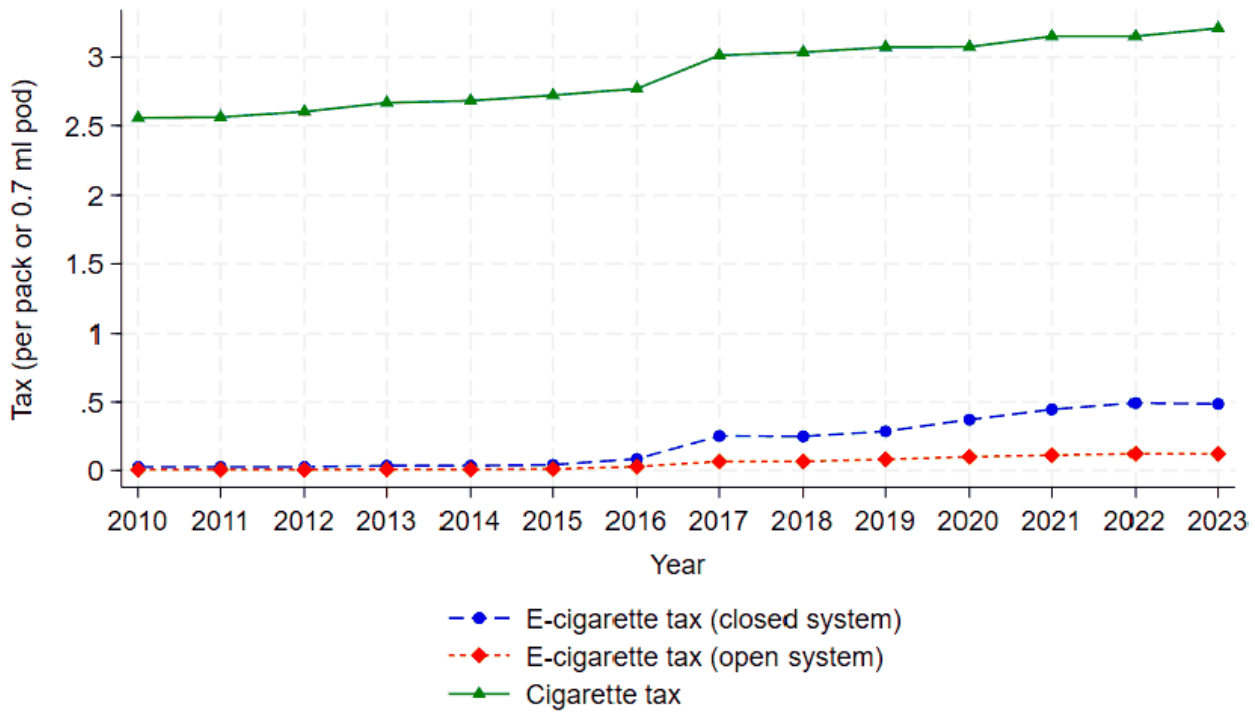
Meta-analysis finds that e-cigarette MLSAs increase current teen cigarette use by 5.7%



Literature on E-cigarette Tax Rates

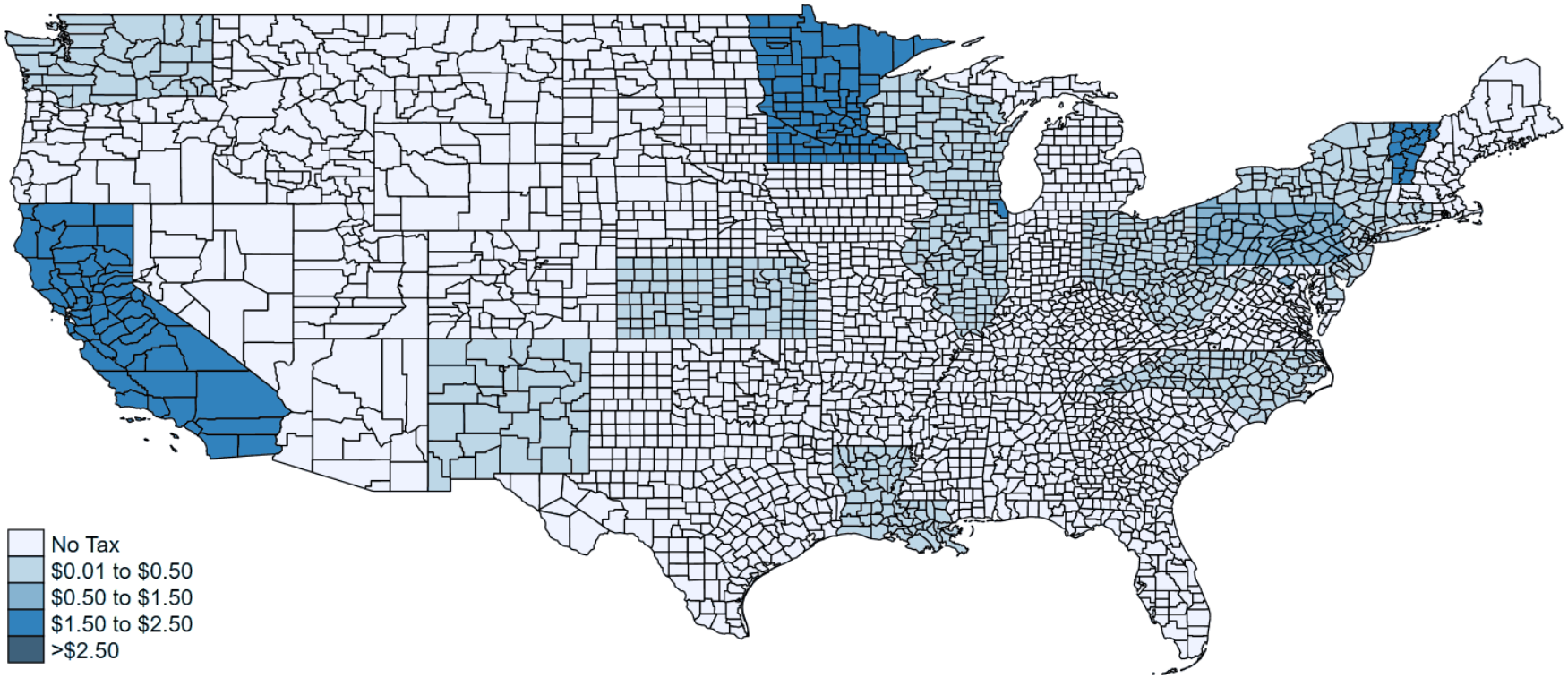
- Prices are endogenous because of omitted variables affecting market-level e-cigarette demand and individual-level e-cigarette use.
- Solution is to use an exogenous source of variation in e-cigarette prices.
- One approach is to use a discrete choice experiment with experimental variation in e-cigarette prices (Pesko et al. 2016; Kenkel et al. 2020; Marti et al. 2019; Shang et al. 2020).
- Alternatively, explore the effect of e-cigarette taxes as a plausibly exogenous source of variation for prices.
  - One challenge is that e-cigarette taxes are levied differently across states: unit excise, ad valorem, sales, and two-tier.
  - Paper provides a methodology and database of standardized taxes (Cotti et al. 2024).

Literature on E-cigarette Tax Rates



Standardized tax rate using Cotti et al. 2024 methodology.

E-cigarette Taxes through end of 2019



Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

E-cigarette Tax Rates on Tobacco Product Sales

- Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022 uses Nielsen retail sales data for 27,817 stores participating each year from 2013 to 2019 to estimate cigarette and e-cigarette price and tax responsiveness.
  - Uses standardized tax values from Cotti et al. 2021.
  - Click here for a presentation of this paper at the Tobacco Online Policy Seminar.

Almost full pass-through of e-cigarette taxes to prices

Table 1

Effect of e-cigarette and cigarette taxes on e-cigarette prices using a two-way fixed effects model: NielsenIQ retail sales UPC-level data 2013-2019.

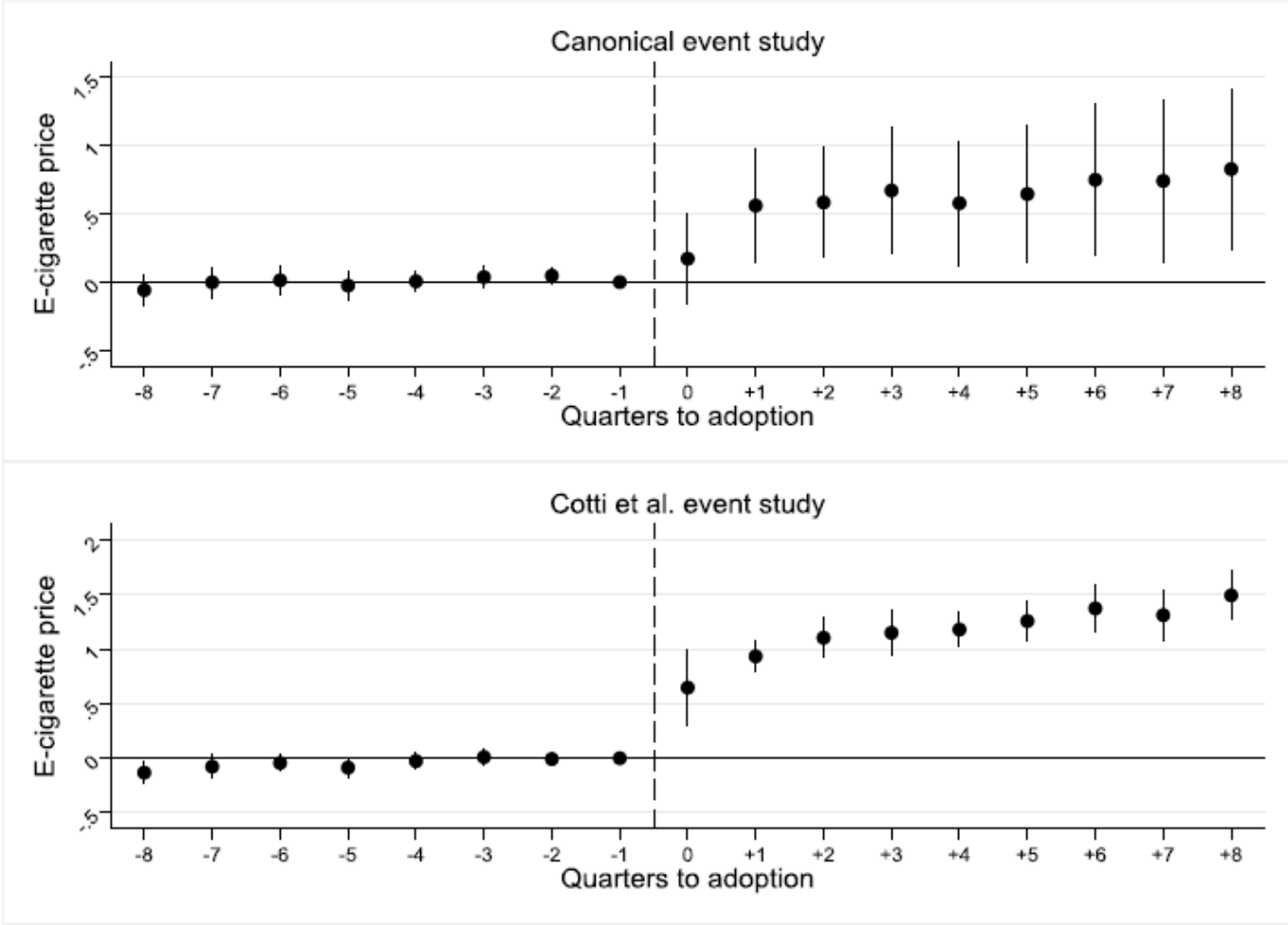
Outcome:	Prices					
E-cigarette tax ($):						
Beta	1.011***	0.980***	0.977***	0.963***	0.996***	0.900***
(SE)	(0.076)	(0.072)	(0.071)	(0.076)	(0.043)	(0.080)
Cigarette tax ($):						
Beta	0.157*	0.124	0.127	0.135	0.016	0.022
(SE)	(0.085)	(0.087)	(0.086)	(0.085)	(0.022)	(0.089)
Period (quarter-by-year) fixed effects	Y	Y	Y	Y	n/a	n/a
Locality fixed effects	Y	Y	Y	Y	Y	n/a
Tobacco control policies	N	Y	Y	Y	Y	Y
Substance use policies	N	N	Y	Y	Y	Y
Demographics	N	N	N	Y	Y	Y
UPC-by-period fixed effects	N	N	N	N	Y	Y
UPC-by-locality fixed effects	N	N	N	N	N	Y
Observations	126,725	126,725	126,725	126,725	126,725	126,725
Mean: E-cigarette price in e-cigarette tax adopting localities, year prior to the tax ($)	4.769	4.769	4.769	4.769	4.769	4.769

Notes: The unit of observation is a UPC-code in a locality (state or county) in a period (quarter-by-year). All models estimated with least squares. Data are weighted by the share of e-cigarette sales in localities that do not adopt an e-cigarette tax. Standard errors that account for within-locality clustering are reported in parentheses. SE=standard error.

***,**, and * = statistically different from zero at the 1%, 5%, and 10% level.

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

Evidence of the parallel trends assumption: taxes have no effect on prices in the pre-tax adoption period (extra details here).



Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

A $1 increase in e-cigarette prices (instrumented) leads to a 47% decline in e-cigarette sales. Own-price elasticity = -2.2.

Sales outcome:	**E-cigarettes**	**Cigarettes**
Instrumented e-cigarette price ($)		
Beta	-837***	4,417**
(SE)	(274)	(1,803)
Price elasticity	-2.20	0.43
Instrumented cigarette price ($)		
Beta	263	-4,223***
(SE)	(238)	(1,565)
Price elasticity	1.09	-0.39
Cragg-Donald Wald *F*-statistic	117.686	117.686
Covariates:		
Locality fixed effects	Y	Y
Period (quarter-by-year) fixed effects	Y	Y
Tobacco control policies	Y	Y
Substance use policies	Y	Y
Demographics	Y	Y
Observations	1,428	1,428
Means in e-cigarette tax localities, year prior to tax		
Sales	1,770	47,956
Prices	4.643	7.185
Means in cigarette tax localities, year prior to tax		
Sales	1,445	65,637
Prices	4.406	5.992

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

The same $1 increase in e-cigarette prices (instrumented) increases cigarette pack sales by 9%. Cross-price elasticity = 0.43.

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Means in cigarette tax localities, year prior to tax		
Sales	1,445	65,637
Prices	4.406	5.992

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

A $1 increase in cigarette price (instrumented) reduces cigarette sales by approximately 6%. Own-price elasticity = -0.39.

Sales outcome:	**E-cigarettes**	**Cigarettes**
Instrumented e-cigarette price ($)		
Beta	-837***	4,417**
(SE)	(274)	(1,803)
Price elasticity	-2.20	0.43
Instrumented cigarette price ($)		
Beta	263	-4,223***
(SE)	(238)	(1,565)
Price elasticity	1.09	-0.39
Cragg-Donald Wald *F*-statistic	117.686	117.686
Covariates:		
Locality fixed effects	Y	Y
Period (quarter-by-year) fixed effects	Y	Y
Tobacco control policies	Y	Y
Substance use policies	Y	Y
Demographics	Y	Y
Observations	1,428	1,428
Means in e-cigarette tax localities, year prior to tax		
Sales	1,770	47,956
Prices	4.643	7.185
Means in cigarette tax localities, year prior to tax		
Sales	1,445	65,637
Prices	4.406	5.992

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

The same $1 increase in cigarette price (instrumented) increases e-cigarette sales by approximately 18%. Cross-price elasticity = 1.09.

Sales outcome:	**E-cigarettes**	**Cigarettes**
Instrumented e-cigarette price ($)		
Beta	-837***	4,417**
(SE)	(274)	(1,803)
Price elasticity	-2.20	0.43
Instrumented cigarette price ($)		
Beta	263	-4,223***
(SE)	(238)	(1,565)
Price elasticity	1.09	-0.39
Cragg-Donald Wald *F*-statistic	117.686	117.686
Covariates:		
Locality fixed effects	Y	Y
Period (quarter-by-year) fixed effects	Y	Y
Tobacco control policies	Y	Y
Substance use policies	Y	Y
Demographics	Y	Y
Observations	1,428	1,428
Means in e-cigarette tax localities, year prior to tax		
Sales	1,770	47,956
Prices	4.643	7.185
Means in cigarette tax localities, year prior to tax		
Sales	1,445	65,637
Prices	4.406	5.992

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

Neither tax appears to affect sales for cigars, chewing tobacco, or loose tobacco.

Tobacco product:	Cigars	Chewing tobacco	Loose tobacco
E-cigarette tax ($)			
Beta	-2,262	123	10
(SE)	(2,184)	(228)	(111)
Tax elasticity	-0.17	0.04	0.01
Implied price elasticity	-0.58	0.15	0.05
Cigarette tax ($)			
Beta	2,729	-186	97
(SE)	(1,970)	(194)	(102)
Tax elasticity	0.47	-0.16	0.46
Implied price elasticity	0.86	-0.29	0.84
Observations	1,428	1,428	1,428
Mean: Sales in e-cigarette tax adopting localities, year prior to the tax	16,641	3,389	897
Mean: Sales in cigarette tax adopting localities, year prior to the first cigarette tax increase	17,355	3,513	631

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

A $1 increase in e-cigarette price (instrumented) reduces flavored e-cigarette sales by nearly 69%, and by 30-33% for non-flavored or menthol/mint-flavored e-cigarettes.

Cigarette type:	E-cigarettes			Cigarettes	
Outcome:	Non-flavored	Menthol/mint	Flavored	Non-flavored	Menthol
Instrumental variables					
Instrumented e-cigarette price ($)					
Beta	-214***	-115***	-508***	3,685***	732
(SE)	(65)	(38)	(193)	(1,267)	(650)
Price elasticity	-1.54	-1.37	-3.22	0.49	0.26
Instrumented cigarette price ($)					
Beta	89	41	133	-2,950**	-1,273**
(SE)	(55)	(30)	(181)	(1,228)	(504)
Price elasticity	0.87	0.76	1.57	-0.36	-0.47
Cragg-Donald Wald *F*-statistic	117.686	117.686	117.686	117.686	117.686
Observations	1,428	1,428	1,428	1,428	1,428
Mean: Sales in e-cigarette tax adopting localities, year prior to the tax	647	389	732	34,936	13,020
Mean: Sales in cigarette tax adopting localities, year prior to the first cigarette tax increase	614	323	506	49,274	16,363

Cotti, Courtemanche, Maclean, Nesson, Pesko, Tefft 2022

E-cigarette Tax Rates on Adults

- Pesko, Courtemanche, Maclean 2020 uses National Health Interview Survey (NHIS) and Behavioral Risk Factor Surveillance System (BRFSS) data from 2013-18 to find:
  - Evidence that higher e-cigarette tax rates reduce adult e-cigarette use and increase adult cigarette use (i.e., economic substitution), especially for young adults <40 years of age.
  - Symmetrical effects using cigarette tax rates.
  - Results suggest that a proposed national e-cigarette tax of $1.65 per milliliter of e-liquid would raise the proportion of adults who smoke cigarettes daily by approximately one pp, or 2.5 million extra adult daily smokers.
- Saffer et al. 2020 study the effect of e-cigarette taxes in Minnesota using synthetic controls, finding that e-cigarette taxes increase adult current cigarette use and reduce smoking cessation.

E-cigarette Tax Rates on Young People

- Abouk, Courtemanche, Dave, Feng, Friedman, Maclean, Pesko, Sabia, Safford 2023 examine the effect of e-cigarette tax rate changes in 10 states using Monitoring the Future (MTF) and Youth Risk Behavior Surveillance System (YRBSS) data through 2019.
  - Youth e-cigarette tax elasticities of -0.06 to -0.21
  - Sizable positive cigarette cross-tax elasticities
  - E-cigarette taxes cause youth to substitute from retail-based purchasing of e-cigarettes to social sourcing of e-cigarettes
  - E-cigarette taxes increase perception of the risk of e-cigarettes
- Pesko and Warman 2022 use price and tax variation to find evidence of economic substitution among youth through 2015.
- Pesko and Friedman 2022 find that e-cigarette tax rates reduce e-cigarette use and increase cigarette use nearly 1:1 interchangeably for young adults 18-25 years of age through 2019.

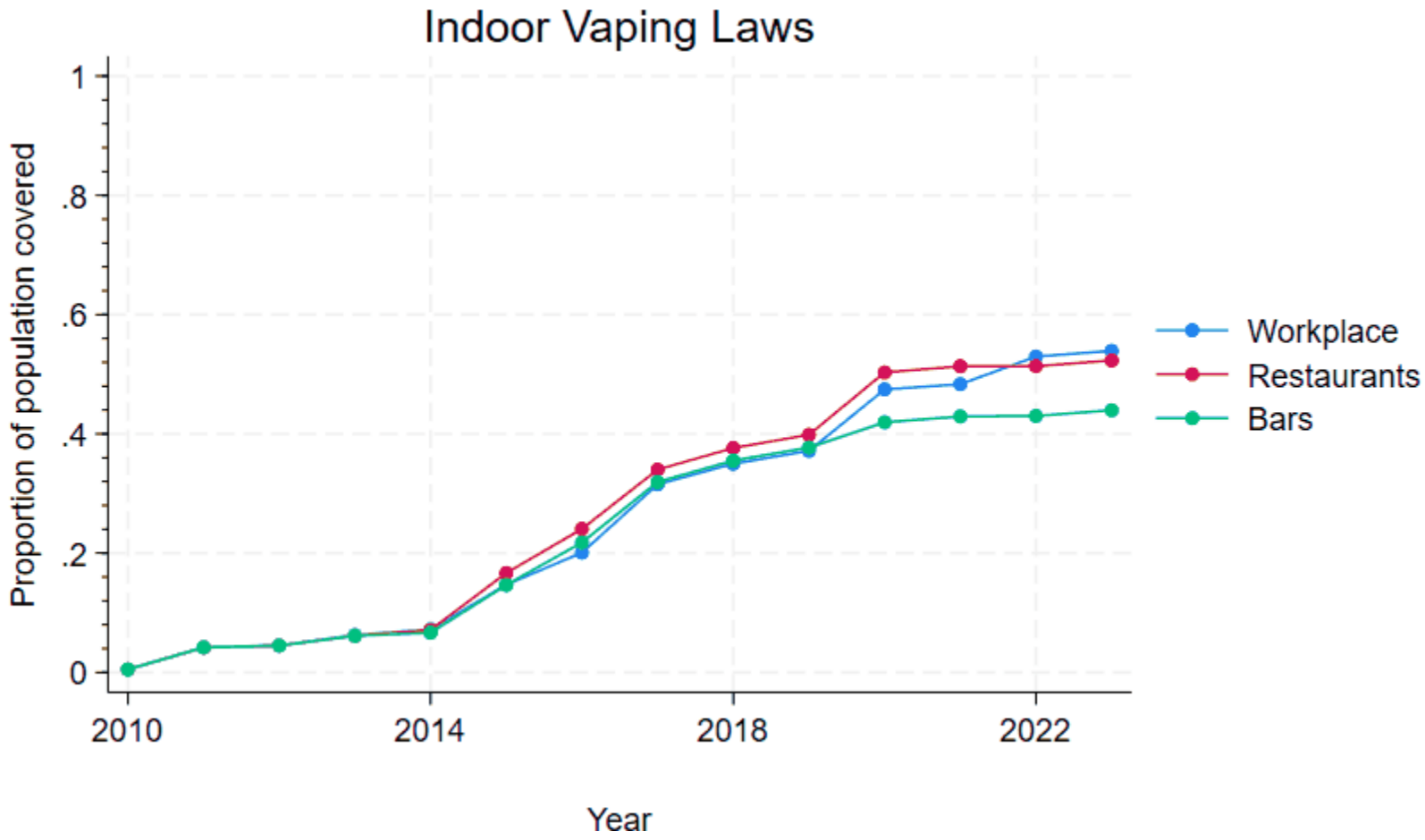
E-cigarette Taxes on Pregnant Women

- Abouk, Adams, Feng, Maclean, Pesko 2023 uses national birth record data from 2013-19 to find that a $1 increase in the standardized e-cigarette tax:
  - Increases pre-pregnancy and prenatal cigarette use by ≈ 0.4 pp (5.7% of the mean)
  - No effect on birth outcomes
- Uses Pregnancy Risk Assessment Monitoring System data from 2016-19 to find that a $1 increase in the standardized e-cigarette tax:
  - Reduces pre-pregnancy e-cigarette use by 1.7 pp (44.8%)
  - Reduces 3rd trimester e-cigarette use by 0.7 pp (60.4%).
- Approximately 1 in 4 pregnant women that stops using e-cigarettes due to an e-cigarette tax smokes cigarettes instead (through less smoking cessation).
- Click here for a presentation of this paper at the Tobacco Online Policy Seminar.

Other E-cigarette Tax Studies

- Allcott and Rafkin 2022 use the pre-2013 smoking propensities for 800 adult demographic cells and 56 youth demographic cells to implement a shift-share strategy to examine the impact of wide use of e-cigarettes starting in the year 2013 on smoking rates.
  - As a component of their paper, they also find mixed evidence of substitution using the Nielsen retail scanner data, depending on specification.
  - Click here for a presentation of this paper at the Tobacco Online Policy Seminar.
- Maclean, Khan, Tsipas, and Pesko 2022 observe no statistically significant change in prescription fills following an increase in the e-cigarette tax rate, though unable to rule out potentially large effects.
- Other studies look at the effects of e-cigarette taxes on demographic subgroups (Chuo et al. 2025) or on the use of other substances (Dave et al. 2025).

Literature on E-cigarette Indoor Vaping Restrictions



Literature on E-cigarette Indoor Vaping Restrictions

- Cooper and Pesko 2017 use national birth record data from 2010-15 to find that indoor vaping restrictions:
  - Increase any prenatal cigarette use by 0.9 pp using a cross-sectional model
  - Increase cigarette use in a given trimester by 2.0 pp using a panel data model
  - No effect on immediate birth outcomes
  - Increase infant mortality (Cooper and Pesko 2022, a follow-up paper using the same time period and data).
- Four studies do not find effects of e-cigarette indoor vaping restrictions on a general population of adults (Friedman, Oliver, Busch 2021; Cotti, Nesson, Tefft 2018; Nguyen and Bornstein 2021; Cheng, Liu, Pesko, Levy, Fong, and Cummings 2022).

Literature on E-cigarette Advertising

- Dave et al. (2019) estimates whether e-cigarette advertising on television and in magazines encourages adult smokers to quit.
- Authors use detailed information on individual-level TV and magazine viewing patterns in the Simmons National Consumer Survey, which contains information on smoking.
- Authors match this individual-level viewing information to all e-cig ads aired on national and local broadcast and cable stations and all ads published in magazines from Kantar Media.
- Authors find TV advertising causally impacts smoking cessation, but magazine advertising does not.
- The results indicate that a policy banning TV advertising of e-cigs would have reduced the number of smokers who quit in the recent past by approximately 3%.

Literature on E-cigarette Advertising

- Tuchman (2019) studies the effects of e-cigarette advertising on e-cigarette, cigarette, and nicotine replacement therapy sales and purchases by exploiting a discontinuity in local advertising markets, using stores and households right along advertising market borders.
- Data:
  - Nielsen retail and household scanner data from 2012-2015.
  - Product level advertising data from Nielsen, showing increases in e-cigarette television advertising mid-2012.
- In the absence of e-cigarette advertising,
  - E-cigarette sales would have been 0.9% lower.
  - Cigarette sales would have been 1.0% higher.
    - 130 million extra packs of cigarettes.
  - Nicotine replacement therapy product sales 1.0% higher.

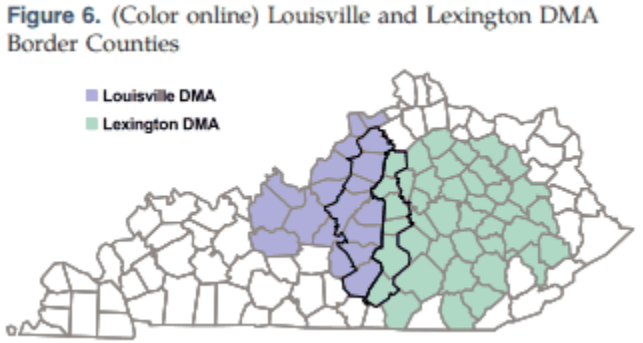


Figure 6. (Color online) Louisville and Lexington DMA Border Counties

Summary of E-cigarette Research

- Using quasi-experimental variation in e-cigarette use from e-cigarette policies, most studies suggest that e-cigarettes reduce smoking.
  - E-cigarette MLSAs, tax rates, and advertising restrictions are all shown to reduce e-cigarette use.
  - According to a review in Pesko 2023, 16 fixed effect studies have explored these three policies. Of these, 14 studies find that e-cigarette regulation increases cigarette use (economic substitutes), 1 finds no relationship, and 1 finds that e-cigarette regulation reduces cigarette use (economic complements).
    - Conclusion supported by a systematic review (Begh et al. 2025).

Conclusion:
Economics Approach to E-cigarette Regulation

- If e-cigarettes are substantially safer than cigarettes, socially optimal e-cigarette policy is likely low regulation and/or subsidizing them for smokers.
  - A subsidy could operate similar to how many states currently give free nicotine replacement therapy to smokers that want to quit.
  - If youth have time-inconsistent preferences, or nicotine is more dangerous for youth than adults, this could motivate higher regulation for youth.
  - Over-regulation of e-cigarettes may be attractive politically, but could lead to more dangerous combustible tobacco use and could lead to overall reductions in social welfare.

If You'd Like to Learn More…

- Tobacco Online Policy Seminar (TOPS)
  - www.tobaccopolicy.org
  - Seminar every two weeks highlighting experimental and quasi-experimental research.
  - Averages >150 attendees per seminar.
  - Submit your research through the TOPS website for consideration.
  - Sign-up for mailing list through the website.
  - Supported in part by an R13 Conference Grant from the Food and Drug Administration Center for Tobacco Products.