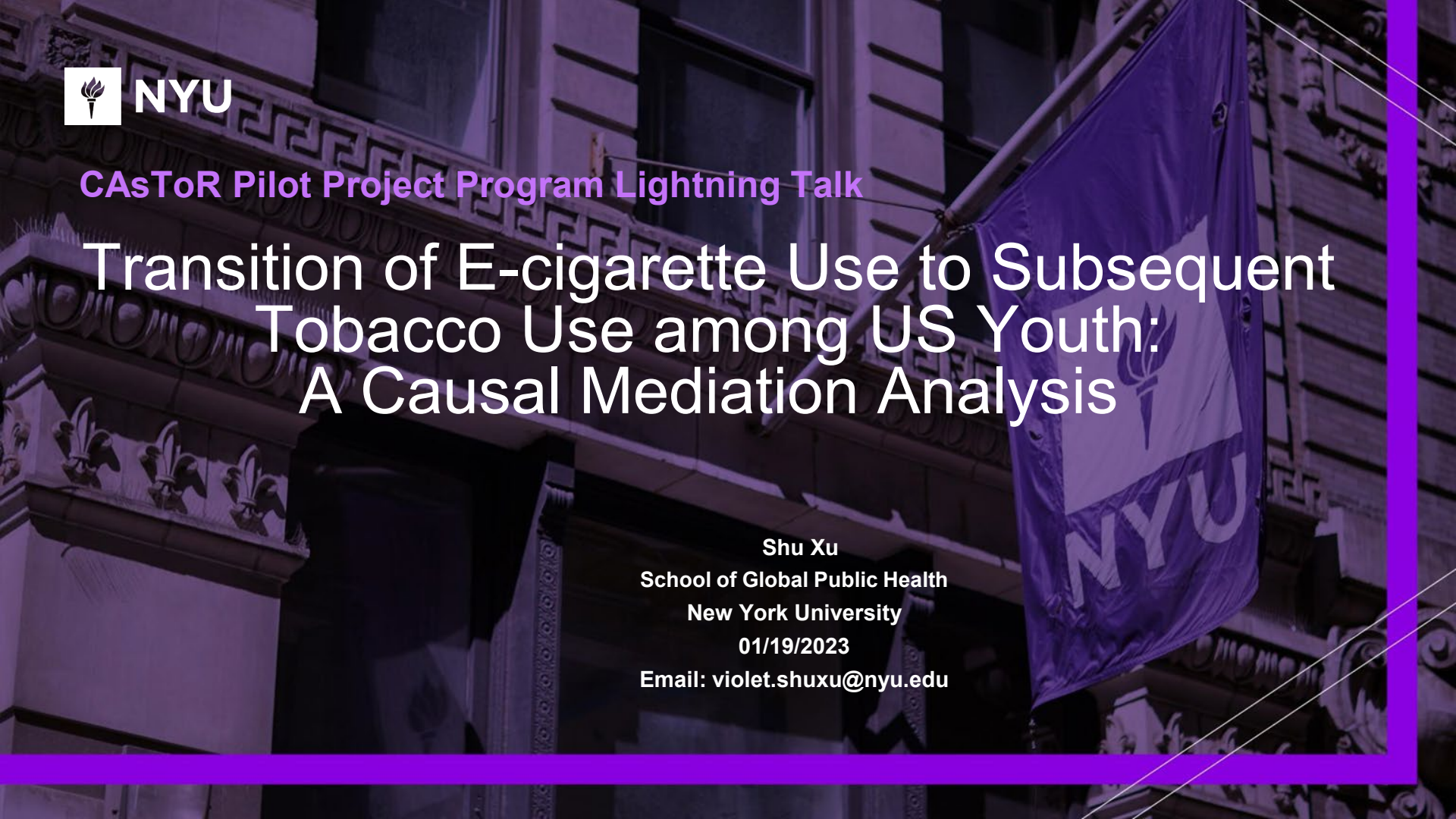

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CAsToR Pilot Project Program Lightning Talk

Transition of E-cigarette Use to Subsequent Tobacco Use among US Youth: A Causal Mediation Analysis

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Outline

- Introduction
- Study Objective
- Methods
- Results
- Conclusions and Future Study
- Research Team
- Acknowledgement

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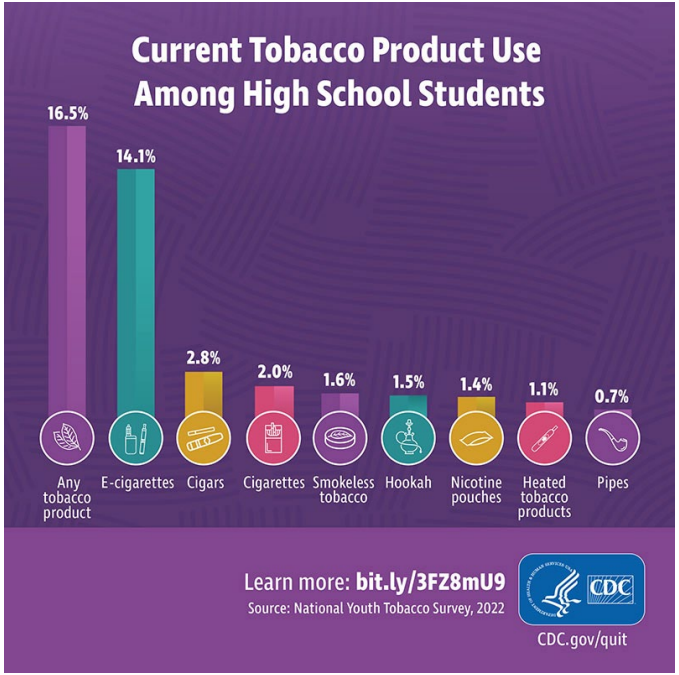
Introduction

- **E-cigarettes (ECs) are the predominant tobacco products among youth in the US. since 2014.**
- **EC use is associated with elevated risk of subsequent CC smoking** (Xu et al., 2021).
- **It is critical to understand the mechanism of this transition.**



Xu, S., Coffman, D. L., Liu, B., Xu, Y., He, J., & Niaura, R. S. (2022). Relationships Between E-cigarette Use and Subsequent Cigarette Initiation Among Adolescents in the PATH Study: an Entropy Balancing Propensity Score Analysis. Prevention Science, 23, 608-617.

Image from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/index.htm

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Objective

This study aims to explain why and assess the extent to which e-cigarette (EC) use has an impact on the subsequent tobacco product use.

Research Questions

- **Q1 (total effect)**

  What is the total effect of EC initiation (versus tobacco naive) on current tobacco use after two years?

- **Q2 (mediated effect: natural indirect effect)**

  Is the total effect mediated by the EC induced change in the mediator?

  How much would current tobacco use change (on average) if participants perceived EC to be less harmful than CC, compared to if participants perceived EC as equally or more harmful than CC?

Methods

- **Data** 

  Waves 1 - 4 (data collected annually from 2013/14 to 2016/18)
- **Participants:** EC initiators and tobacco naïve youth at Wave 2 (aged 12 – 17 yrs, n = 7511)
- **Data Analysis:** Causal mediation analysis using R *mediation* and R *medflex* packages; Traditional mediation analysis using R lavaan

Methods

PATH Population Assessment of Tobacco and Health

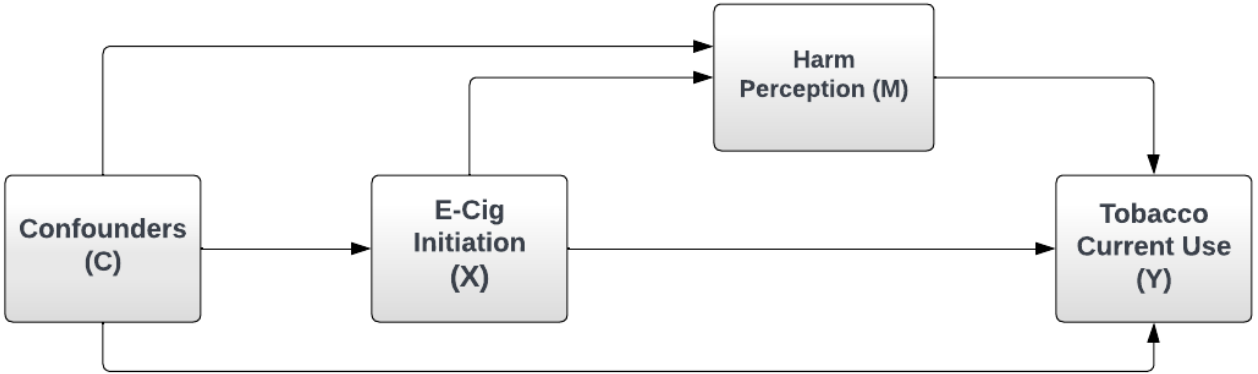
Mediator (W3)

"Is using EC less harmful, about the same, or more harmful than smoking CC?"

1 = less harmful 0 = same/more harmful

Confounders (W1)

age, gender, race/ethnicity, non-prescribed drug use, alcohol use, marijuana use, depression, history of asthma, and harm perceptions of e-cigarette use relative to cigarette use



Exposure (W2)

1 = yes, 0 = no

Outcome (W4)

Current tobacco use (1 = yes, 0 = no)

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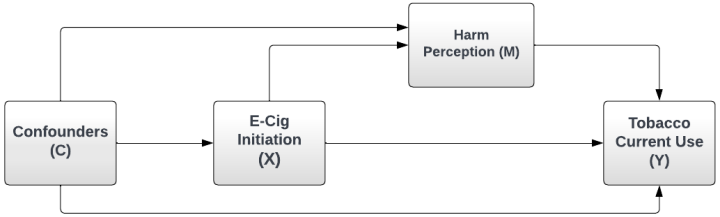
Why Causal Mediation Analysis

- The definition and identification of causal effects are independent of analytical models, which is different from the traditional approach.
- A longitudinal design allows the temporal order of exposure and effect.
- Software and tutorials (Xu et al., under review) become available for public use
- Transparent and rigorous modeling would allow reproducible evidence to inform tobacco policymaking.
- In contrast, the traditional mediation analysis for binary variables is more technically demanding. Interpretation of results is more challenging (Rijnhart et al., 2021).

Xu, S., Coffman, D. L, Luta, G., & Niaura, R. S., (Under Review). Tutorial on causal mediation analysis: An application to health psychology research. Rijnhart, J. J., Valente, M. J., MacKinnon, D. P., Twisk, J. W., & Heymans, M. W. (2021). The use of traditional and causal estimators for mediation models with a binary outcome and exposure-mediator interaction. Structural Equation Modeling: A Multidisciplinary Journal, 28, 345-355.

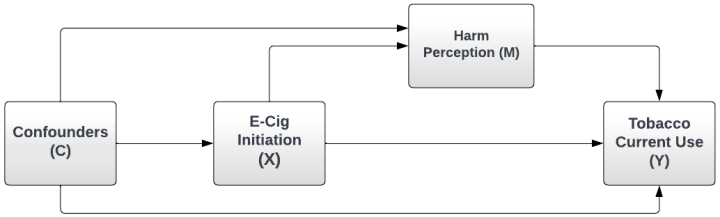
Results



- Among the 7.3% (n = 546) of youth who initiated e-cigarette use at Wave 2, 47.4% (n = 259) perceived e-cigarette use as less harmful than cigarette use at Wave 3, and 33.7% (n = 184) became current tobacco users at Wave 4.

- Among the 92.7% (n = 6965) of youth who stayed tobacco naive at Wave 2, 27.5% (n = 1912) perceived e-cigarette use as less harmful than cigarette use at Wave 3, and 9.4% (n = 654) became current tobacco users at Wave 4.

Results



- The **total effect** of EC use corresponded to a 17.5 % increase in the risk of current tobacco use. The adjusted odds of current tobacco use among EC users was 3.69 times (95% CI: 2.97 – 4.57) the odds among EC never users. (**Q1**).

- The **mediated effect** on current tobacco use that was due to EC use induced changes in harm perceptions, corresponded to 1.11 times (95% CI = 1.07 - 1.15) the adjusted odds of current tobacco use, accounting for 9.3% of the total effect (**Q2; causal mediation analysis**).

- The **mediated effect** of e-cigarette initiation on current tobacco mediated through harm perceptions was calculated as the product of two coefficients: one for the association between e-cigarette initiation and harm perceptions (AOR = 2.21, 95% CI = 1.76 - 2.78), and the other for the association between harm perceptions and current tobacco use (AOR = 1.47, 95% CI = 1.33 - 1.61). (**Q2; traditional mediation analysis**).

Conclusions

- Harm perceptions significantly mediated the association between EC initiation and subsequent current tobacco use.

- Results help to provide important empirical evidence to inform policy decision-making and intervention development.

Future Studies

- My long-term goal is to use and disseminate causal inference methods to improve public health for health equity.

- I will take a causal machine learning approach to leverage the big data from large-scale epidemiologic tobacco product use studies.

Our Team

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