

# Transitions in ENDS and cigarette use among youth in the PATH study from 2015—2023: a multistate transition modeling analysis

Olivia K. Roberts, Jihyoun Jeon, Evelyn Jimenez-Mendoza, Stephanie R. Land, Neal D. Freedman, Rossana Torres-Alvarez, Ritesh Mistry, David T. Levy, Rafael Meza, Andrew F. Brouwer

*Department of Epidemiology,  
University of Michigan  
oroberts@umich.edu*

**TCORS**

**Center for the  
Assessment of Tobacco  
Regulations  
[CA<sub>s</sub>TO<sub>R</sub>]**

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	Tobacco Industry	E-cigarette & nicotine product industry (excluding pharma)	Pharma Industry
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Changes in the marketplace, public health events, and regulations may have impacted transitions to and from ENDS and cigarette use among youth.

Increase in ENDS sales beginning in 2017

Flavors targeted to youth

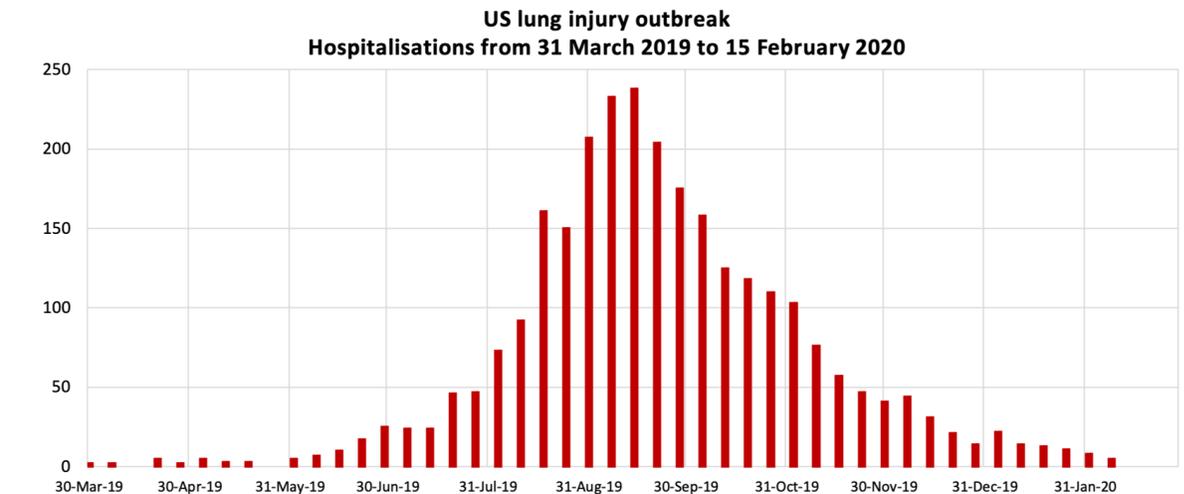


Changes in the marketplace, public health events, and regulations may have impacted transitions to and from ENDS and cigarette use among youth.

Surgeon General's advisory on the youth vaping epidemic in 2019



Lung injury outbreak in 2019-2020



Source: Centers for Disease Control and Prevention (CDC). Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products. Ref [1].

Changes in the marketplace, public health events, and regulations may have impacted transitions to and from ENDS and cigarette use among youth.

ENDS flavor restrictions



Anti-vaping campaigns



Tobacco 21 laws



**Tobacco  
21 Law**



# Research question

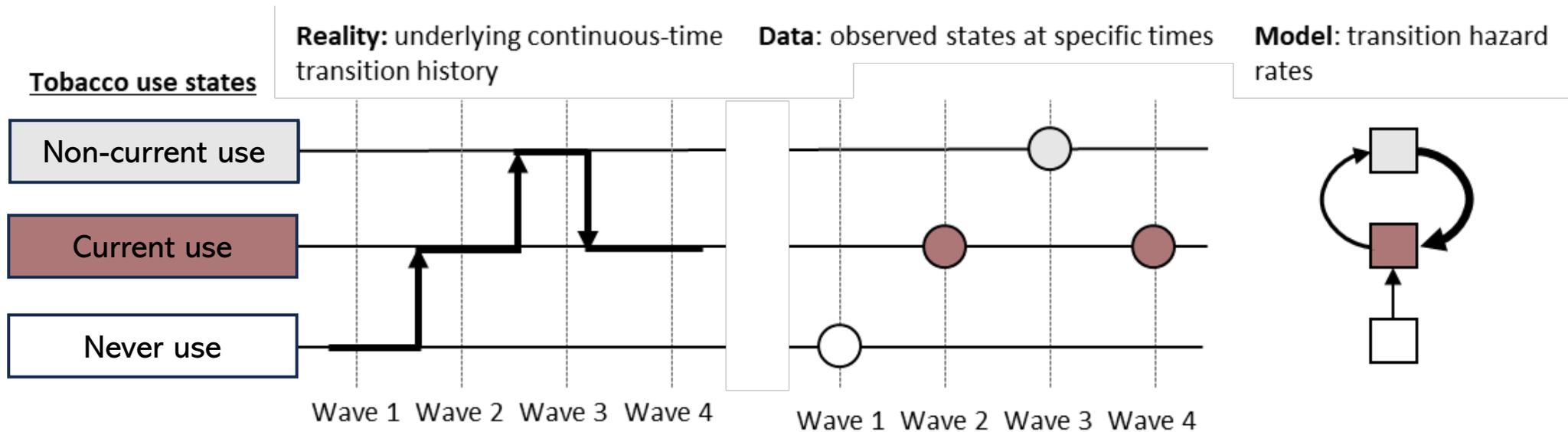
How have transitions in ENDS and cigarette use among youth changed over time?

# Data

- PATH is a nationally representative longitudinal study of tobacco use
- Waves 2–7.5 (2015–23)
  - This analysis includes special collection Waves 4.5, 5.5, 7.5
  - 26,744 total youth aged 12-17 stratified by ages 12-14 and 15-17 years
  - Follow-up time between Waves was assumed to be one or two years, as appropriate for each Wave pair
- Our tobacco use state variables are derived from questions about:
  - Established use of cigarettes or ENDS
  - Past-30-day use of cigarettes or ENDS
- Incorporate longitudinal participant weights

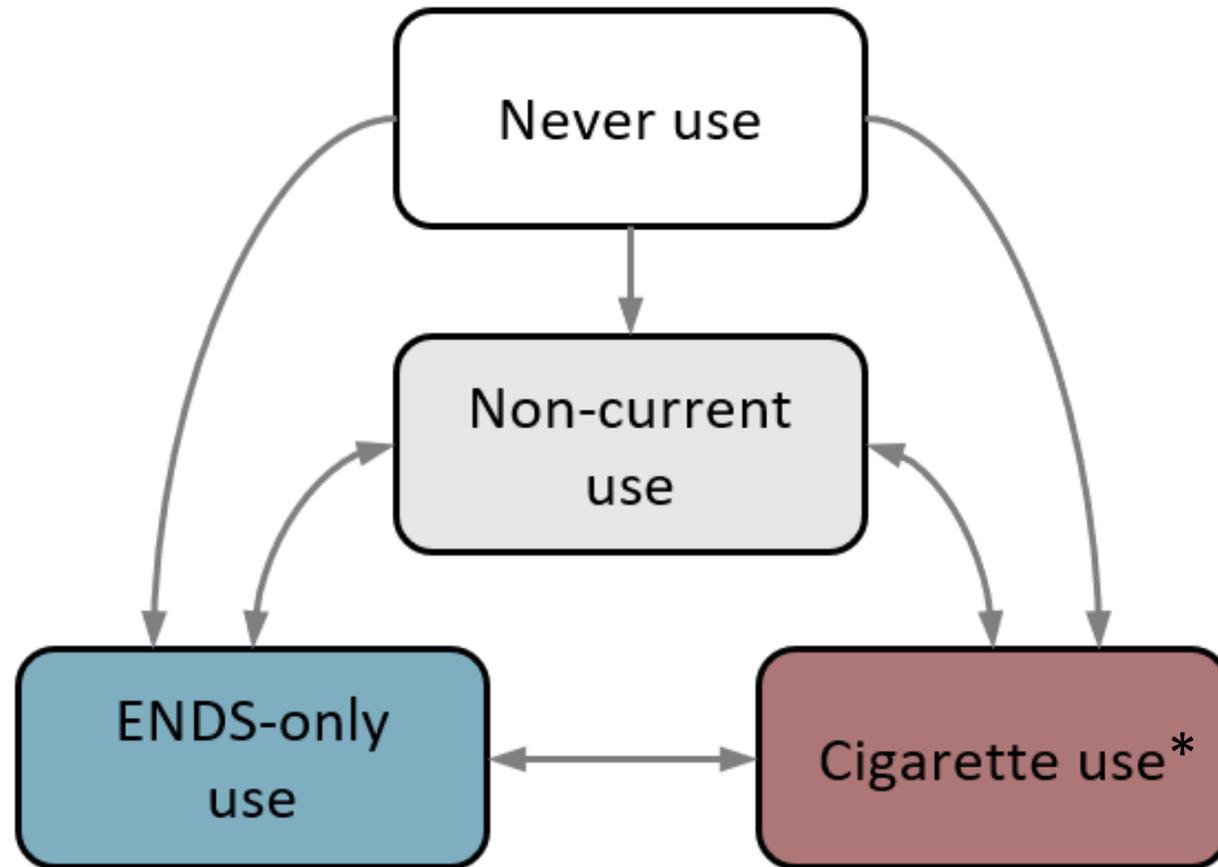
# Methods – Multistate transition model

Estimates underlying transition hazards (rates) assuming that a person's tobacco-use state over time can be approximated by a continuous-time, stochastic model.



Brouwer et al. (2020). *Tobacco Control*.  
Example code using PATH weights is  
available at [tcors.umich.edu](http://tcors.umich.edu)

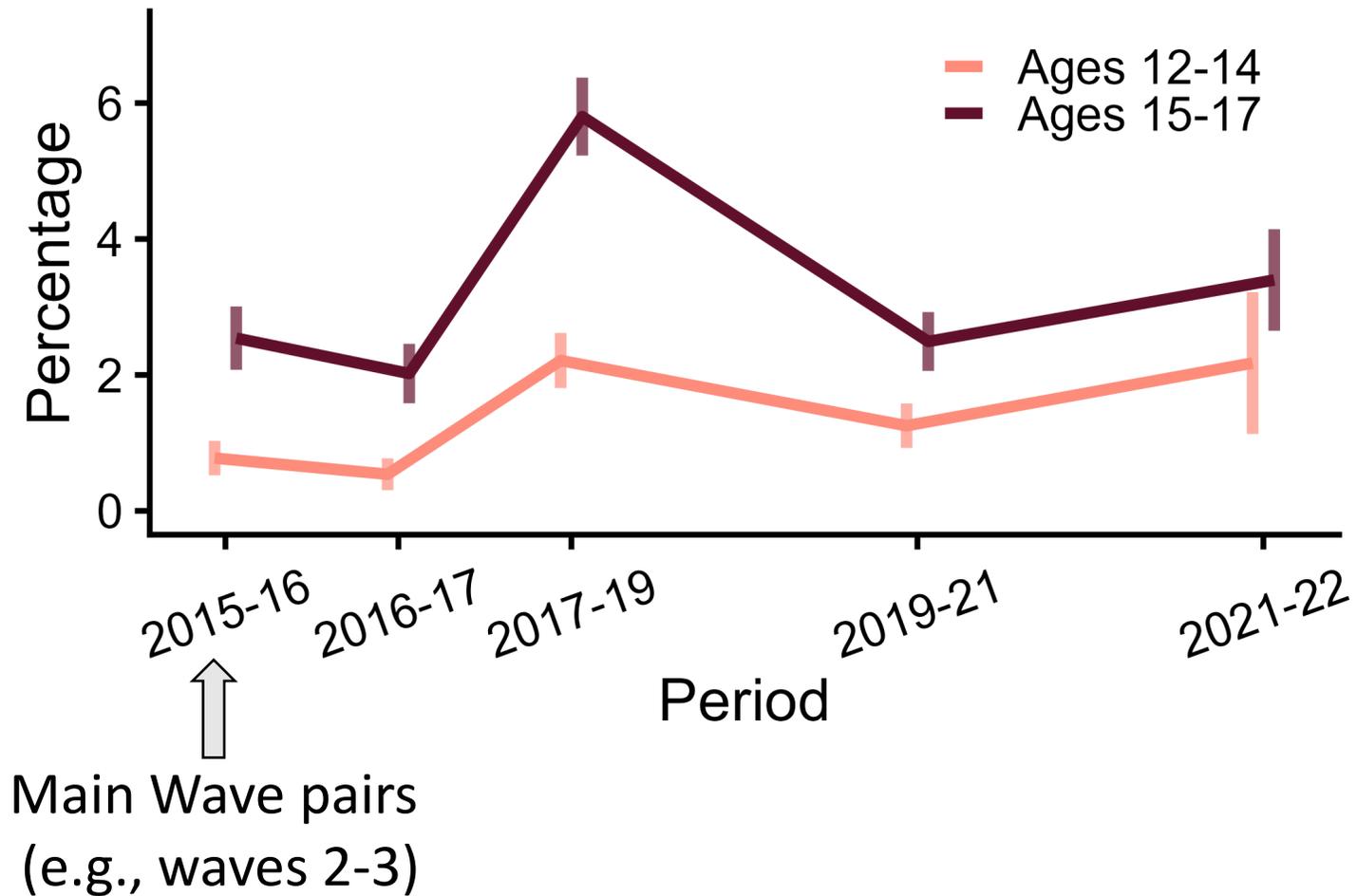
# Methods – Product use transitions



Dual use of ENDS and cigarettes was not modeled as a separate state due to a low prevalence of cigarette-only or dual use in recent waves

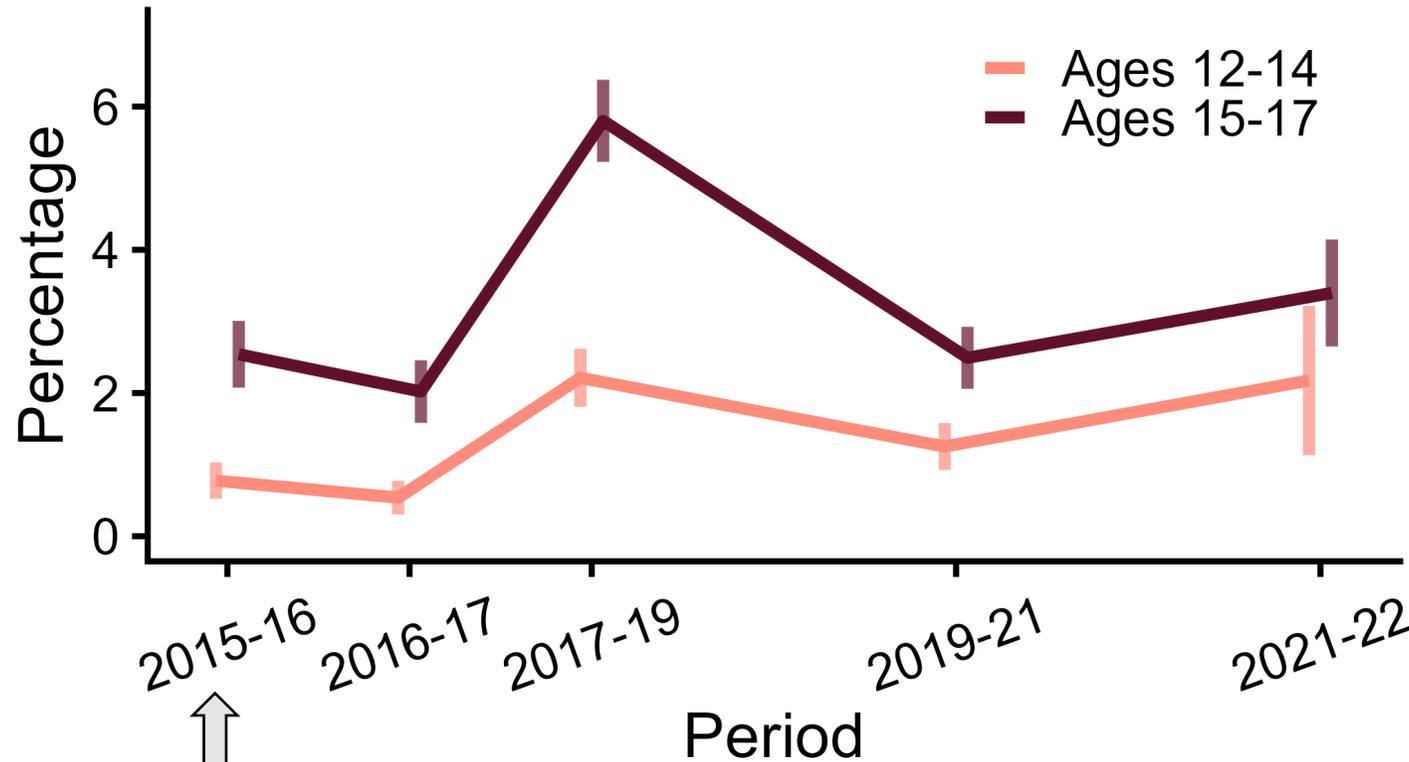
\* With or without ENDS

# Interpreting results: never use to ENDS-only use



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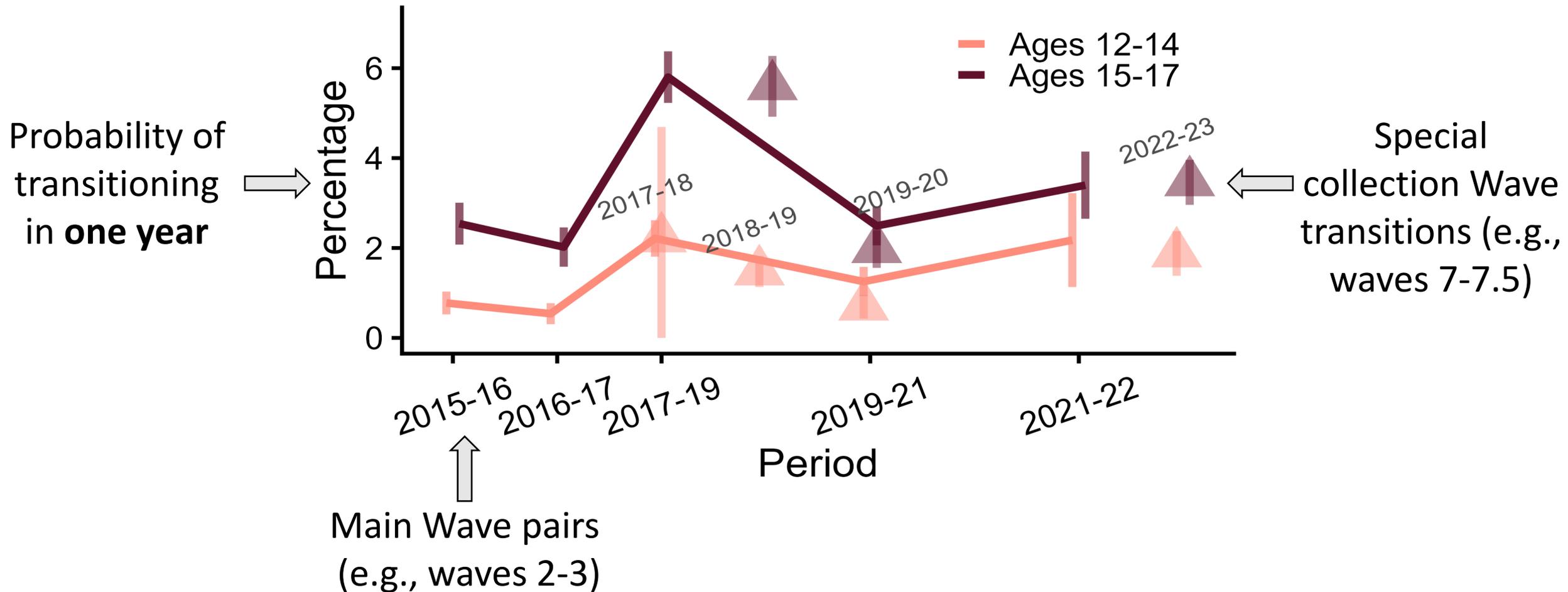
Probability of transitioning in **one year**



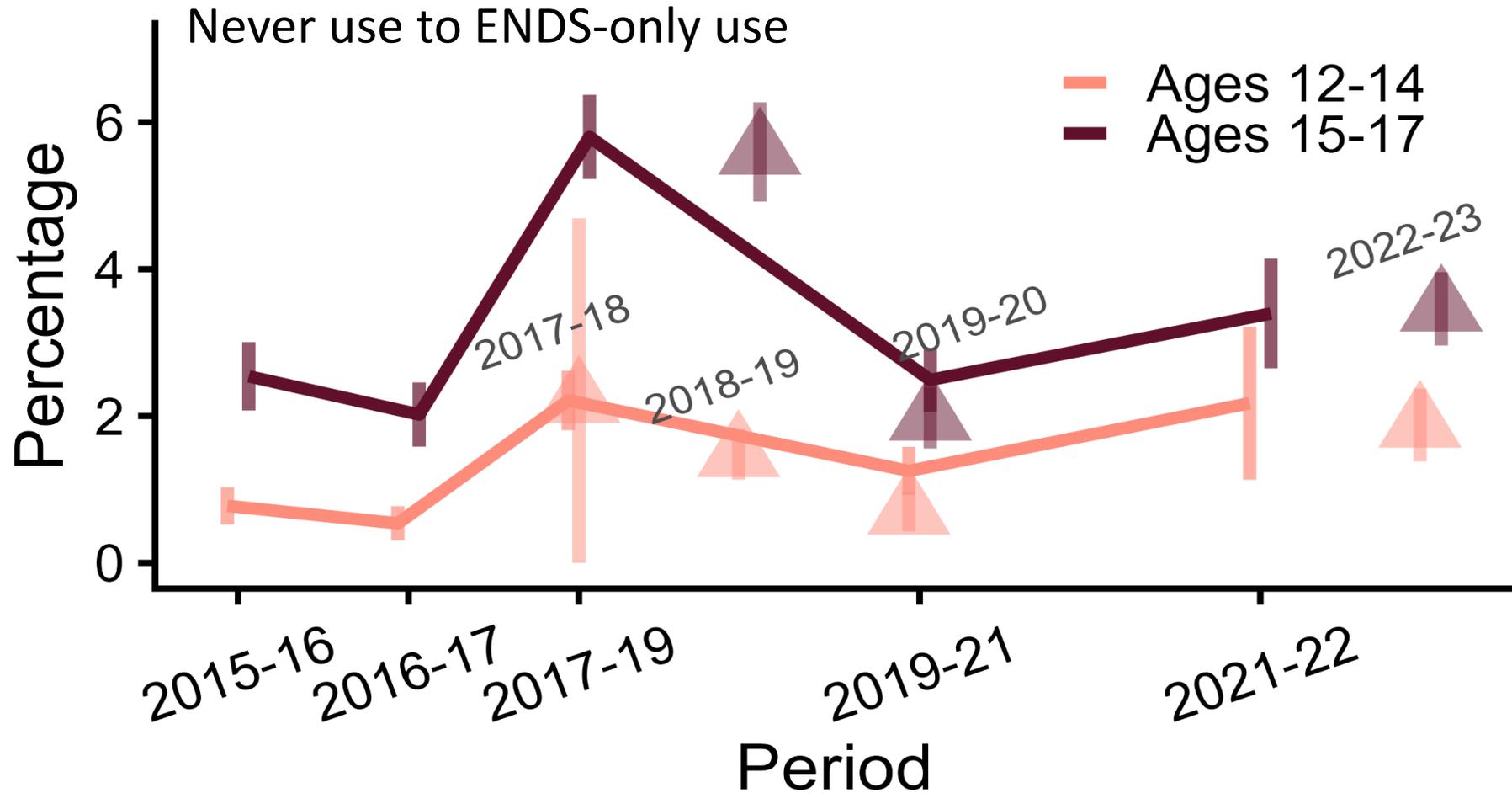
Main Wave pairs  
(e.g., waves 2-3)



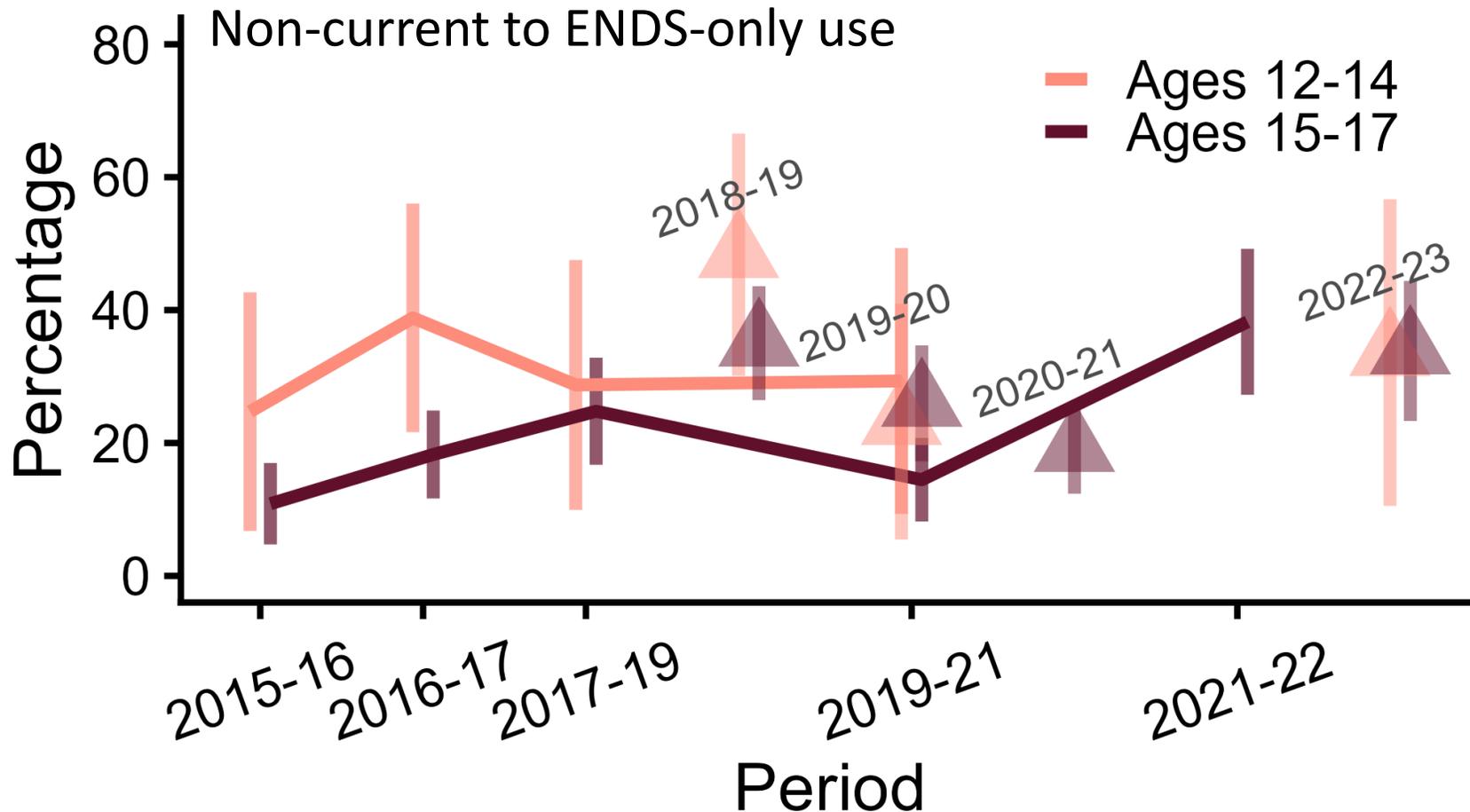
# Interpreting results: never use to ENDS-only use



We see a peak followed by a plateau in ENDS initiation from never use

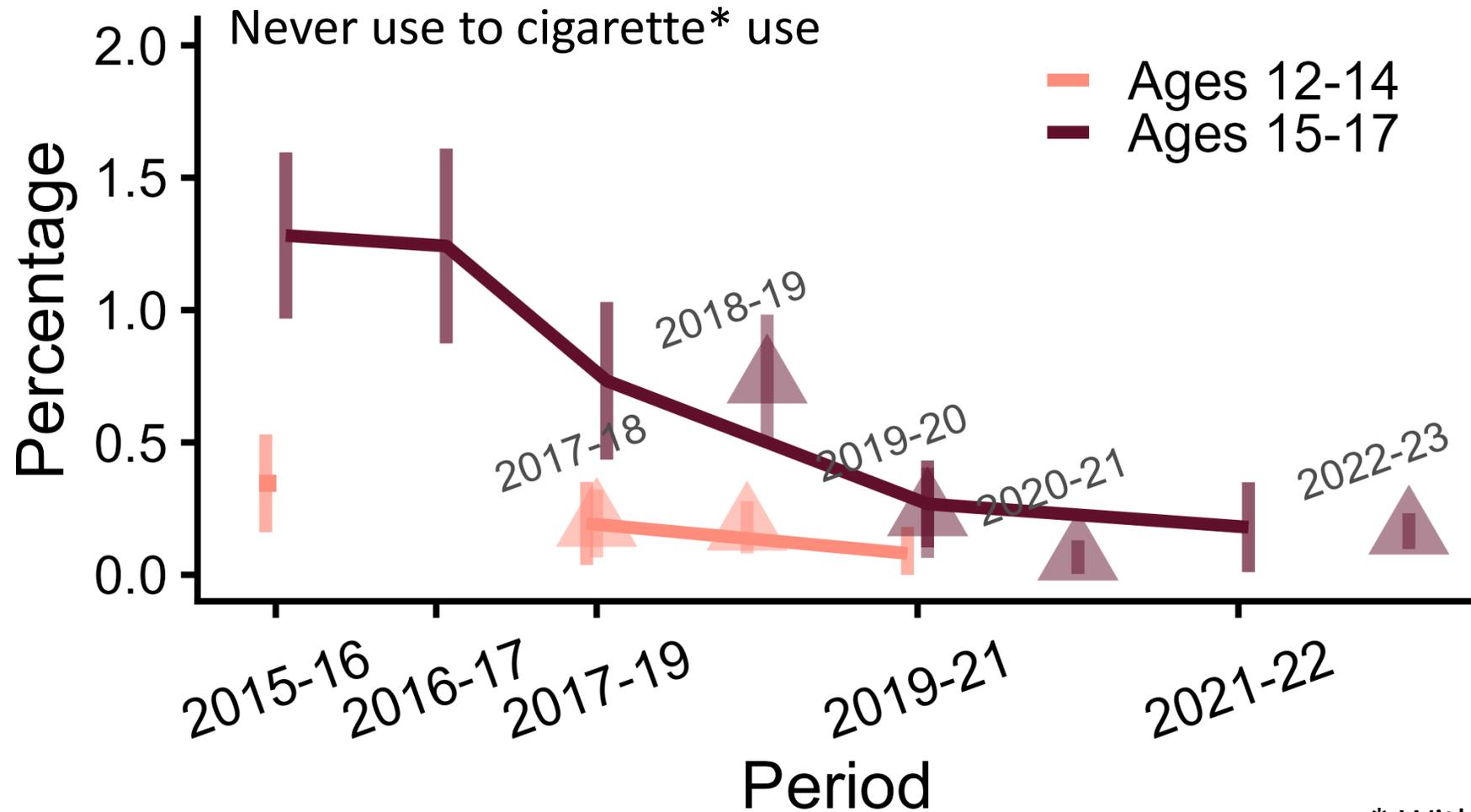


# This peak is not observed in ENDS initiation from non-current use



Note: results supported by fewer than five observed transitions were censored because of high uncertainty

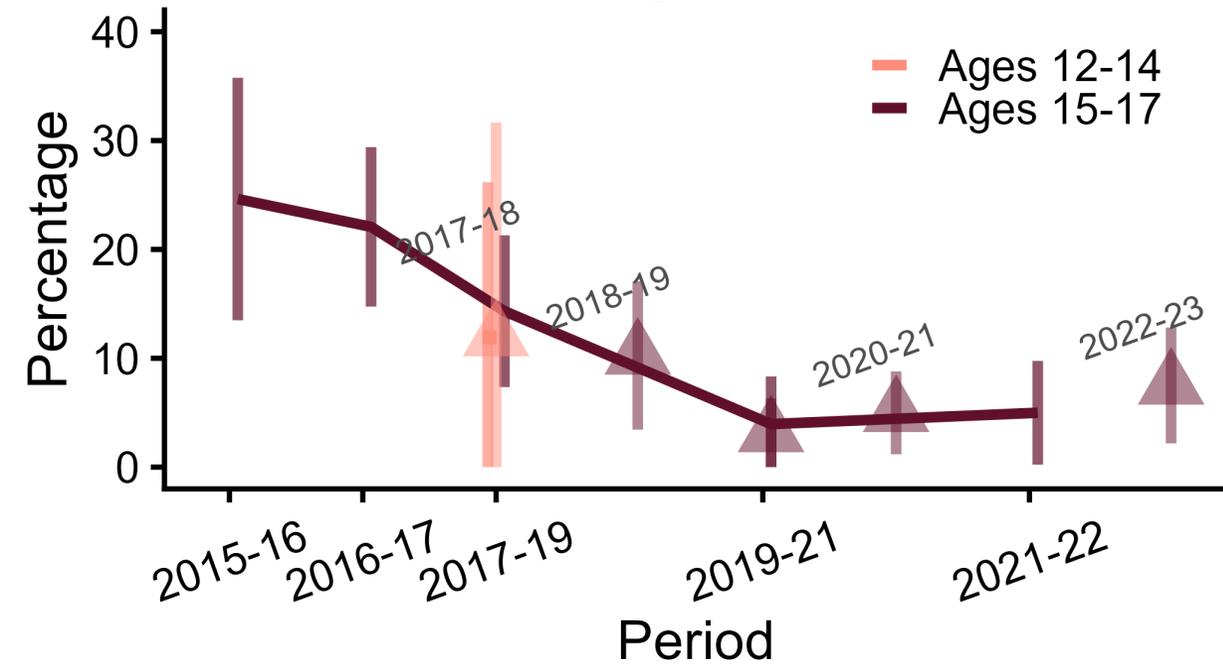
# There is a decline in cigarette initiation from never use



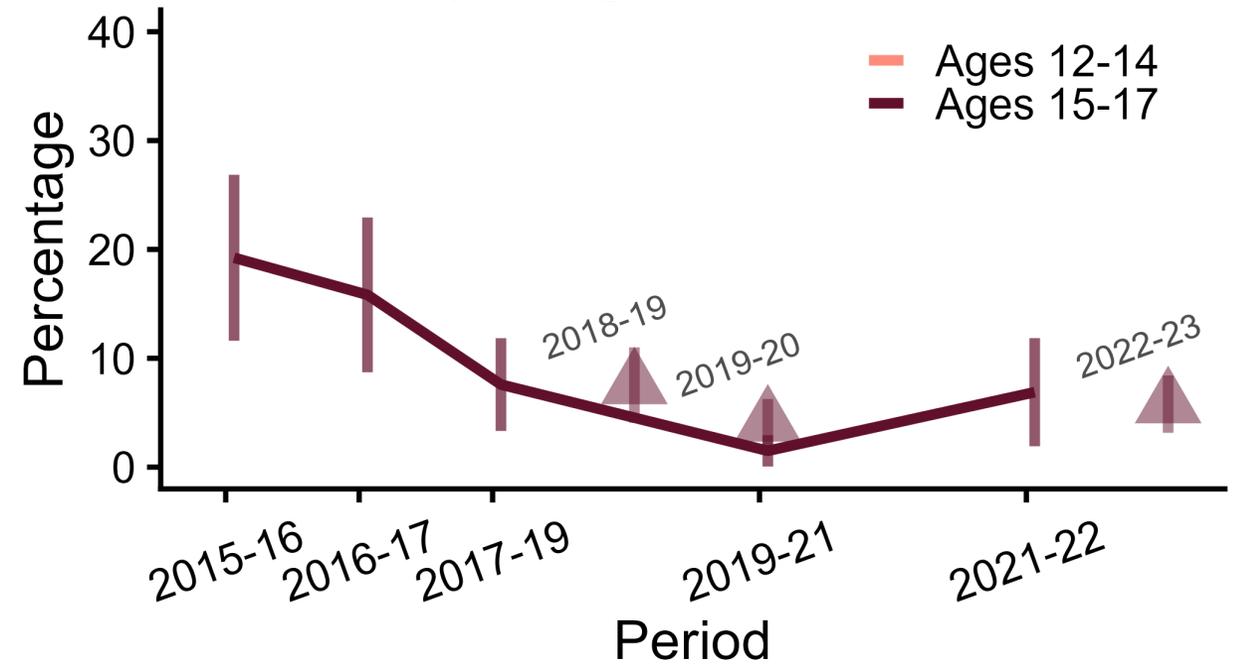
\* With or without ENDS

# All transitions into cigarette use largely declined over this period

## Non-current to cigarette\* use

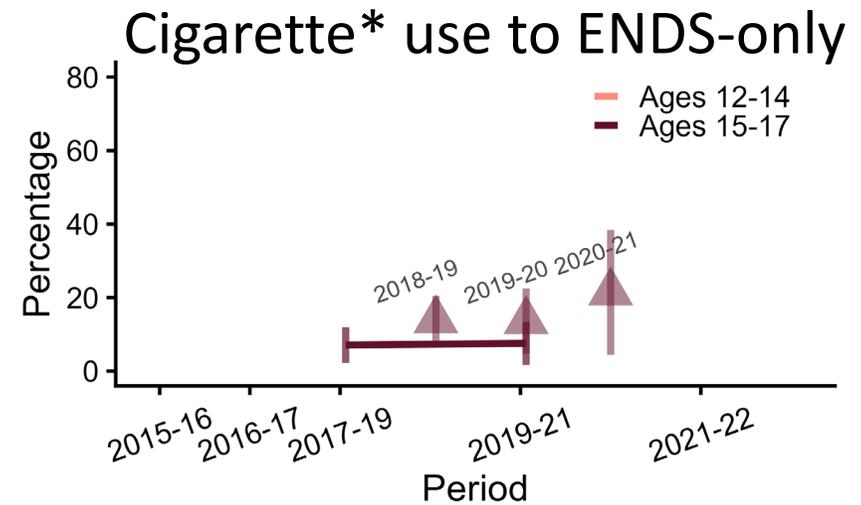
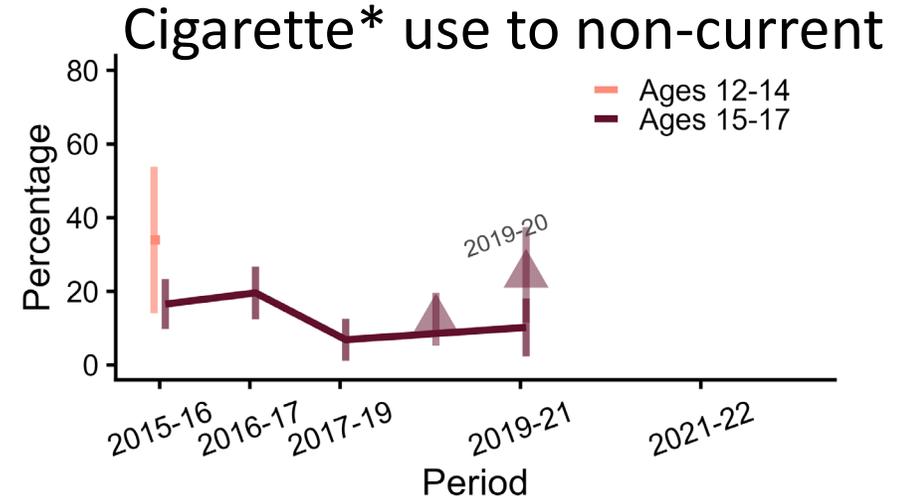
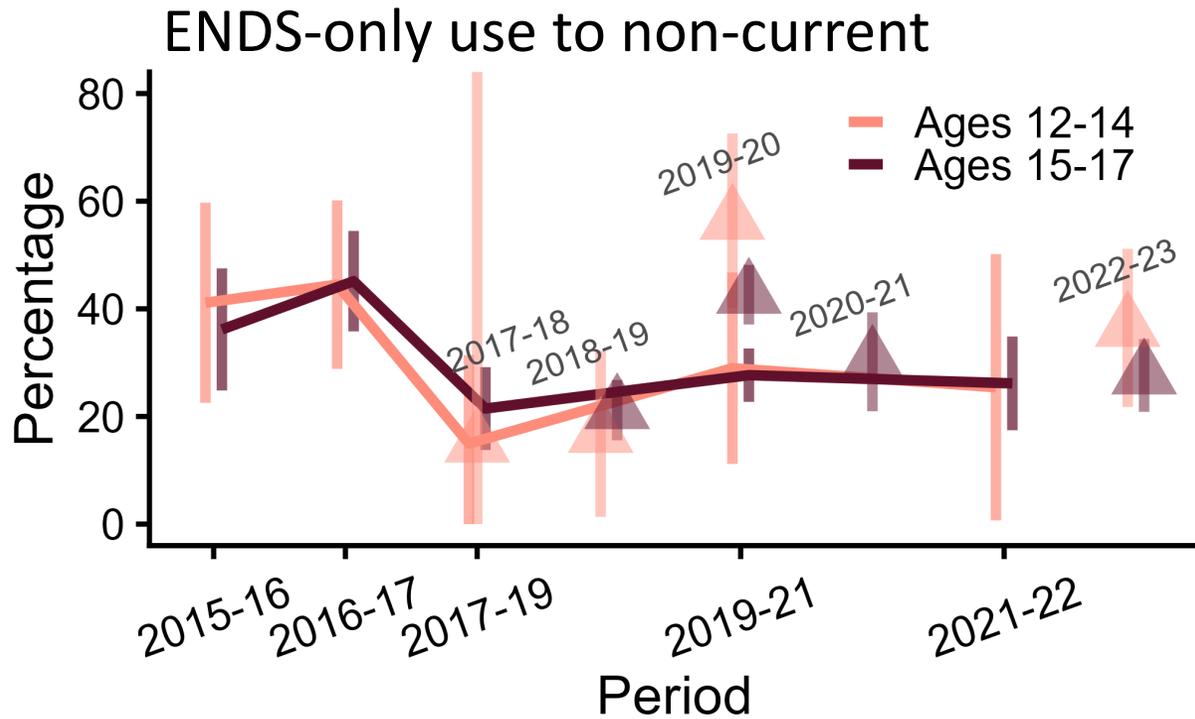


## ENDS-only to cigarette\* use



\* With or without ENDS

# Cessation remains relatively stable over time



\* With or without ENDS

# Take-aways

- Changes in ENDS and cigarette uptake
  - ENDS initiation probability from never use peaked in 2017-2019 and has since plateaued
  - Cigarette\* initiation probability from never, non-current, and ENDS-only use decreased over time
  - 15–17-year-olds were more likely to initiate ENDS from never use than 12–14-year-olds
- Cessation rates for both ENDS and cigarettes have remained relatively stable over time
  - About 25% of youth using ENDS-only quit in one year
  - About 15% of youth using cigarettes\* quit in one year
  - There were few differences in cessation between 15–17-year-olds and 12–14-year-olds

\* With or without ENDS

# Tobacco regulatory implications

- Adoption of cigarettes among youth is increasingly rare, but many youth who use cigarettes used ENDS first
- Because cessation rates have remained relatively stable, tobacco control efforts aimed at reducing initiation of all tobacco products may be the most effective method of reducing ENDS and cigarette use among youth
- Continued monitoring of transitions is necessary as the tobacco product landscape continues to evolve

Questions?

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