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EVP's Impact on US Adult cigarette prevalence: Insights from Machine Learning Analysis

Serafino Teseo, Thomas Verron, Xavier Cahours, Thomas Nahde

Report about NHIS survey tobacco-related results

Summer 2023:

CDC Full Dataset Released: Encouraging Re US Total Nicotine Sustainability

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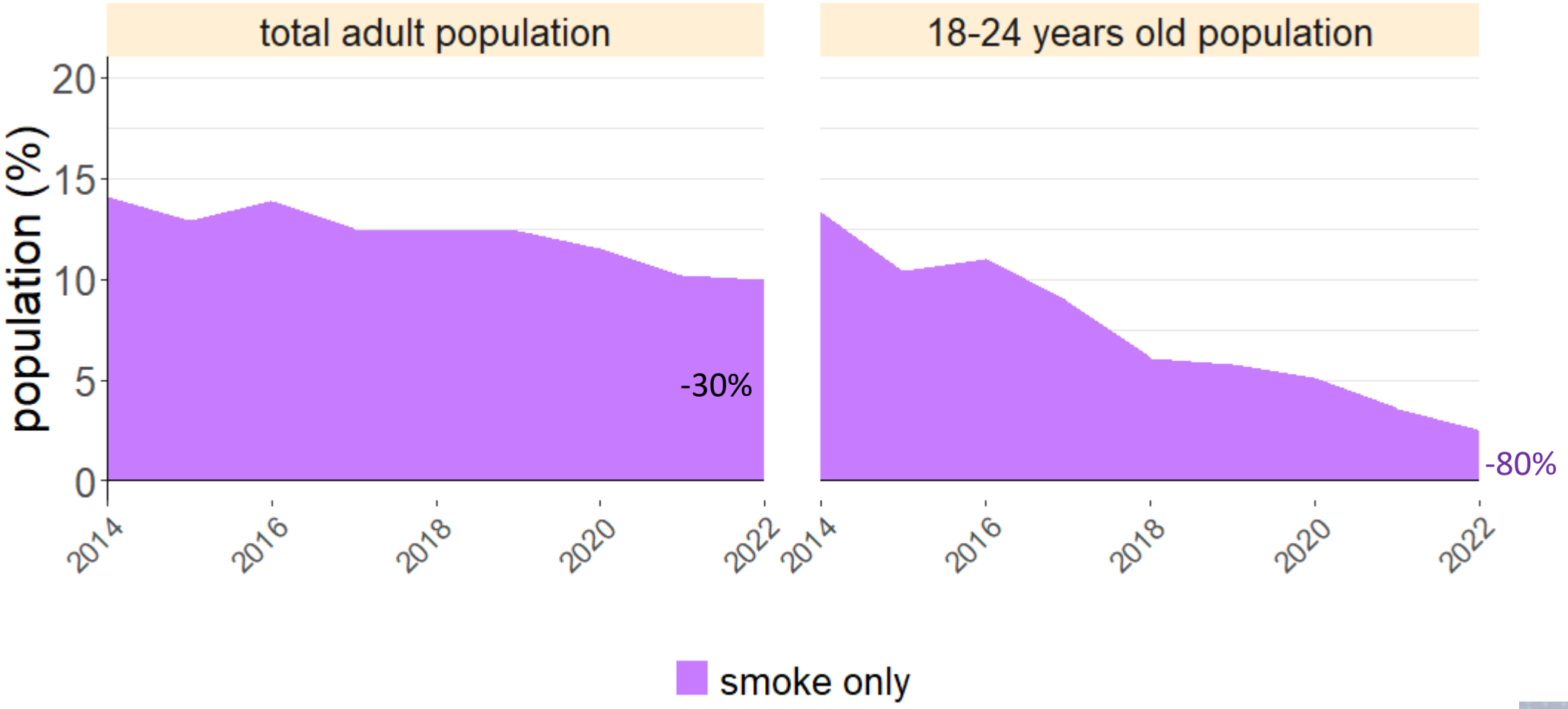
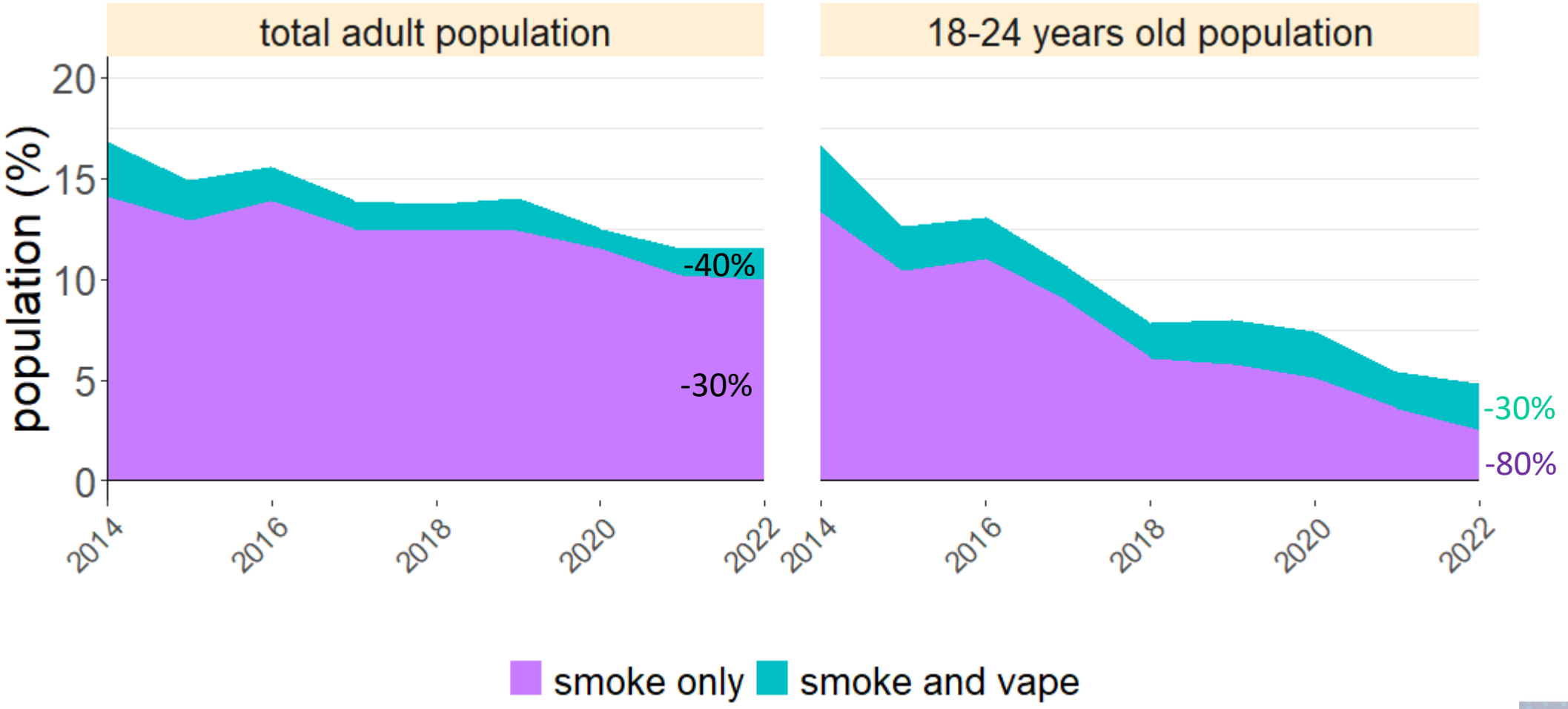
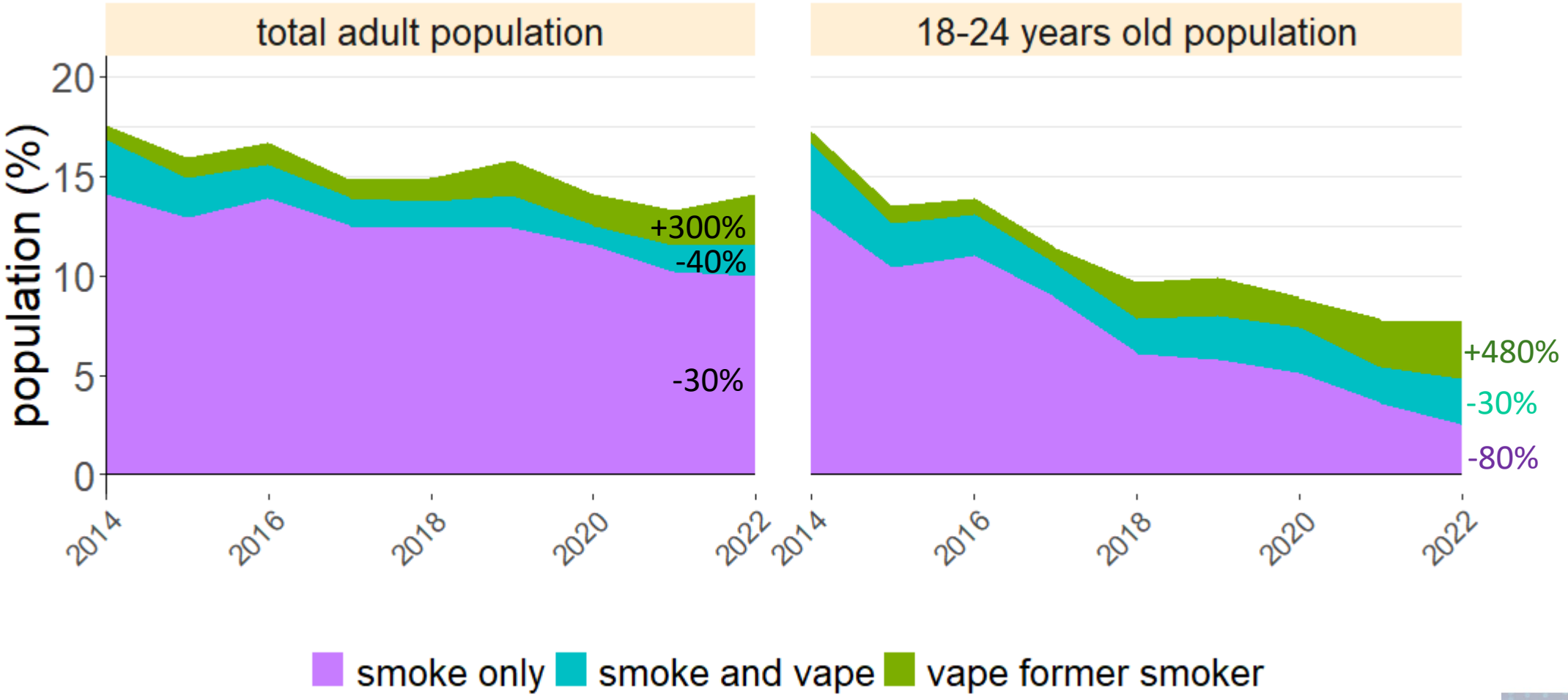
Smoking-only prevalence has declined over time, especially among young adults



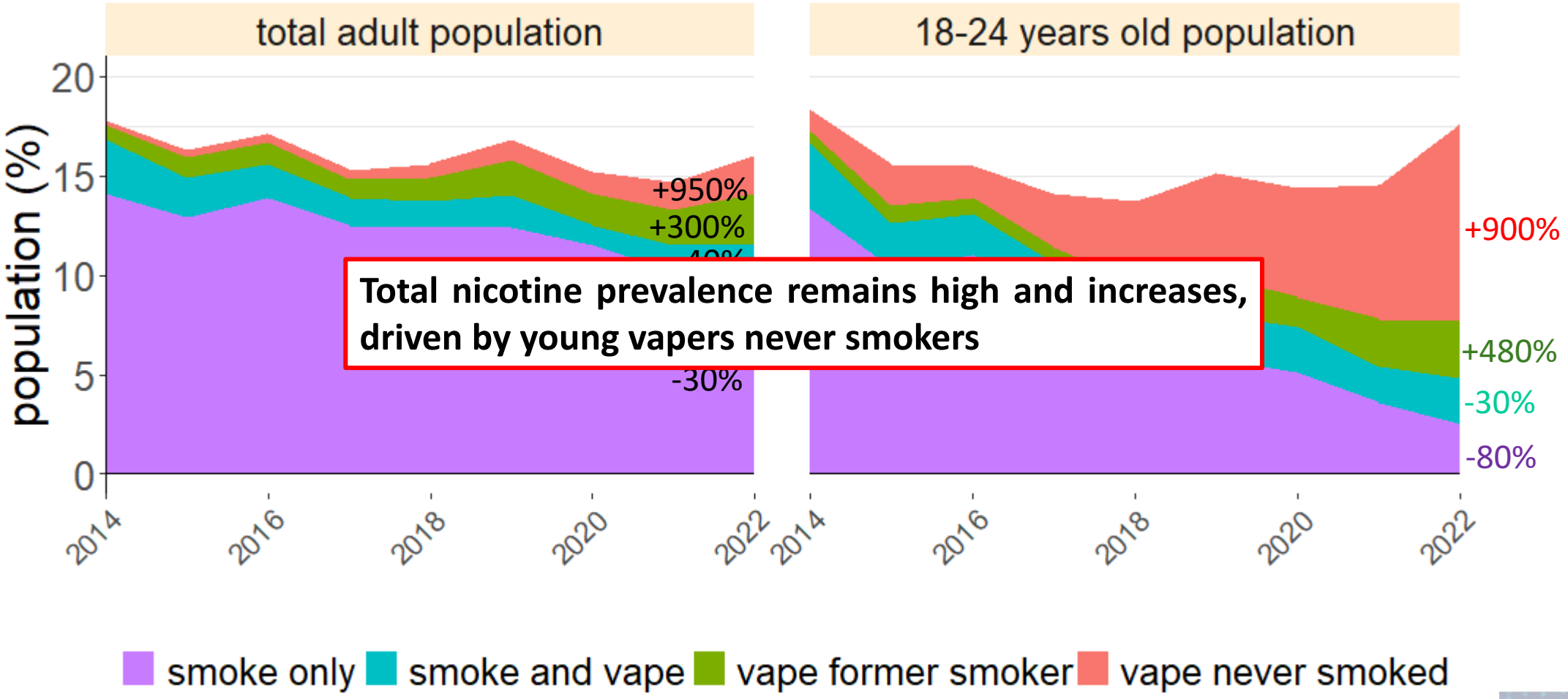
Dual prevalence has also declined over time



Vapers former smokers: 3- to 5-fold increase



Vaping among never smokers: > 9-fold increase



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Beyond study conclusions: Harm Reduction insights

Open questions:

- Do US nicotine prevalence changes depend on EVP introduction?
- What are the effects of EVP introduction?

Objective:

- Determine EVP effects on US nicotine prevalence using time series forecasting

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Time series forecasting

- Time series: a series of data points indexed in time order
- Time series forecasting: using models to predict future values based on past values
- Facebook Prophet: explicitly models data as a combination of cycles including seasonal changes, trends etc.
- **We collected pre-2013 data and integrated with current data**
- **Based on these data, we simulated smoking prevalence in a hypothetical scenario where EVPs have never been introduced**

Prophet

https://facebook.github.io/prophet/

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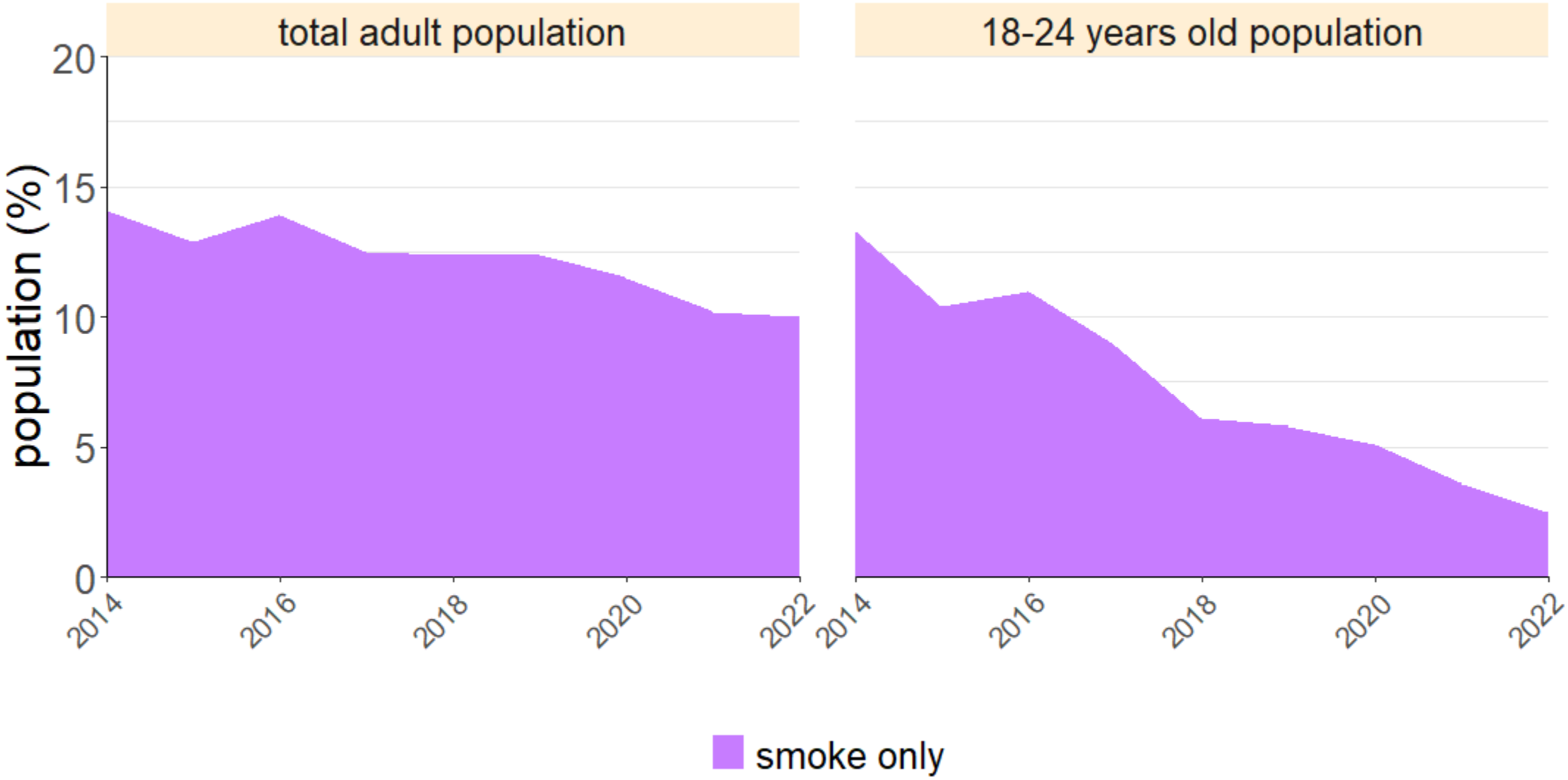
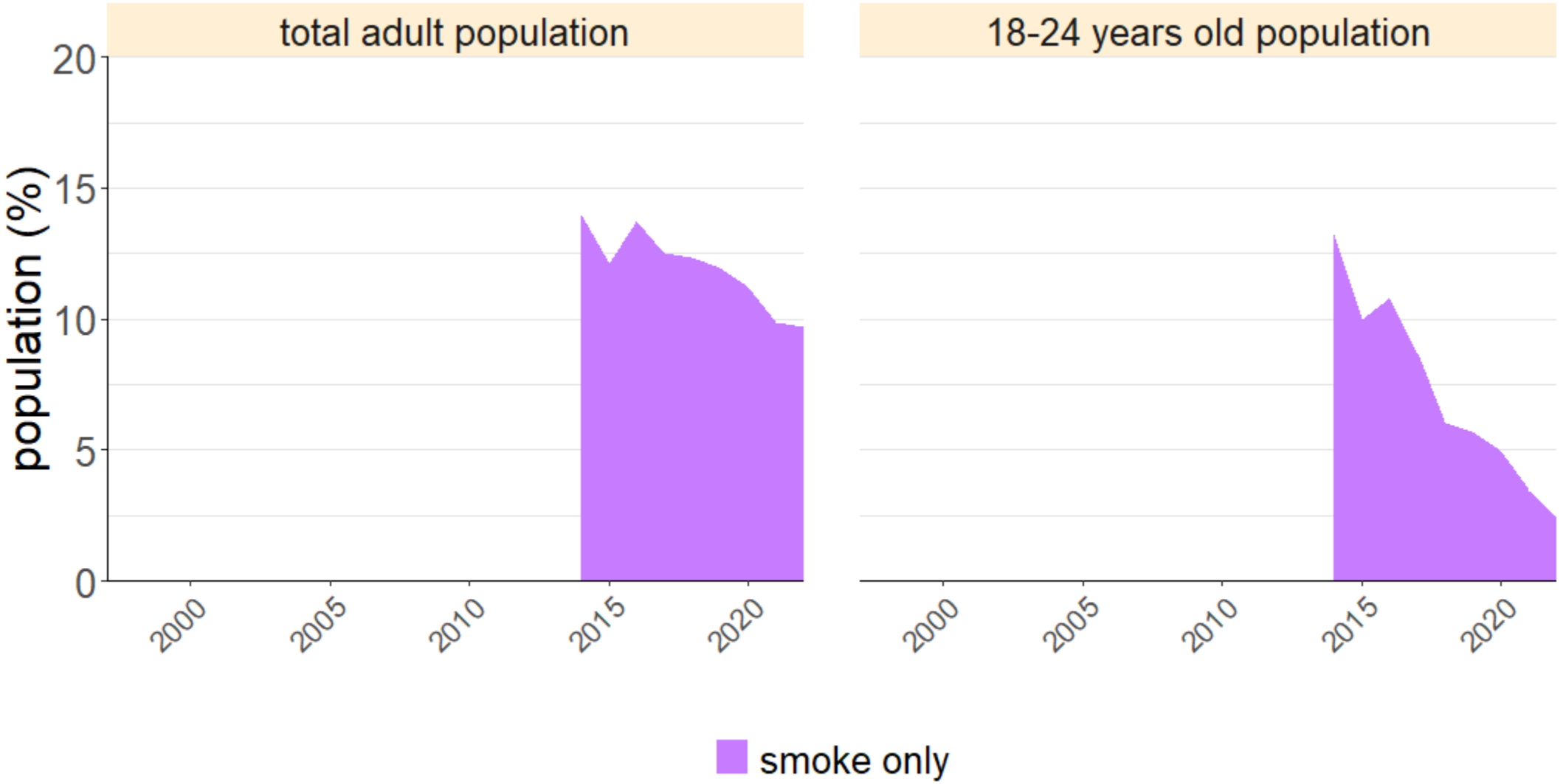
Reproducing NHIS smoking prevalence results



Scaling NHIS smoking prevalence results



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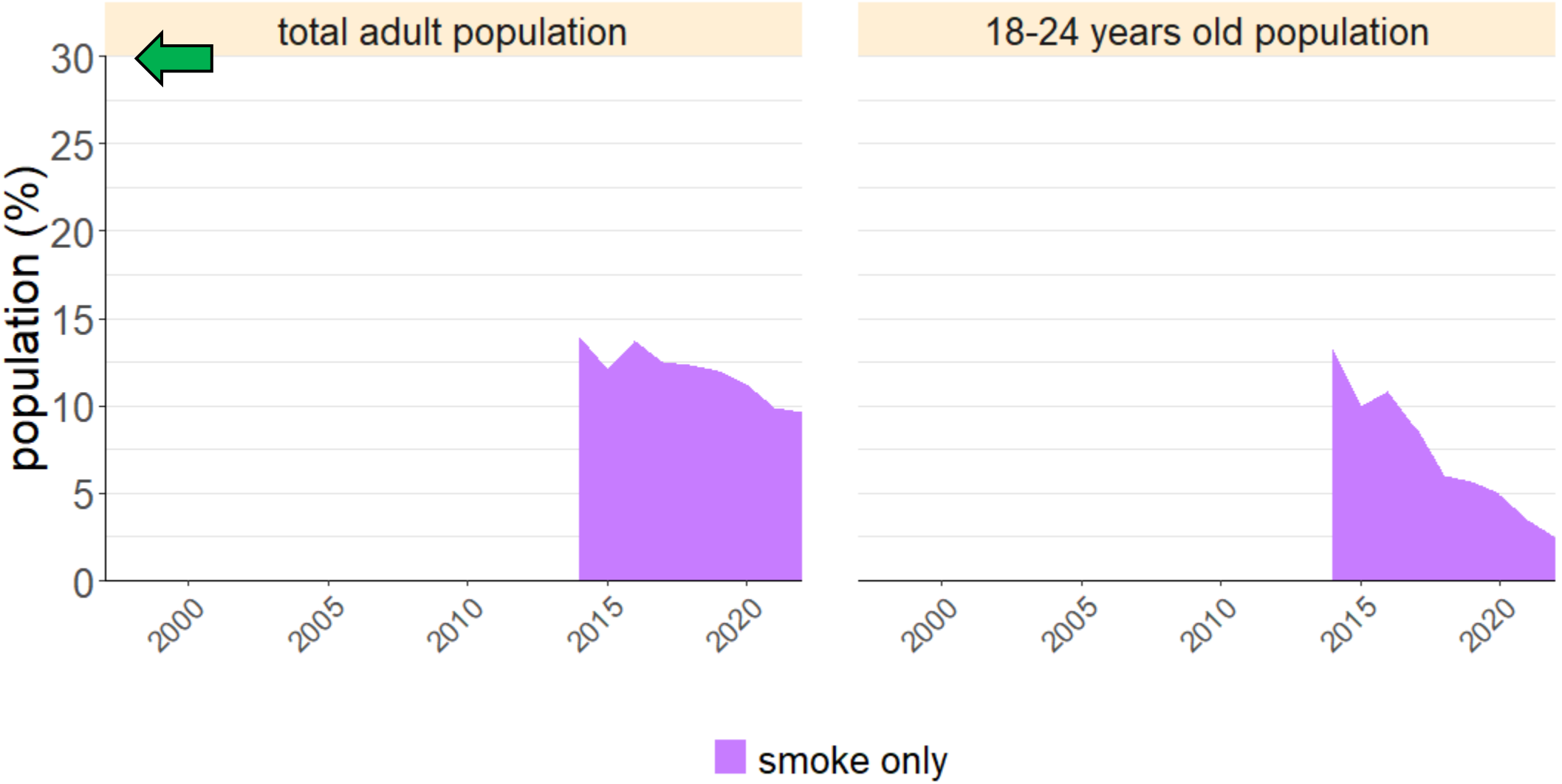
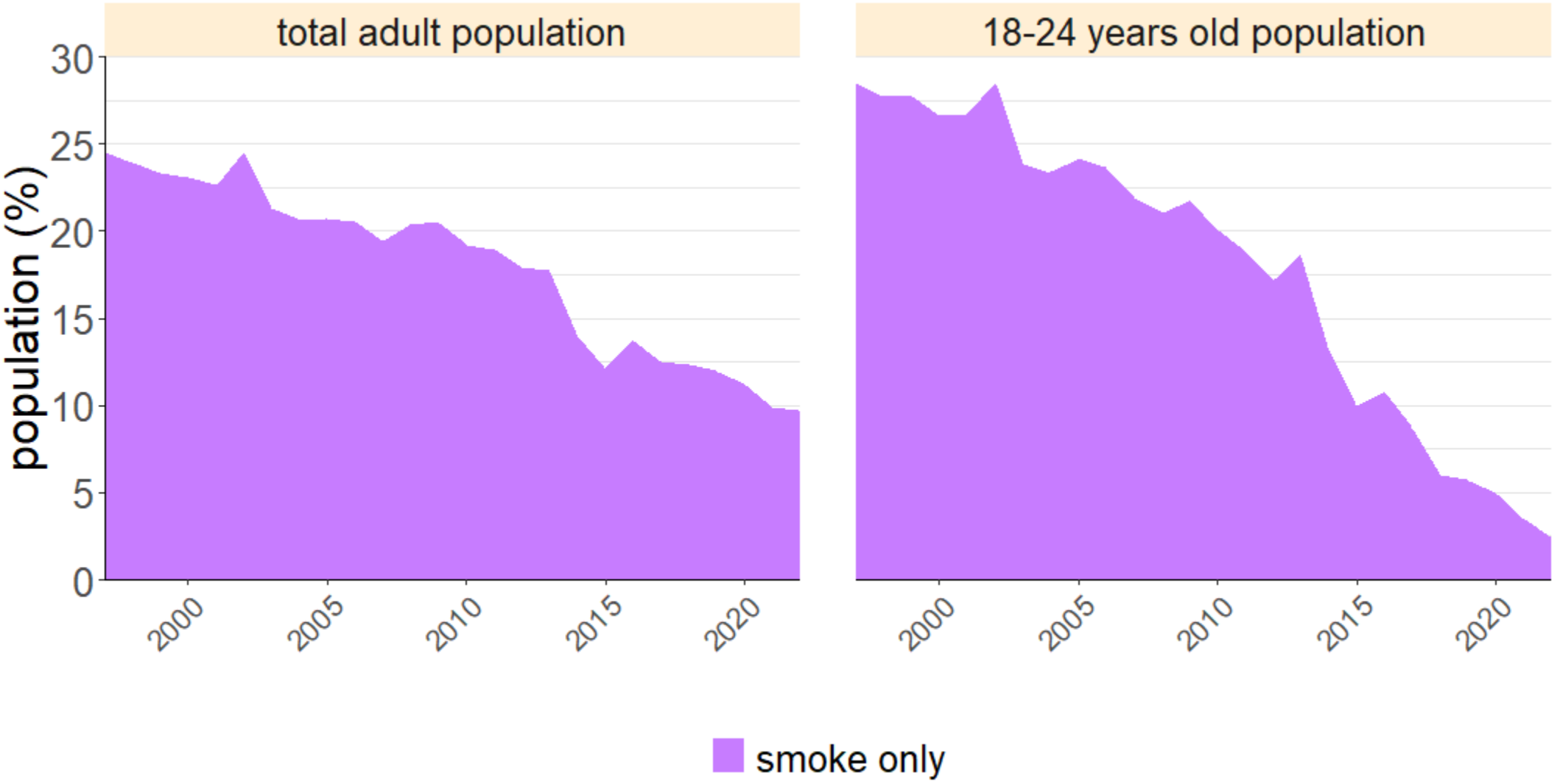
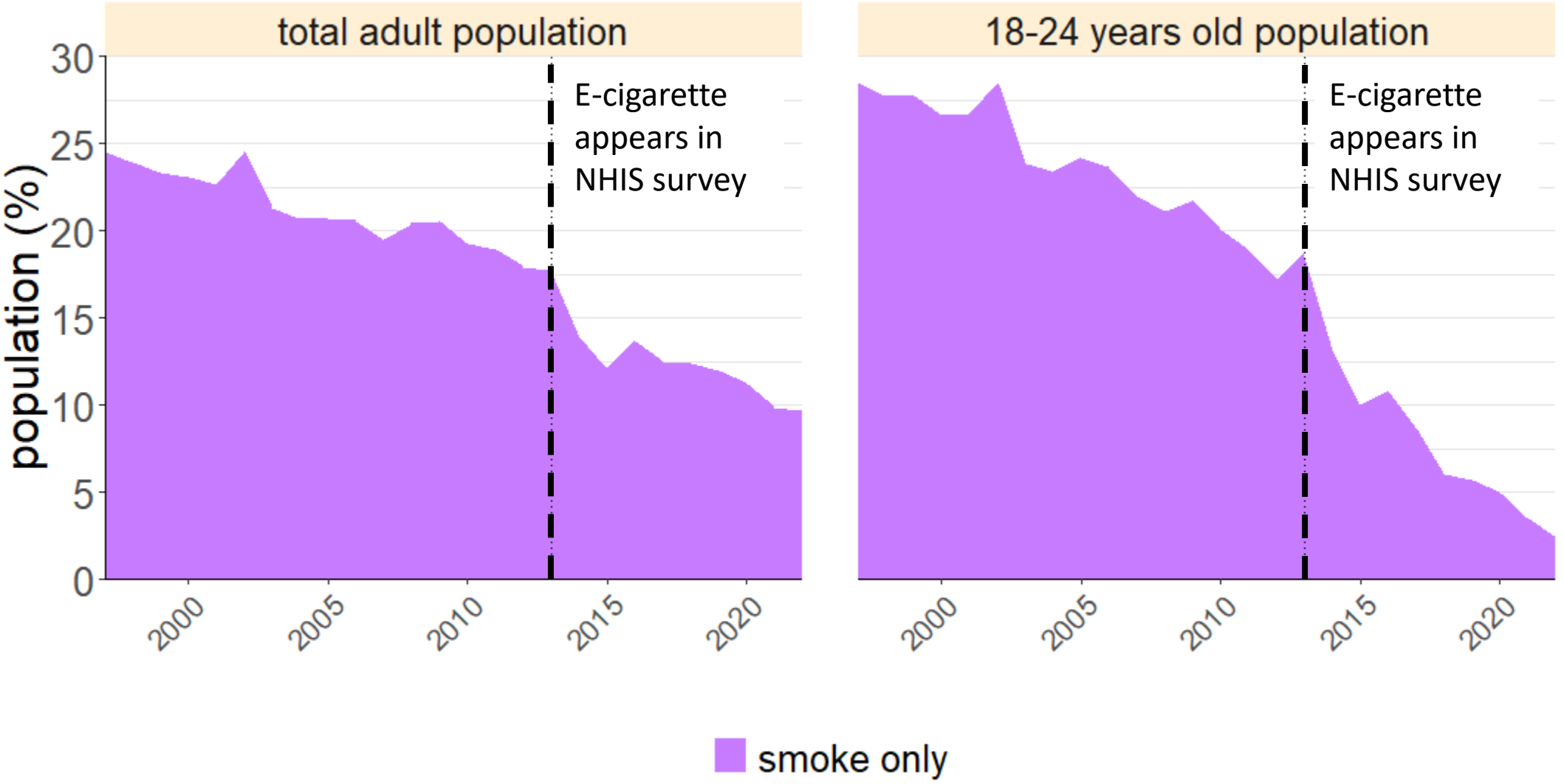
Scaling NHIS smoking prevalence results



Extending time window from 8 to 25 years



Separating pre- and post-EVP eras



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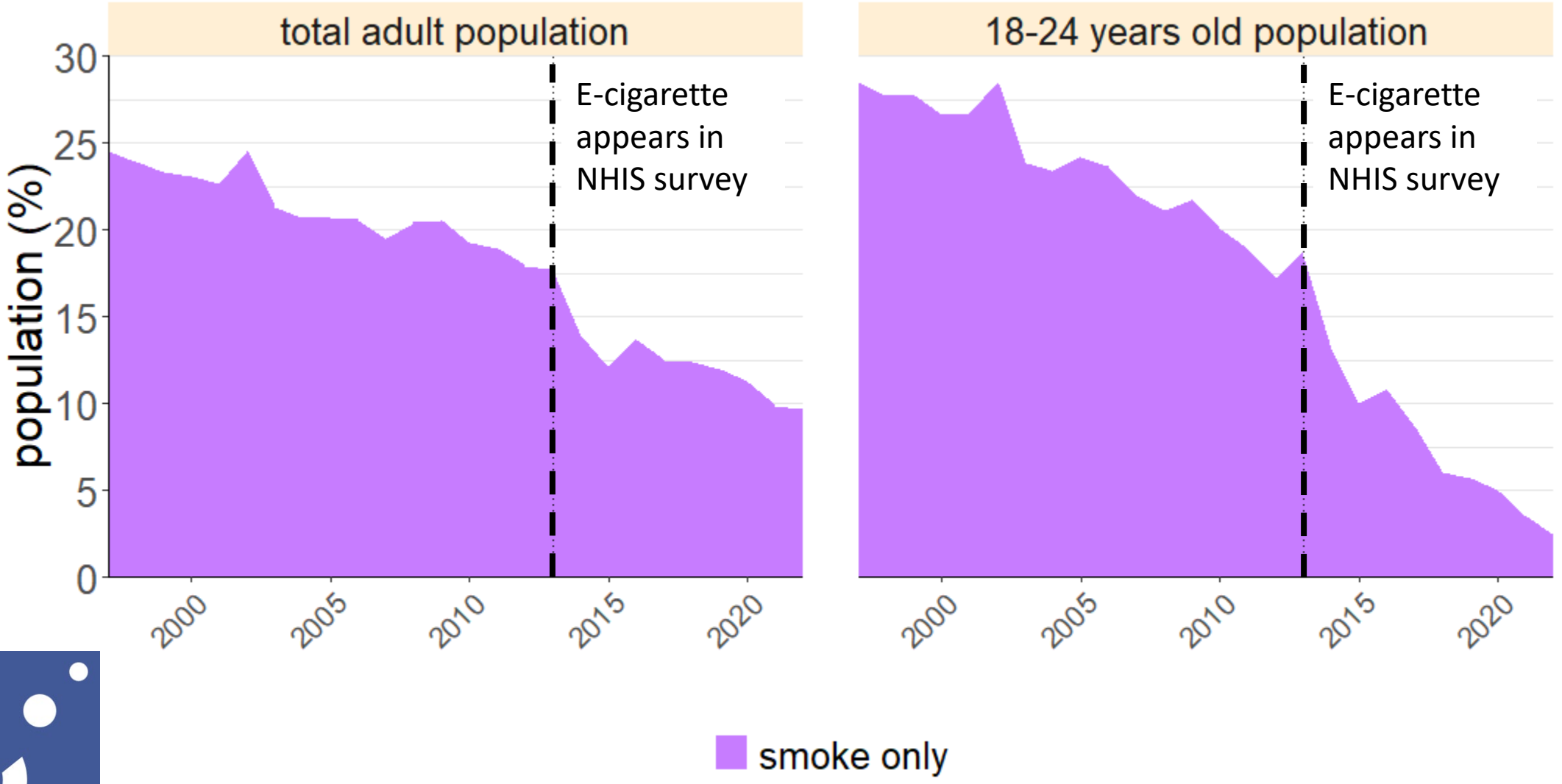

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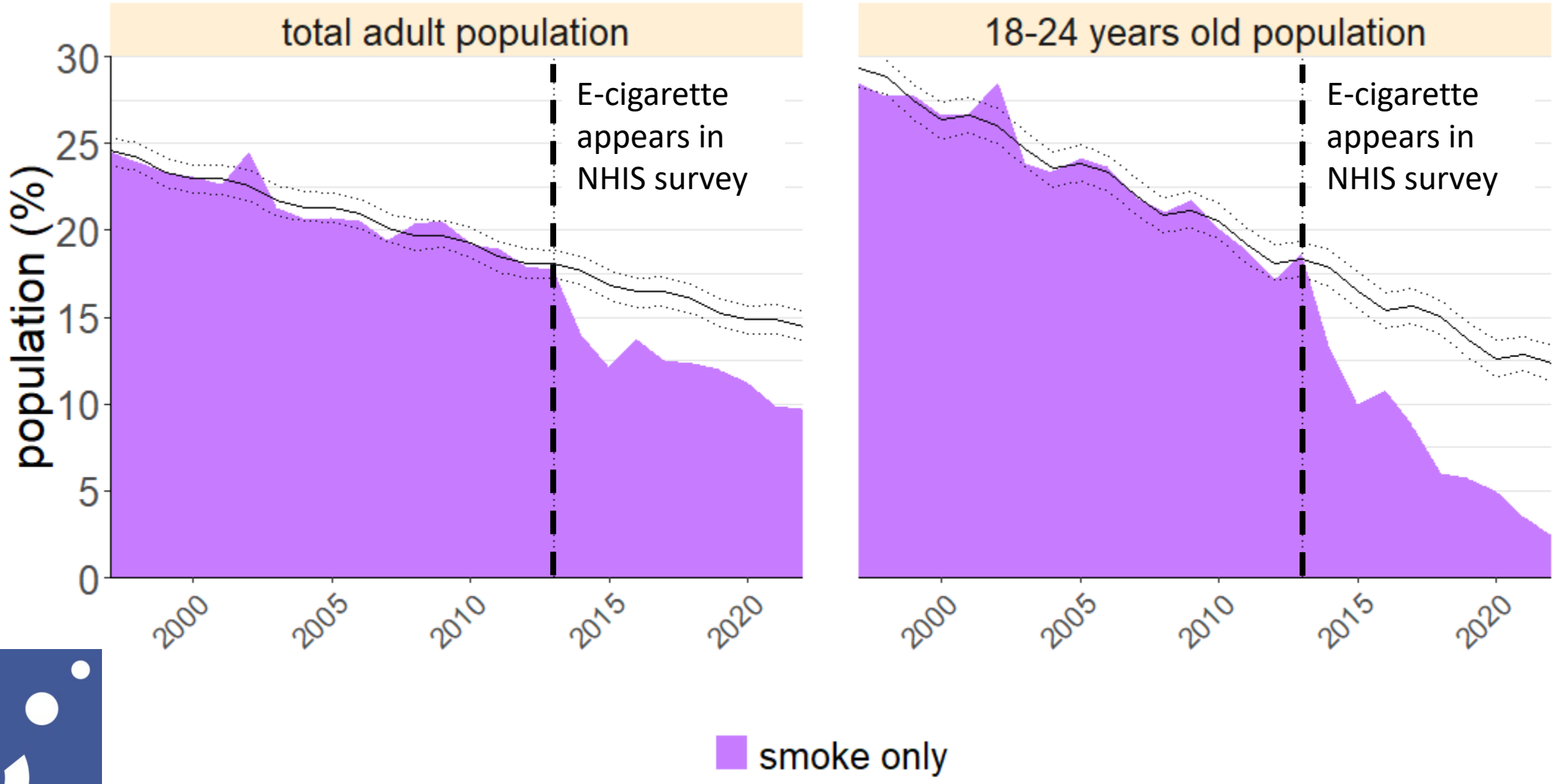
Simulating smoking prevalence without EVPs



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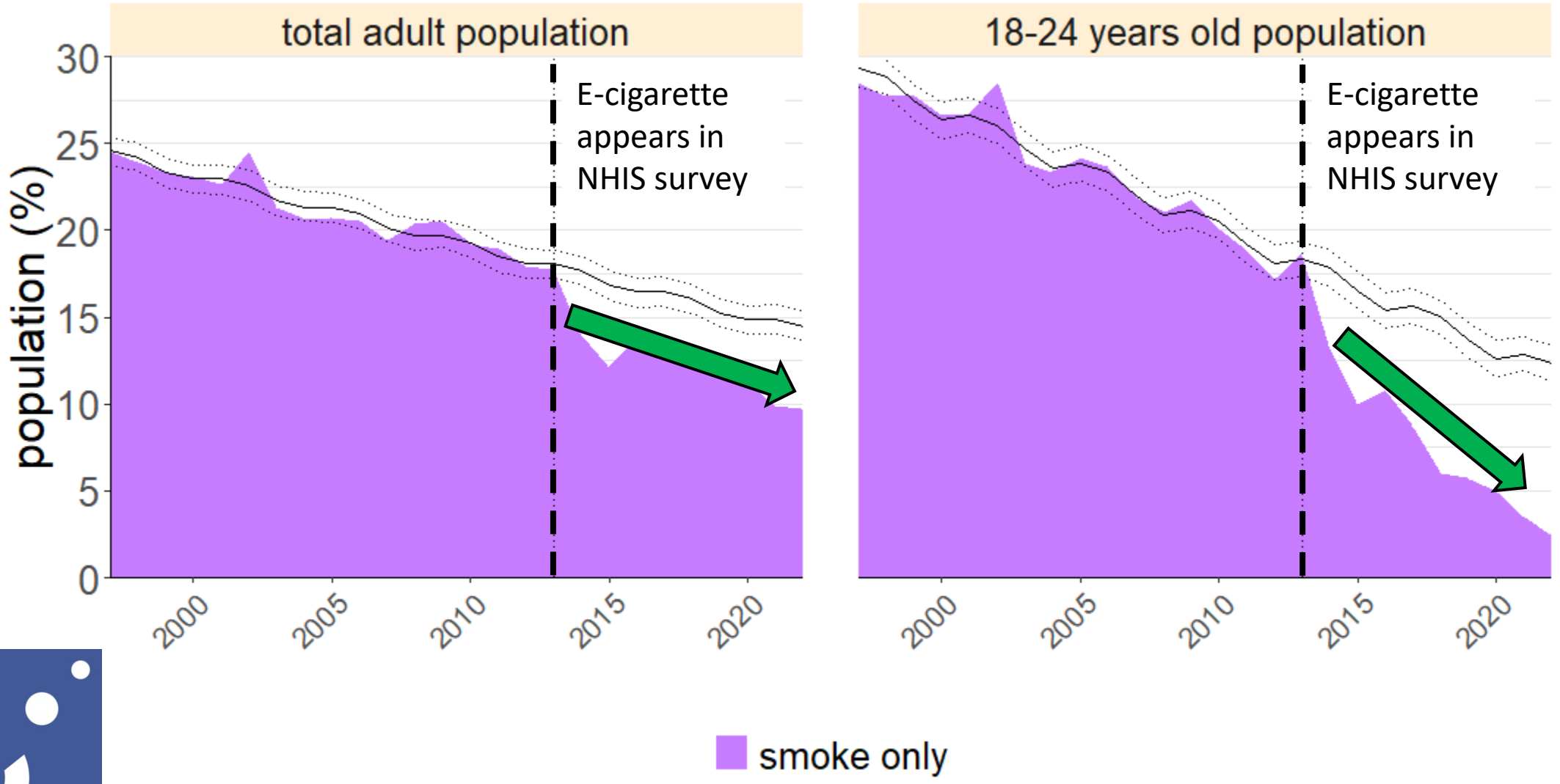
Possible EVP effects on TOTAL nicotine prevalence: Scenario 1



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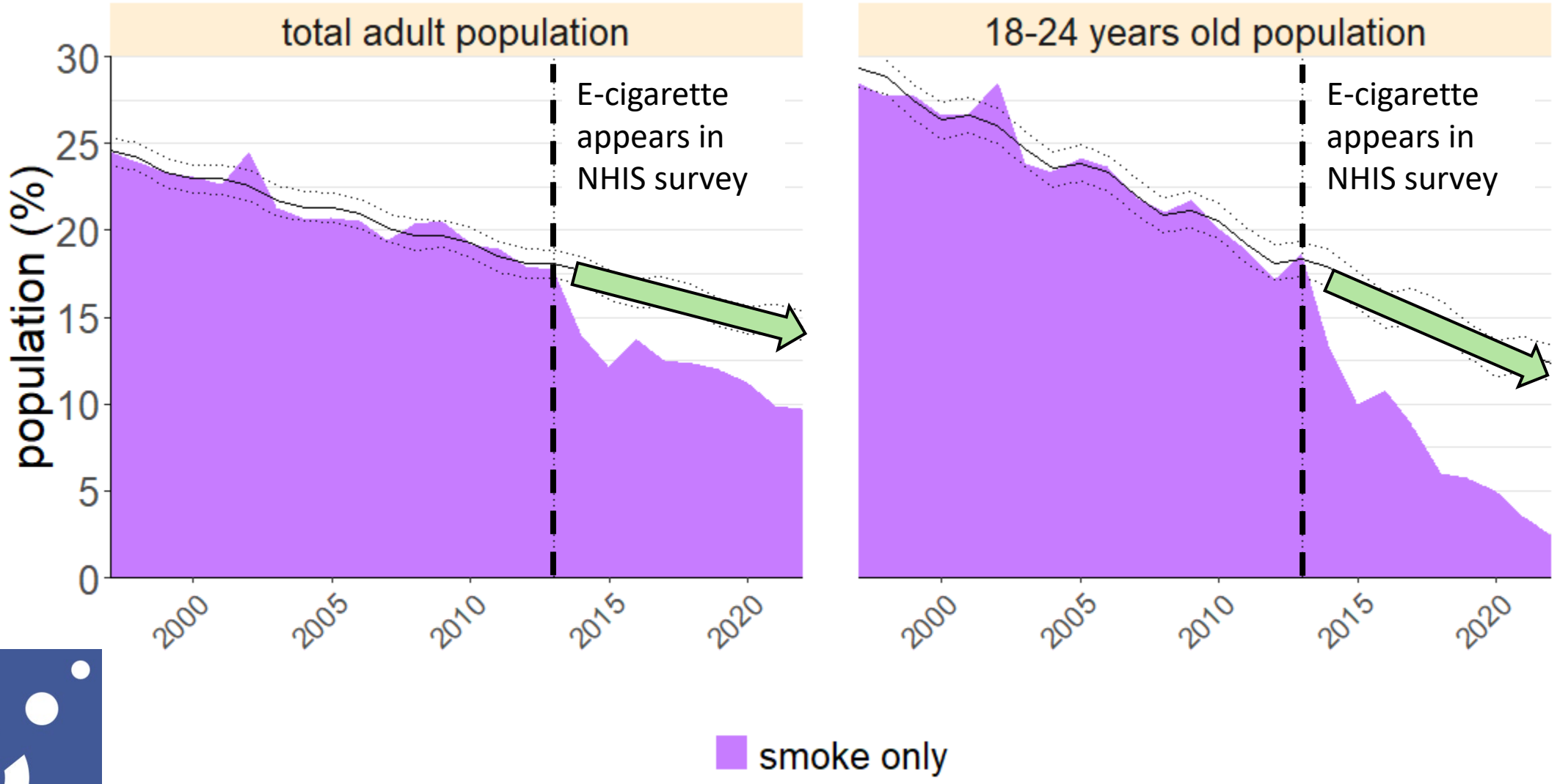
Possible EVP effects on TOTAL nicotine prevalence: Scenario 2



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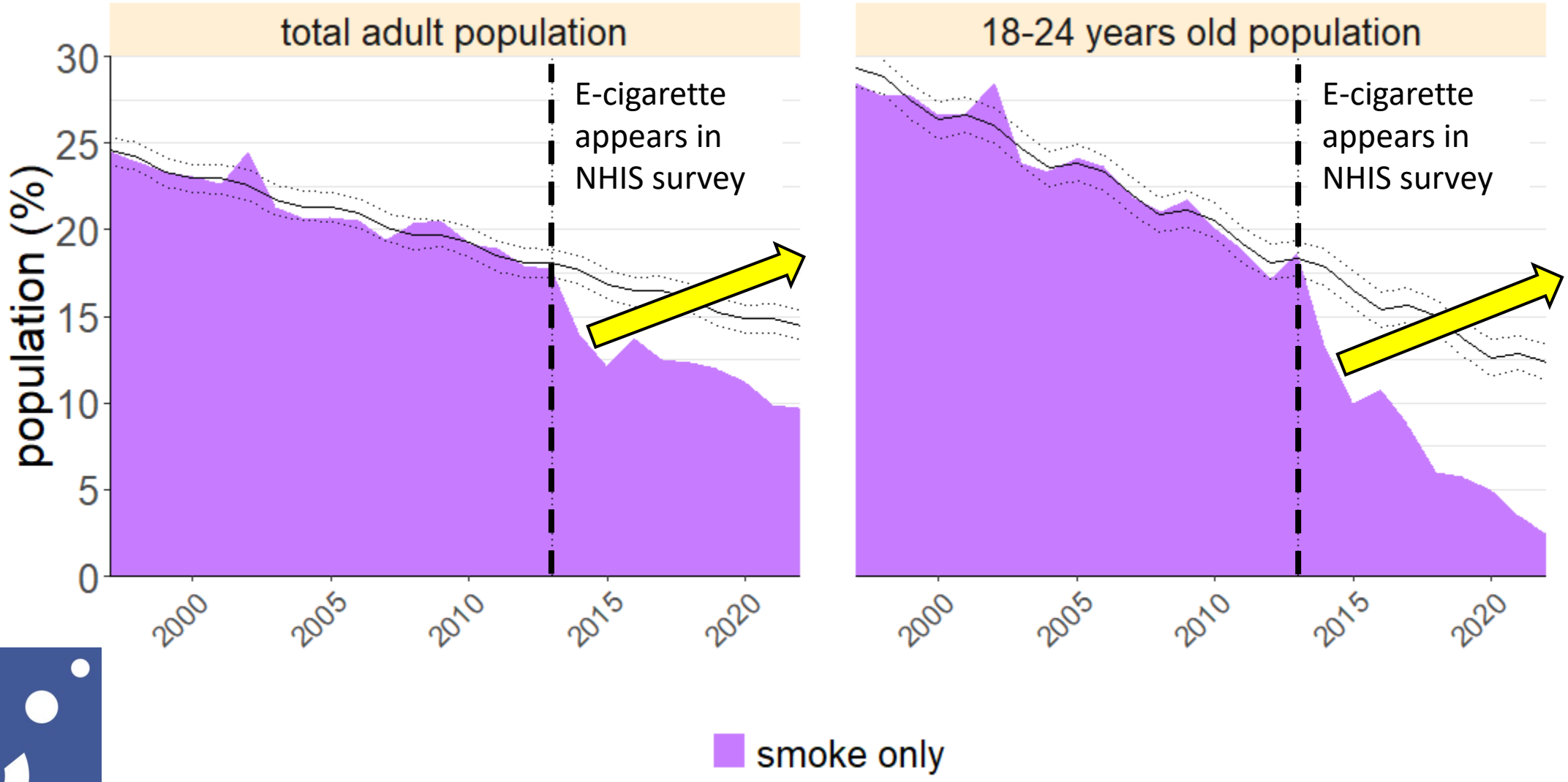
Possible EVP effects on TOTAL nicotine prevalence: Scenario 3



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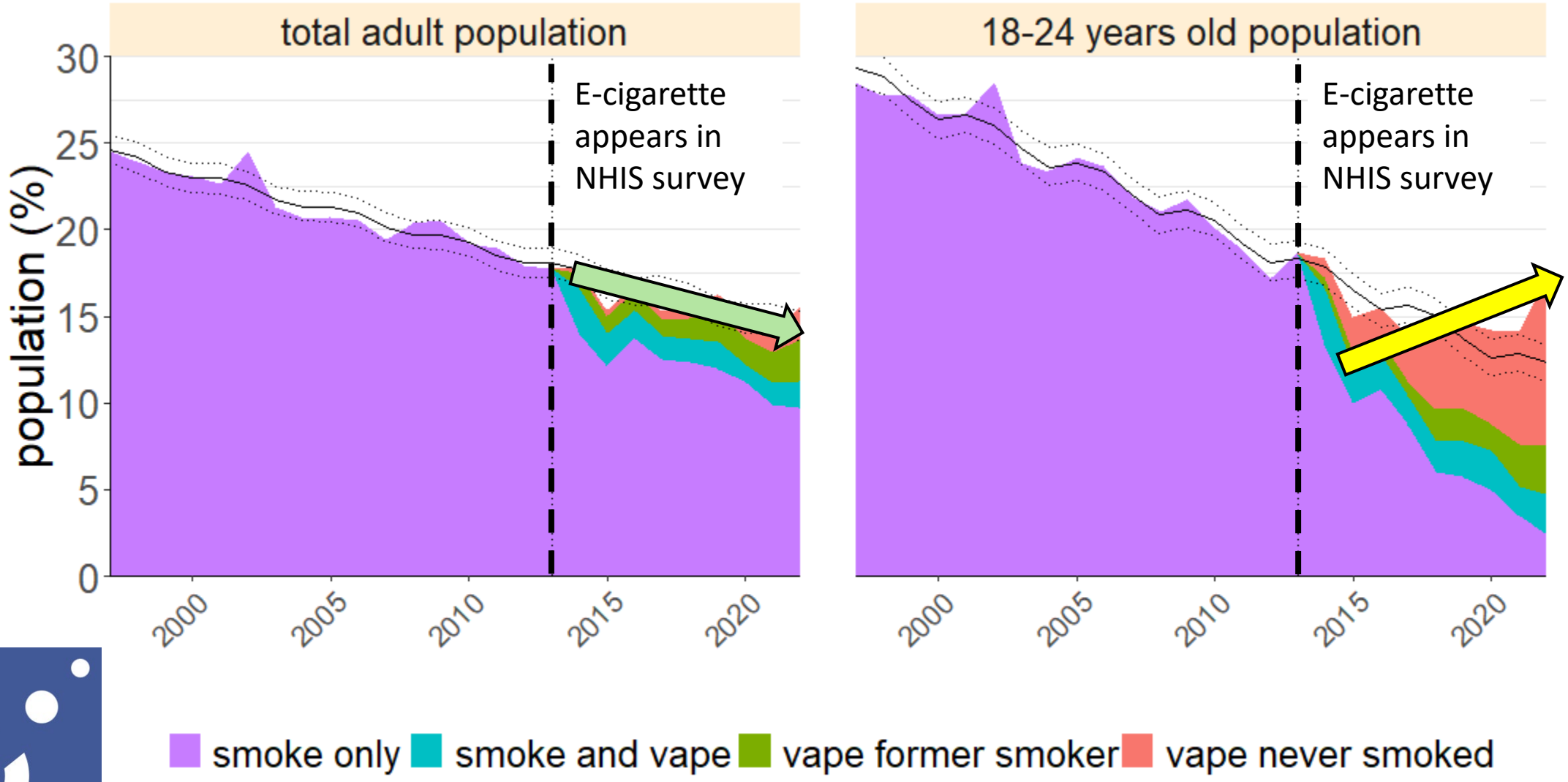
Possible EVP effects on TOTAL nicotine prevalence



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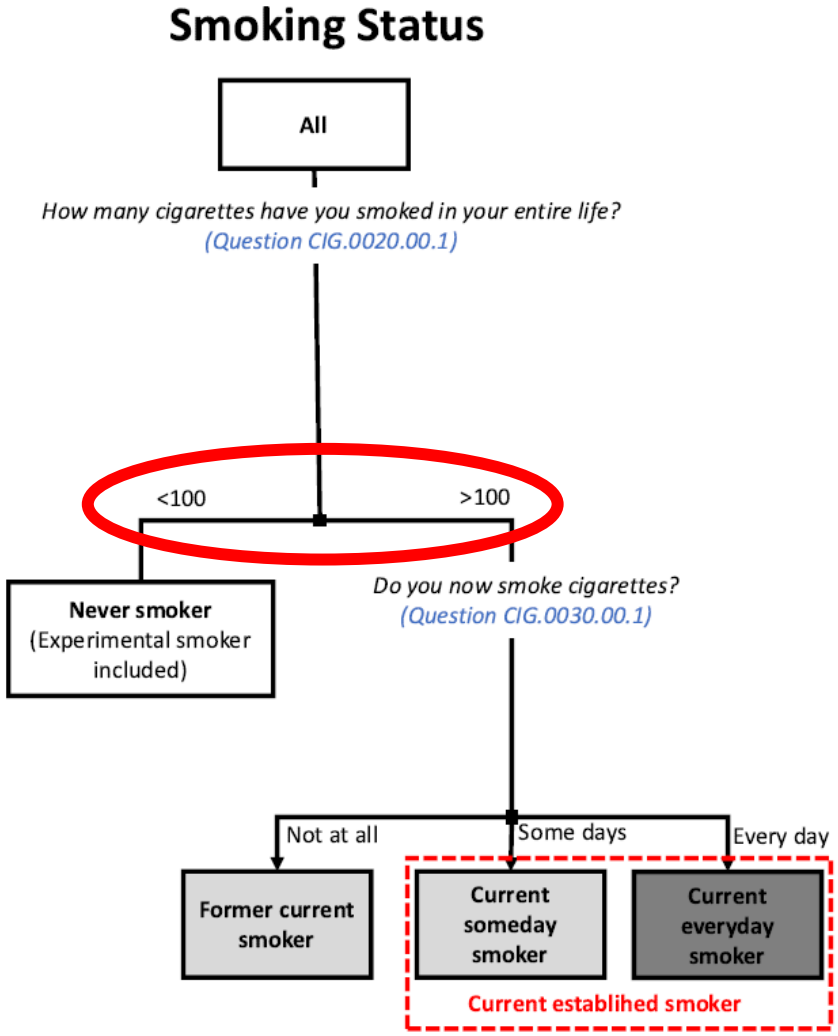
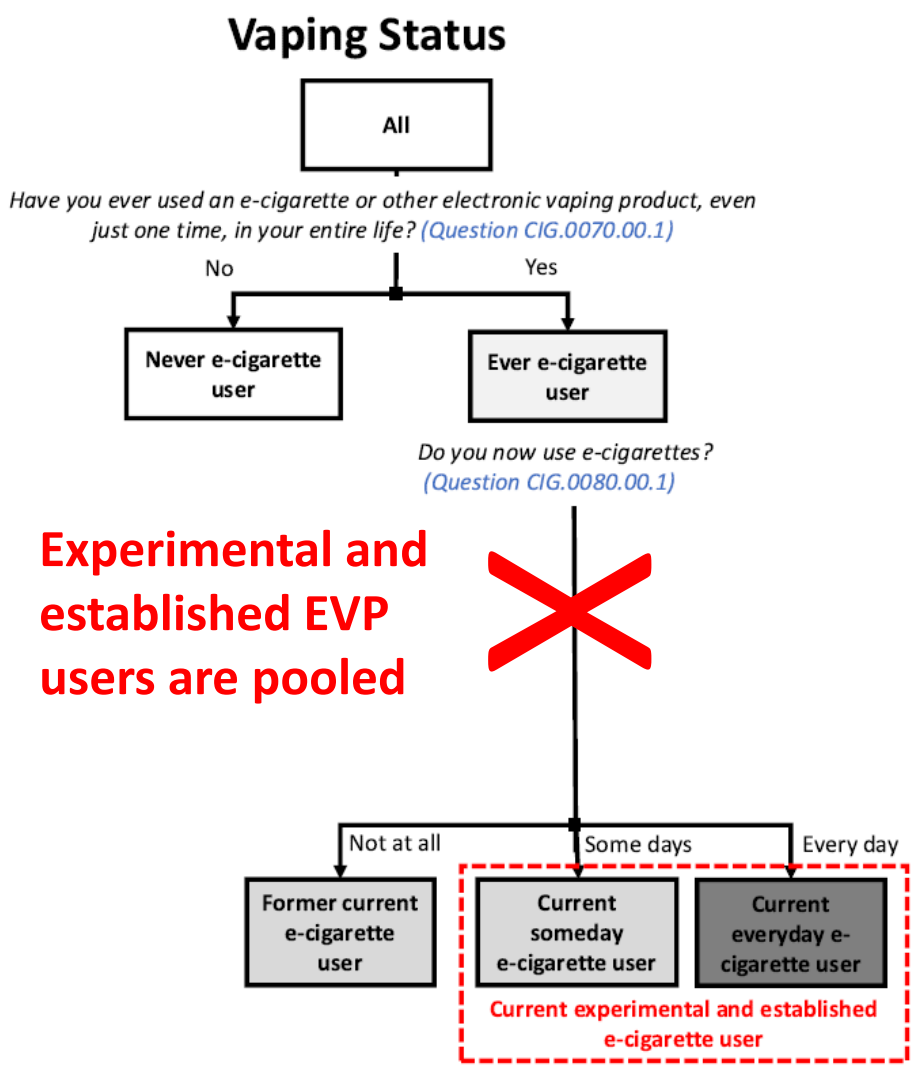
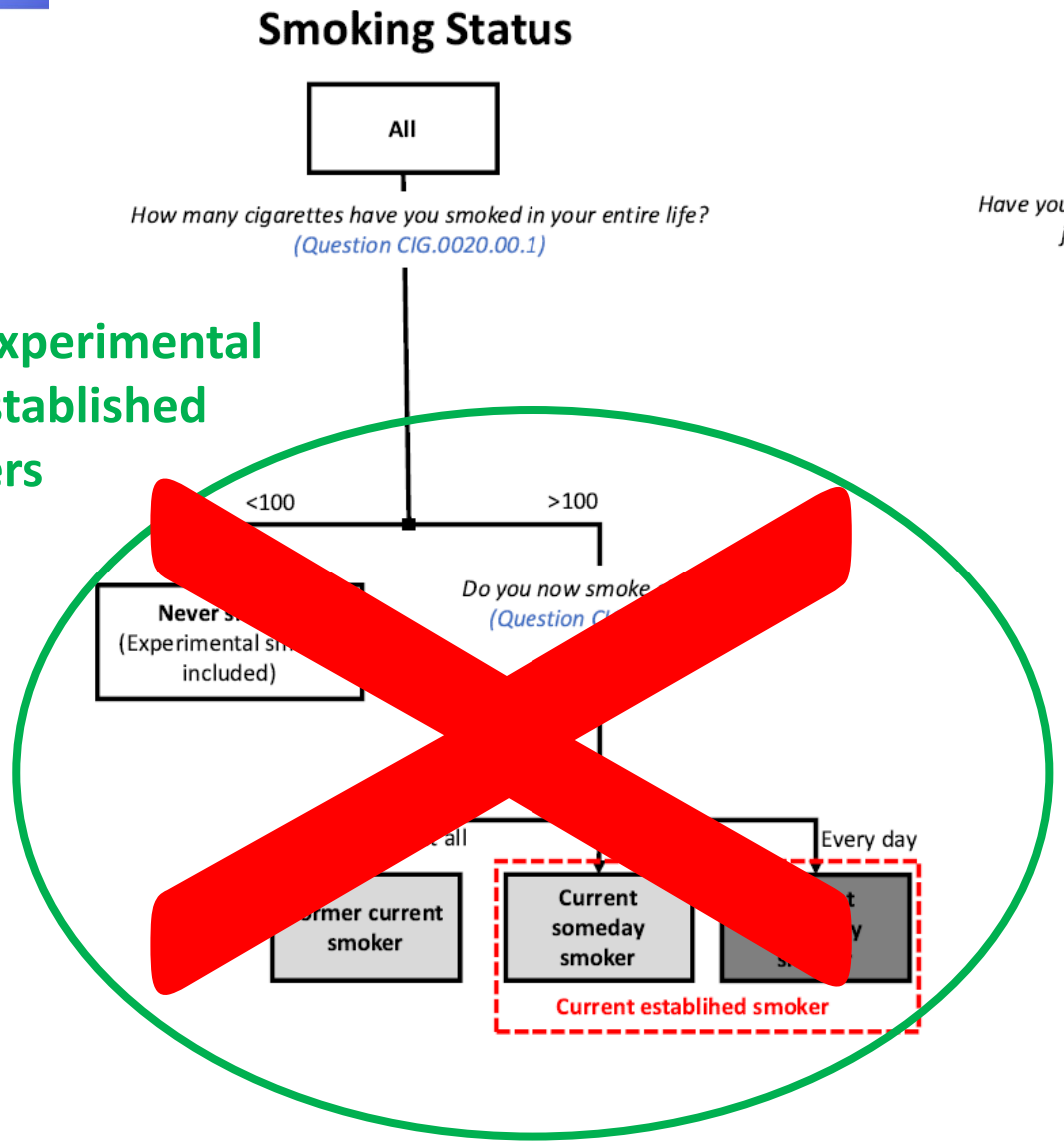
Smoker and EVP user definitions are mismatched

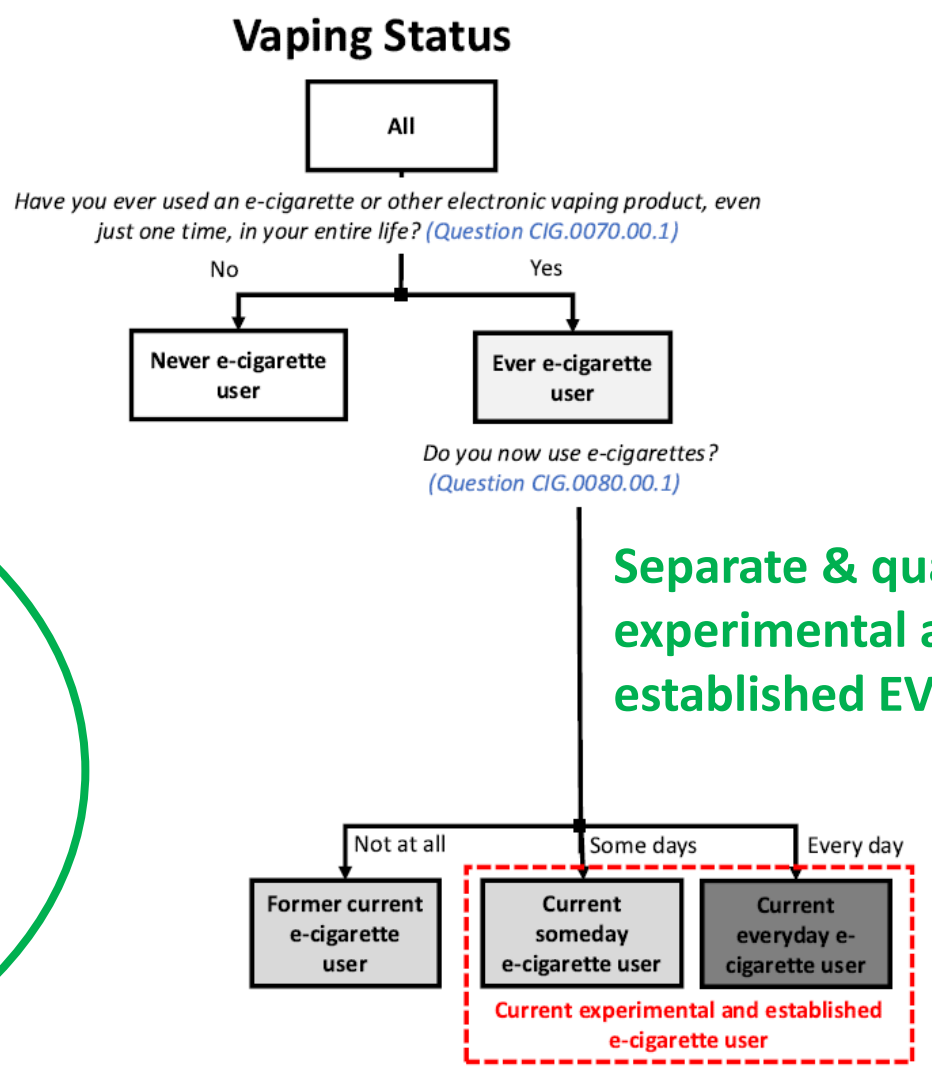




Possible intervention to correct our analysis

Pool experimental and established smokers





Separate & quantify experimental and established EVP users

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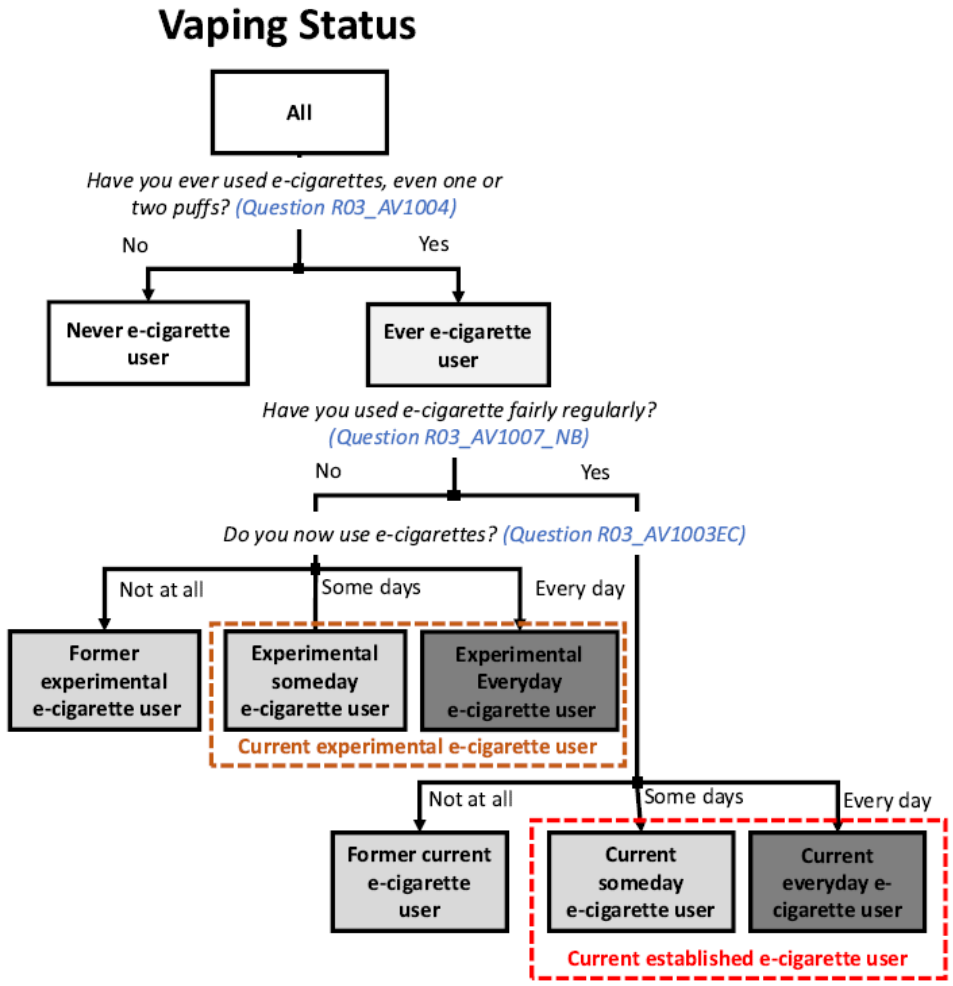
Extrapolating established EVP user frequencies

PATH
Population Assessment of Tobacco and Health
A collaboration between the NIH and FDA

Replenishment sample (wave 4 (2017))

- 8000 naive individuals
- EVP already popular in 2017



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Established EVP user frequencies can be used to adjust CDC data

Replenishment sample
(wave 4 (2017))

- 8000 naive individuals
- EVP already popular in 2017

% of established EVP users among Total EVP users:

56% for adults overall
57% for young adults

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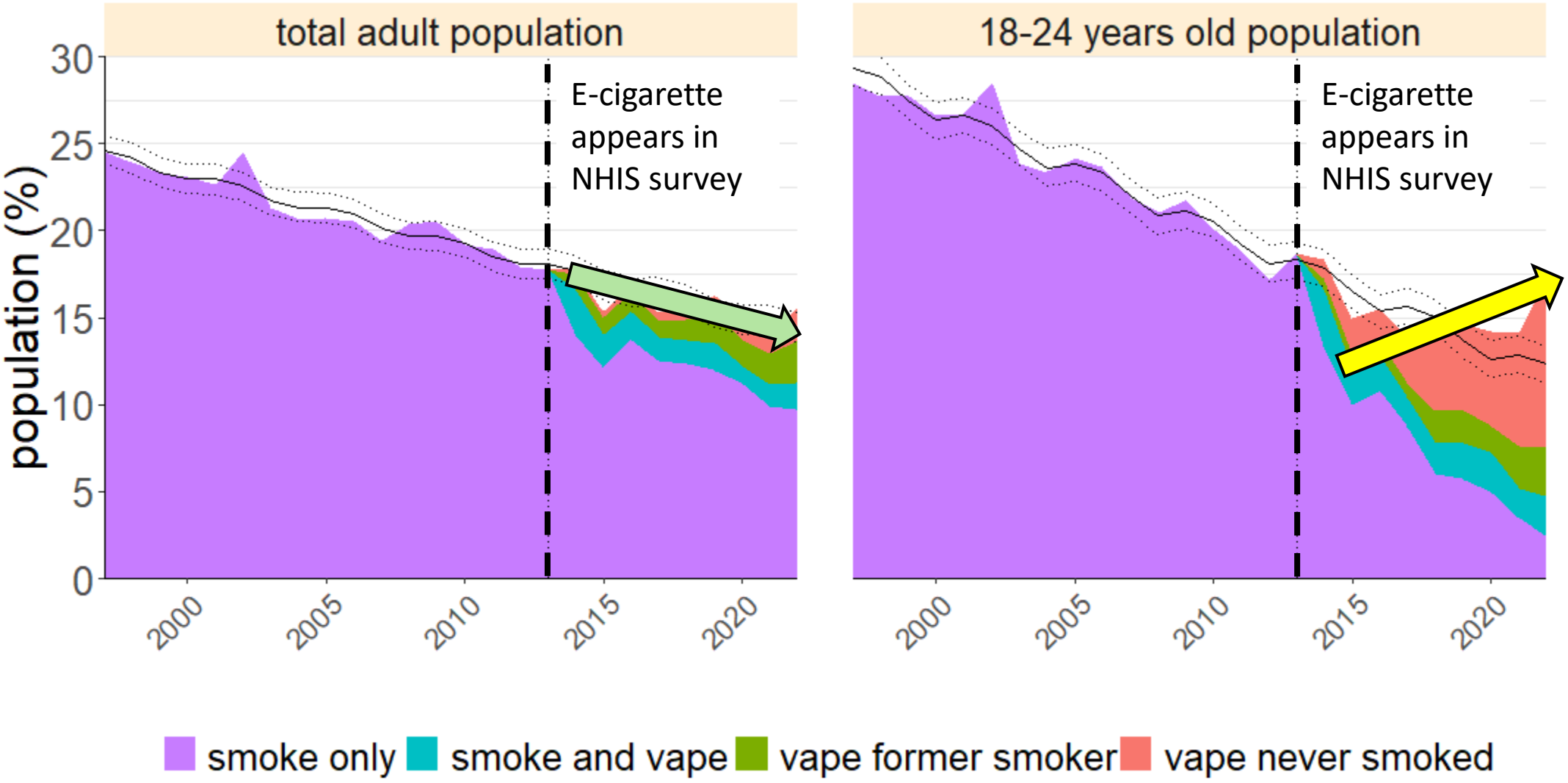
EVP prevalence before adjustment



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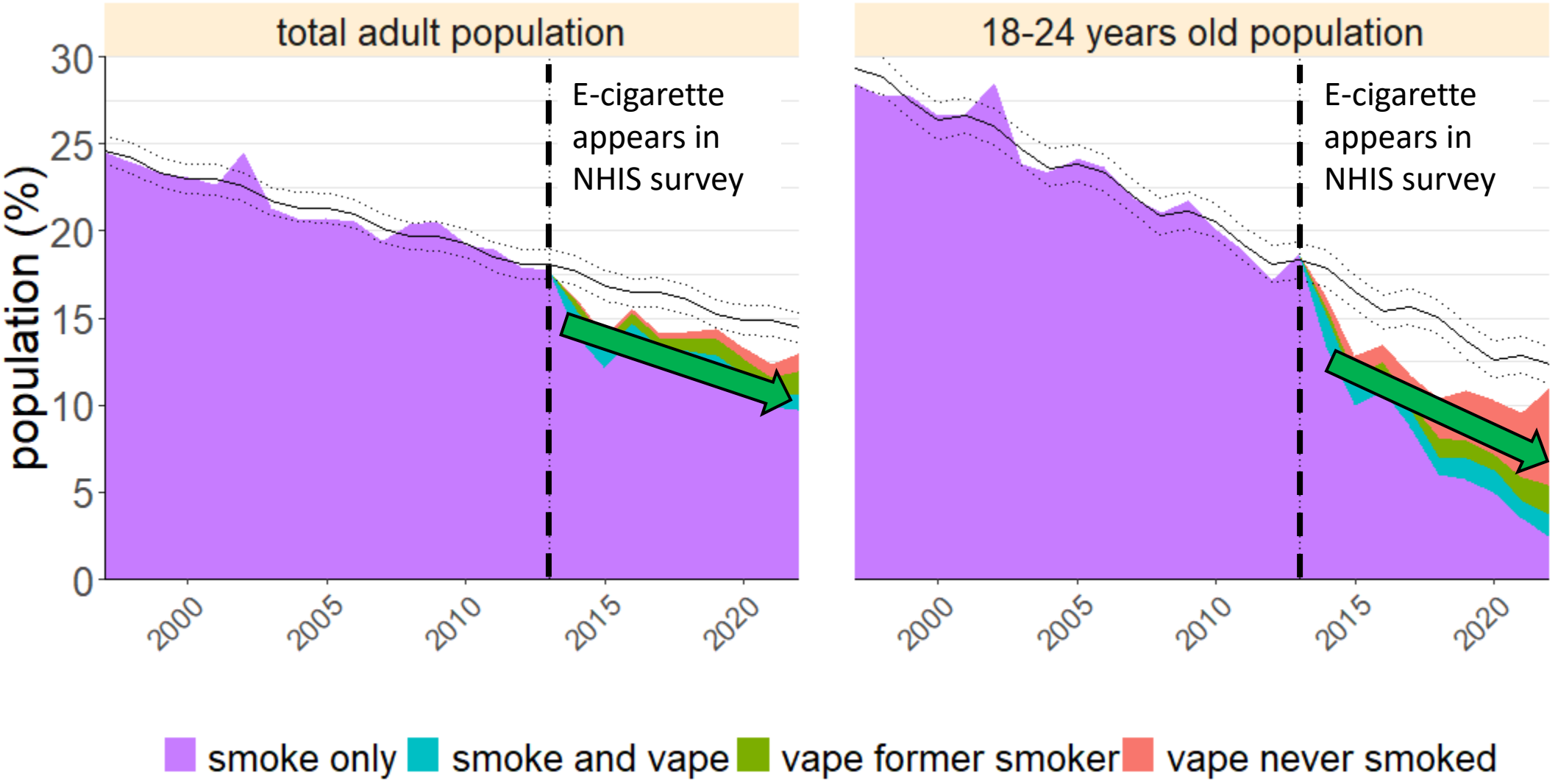
EVP prevalence after adjustment



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Summary

- Substantial smoking decrease in the last 25y, with acceleration since EVP introduction, especially in young adults → **EVPs likely strong contributors to the decline of cigarette smoking**

- Potential oversight of the equity research study. Mismatch of definitions of cigarette smokers and EVP users, **total nicotine prevalence still below the smoking-only predicted trend**

- Potential increase in EVP use among young adults from 2020 to 2022

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Take home messages

- **Current studies are not reliable and comparable. There is critical need to standardized and consistent definitions within consumer behavior studies**

- **High potential from state-of-the-art machine learning models: integrating past with current data produces realistic measures of a product's potential impact over time → accurate predictions are key in tobacco harm reduction**

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Acknowledgements

Xavier Cahours

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Thomas Nahde