

SMOKING REDUCTION TRAJECTORIES AND THEIR ASSOCIATION WITH SMOKING CESSATION

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Introduction

- Smoking is the leading cause of premature death and preventable illness worldwide [7].
- Reduction may be as effective as abrupt quitting in achieving cessation [4].

- When people are asked to reduce smoking, how do people choose to do so?
- Are there smoking or demographic factors associated with certain reduction patterns?
- Which patterns of reduction are associated with better cessation outcomes?

Methods

Data

- Smoking and demographic information from 5 clinical trials of NRT [1–3, 5, 6]
- Baseline and follow-up (weeks 2, 10, 18, and 26) CPD were recorded
- CPD and expired breath carbon monoxide (CO) collected at week 56
- In the parent trial:
 - Participants were randomly assigned to receive active or placebo NRT
 - All participants were told to reduce their smoking as much as possible

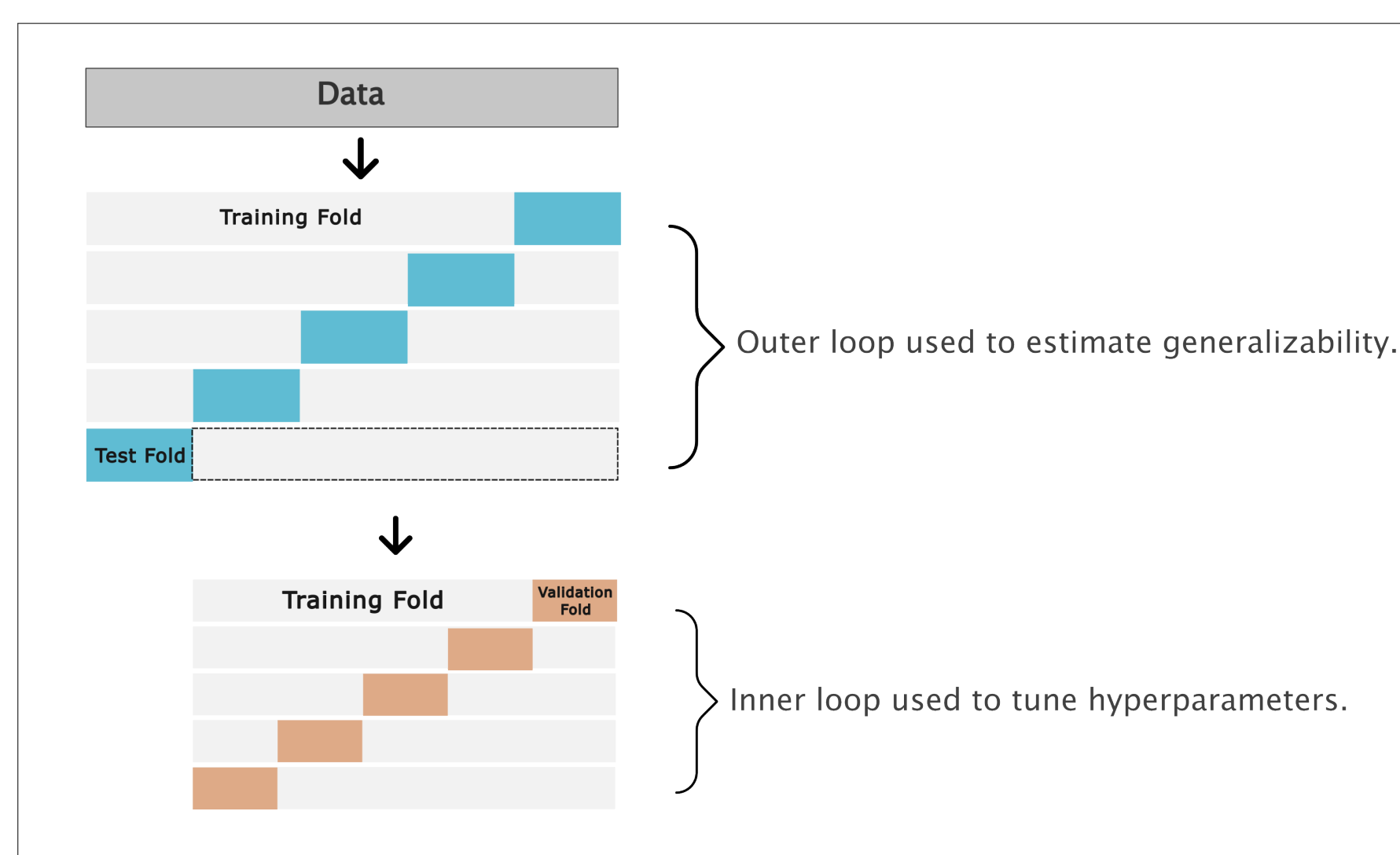


Fig. 1: Nested cross validation scheme. Data were partitioned into 80% training and 20% testing sets to evaluate generalizability across five folds. Each training fold was further divided into 80% training and 20% validation folds to tune hyperparameters.

Analysis

1. We estimated smoking trajectories using latent class analysis (LCA) as a function of percent reduction in CPD. Participants were assigned to the most likely latent class.
2. We used regularized regression (i.e., elastic net) under a nested cross validation scheme (see Figure 1) to predict latent class using baseline and demographic characteristics.
3. We predicted biochemically-verified smoking status at week 52 using baseline and demographic characteristics, plus latent class.

- Pre-registered protocol: <https://osf.io/qh378/>
- Analytical code: <https://github.com/ajbarrows/mcneil-lca>

Results

Participants

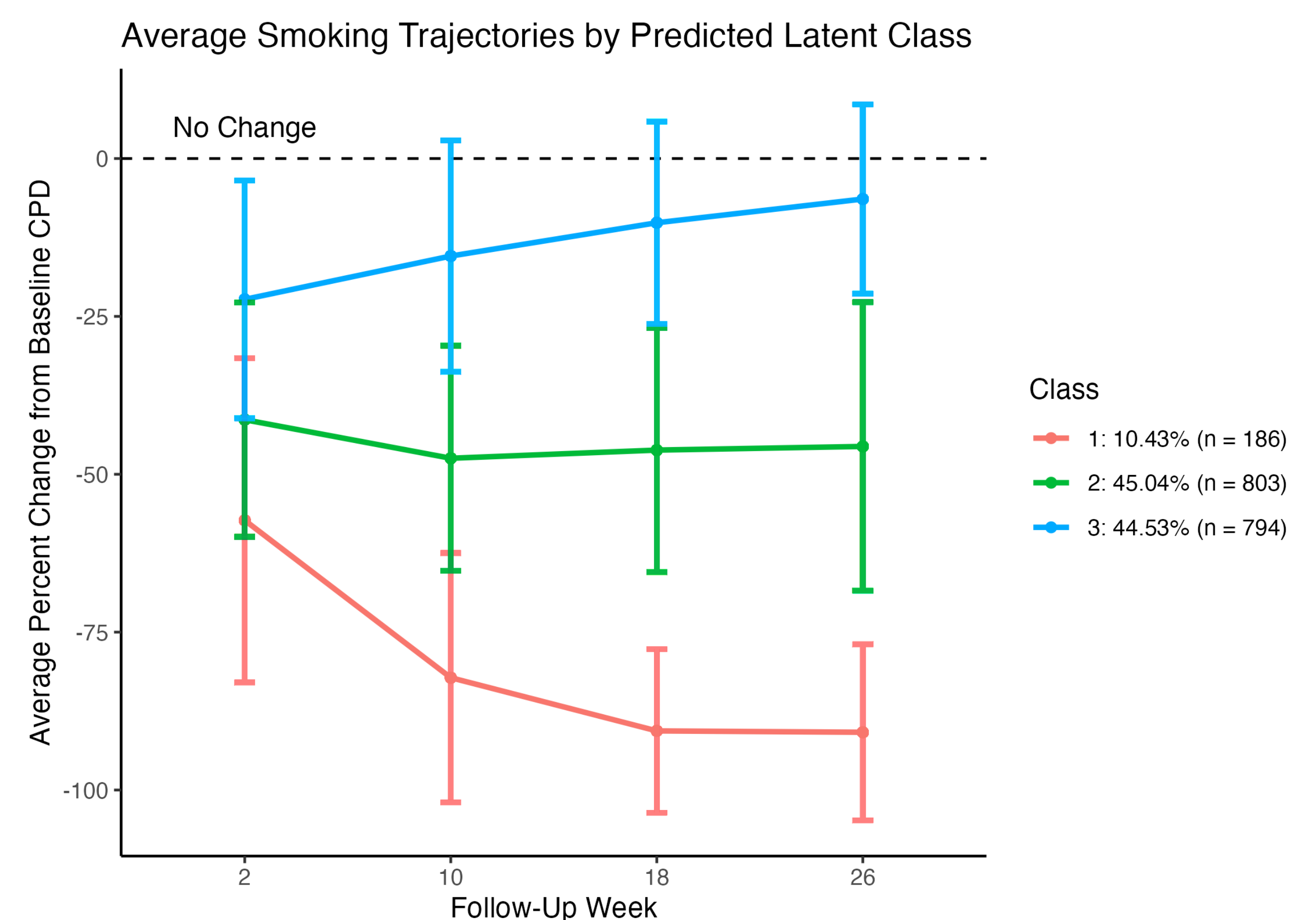
- 108/2066 participants were excluded for missing values.
- Resulting $n = 1783$:
 - From five countries
 - 44.8% male, mean age 44.10 ± 10.72 years
 - Smoked an average of 27.32 ± 9.73 CPD

Latent Class Analysis

- Class 1: $\sim 10\%$ initially reduced and nearly eliminated smoking
- Class 2: $\sim 45\%$ reduced by nearly 50% and remained
- Class 3: $\sim 45\%$ initially reduced but reverted to their baseline smoking

Predicting Latent Class

- Demographic data and baseline characteristics (e.g., smoking and quit behavior, FTND, SF-36, trial treatment group) were used as independent variables
- Latent class was used as the dependent variable
- One cross-validated elastic net logistic regression for each latent class (i.e., one-versus-all)
- All models performed better than chance:
 - Class 1 test AUC = 0.766, $p < .001$. Tended to be older with lower anxiety and nicotine dependence, more likely to have received active NRT.
 - Class 2 test AUC = 0.569, $p = .008$. No clear pattern of characteristics.
 - Class 3 test AUC = 0.523, $p < .001$. Inverse of class one: higher nicotine dependence, more likely to have received placebo NRT.



Predicting Smoking Status

- 122/1783 (6.8%) achieved biochemically-verifiable smoking cessation at week 52:
 - Class 1: 70/186 (37.6%); Class 2: 34/803 (4.2%); Class 3: 18/776 (2.3%)
- Elastic net logistic regression predicting smoking cessation using
 - baseline characteristics alone: AUC = 0.632 ± 0.006 , $p < .001$
 - baseline characteristics plus latent class: AUC = 0.776 ± 0.010 , $p < .001$
- **Adding latent class as an independent variable improved cessation prediction by 14.4%**

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Conclusions

- **Examining latent trajectories in smoking behavior among people not motivated to quit revealed three distinct patterns**
- **One of these trajectories was nearly twice as likely as the others to achieve cessation**
- **Smoking reduction in the first two weeks after intervention by $\geq 50\%$ \rightarrow substantially increased cessation likelihood**