

Changing age patterns of cigarette and ENDS transitions in the PATH study: a multistate transition model analysis of adults and youth through 2017 (Waves 1–4) vs after 2017 (Waves 4–5)

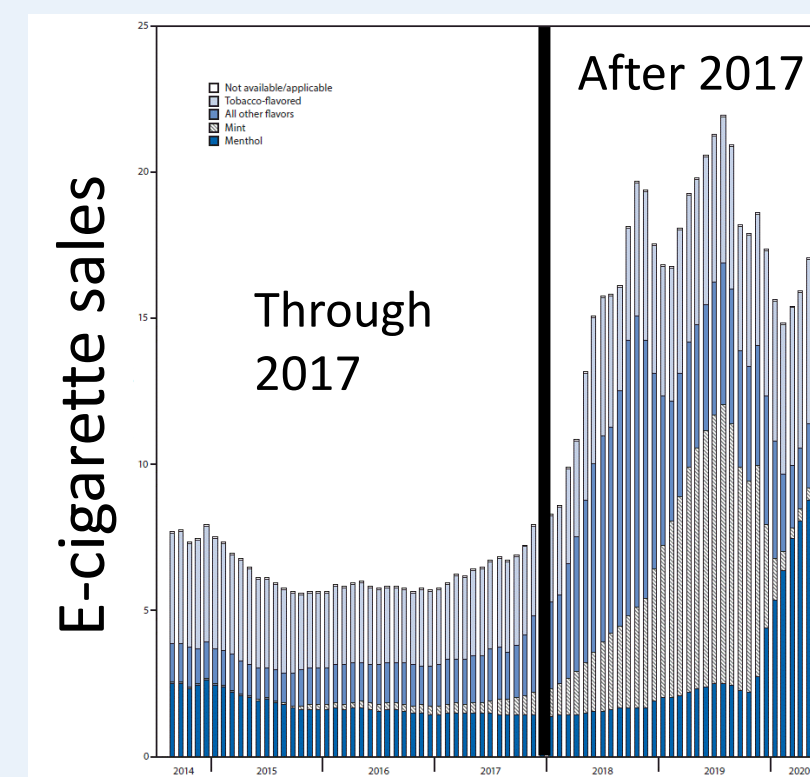
TCORS 2.0
University of Michigan & Georgetown University
Center for the Assessment of Tobacco Regulations [CAStoR]

Andrew F. Brouwer¹, Jiyoung Jeon¹, Evelyn Jimenez-Mendoza¹, Stephanie R Land², Ritesh Mistry³, David T. Levy⁴, Rafael Meza¹
Contact: brouweaf@umich.edu

Affiliations. 1. Epidemiology, University of Michigan. 2. National Cancer Institute, National Institute of Health. 3. Health Behavior and Health Education, University of Michigan. 4. Department of Oncology, Georgetown University.

Introduction

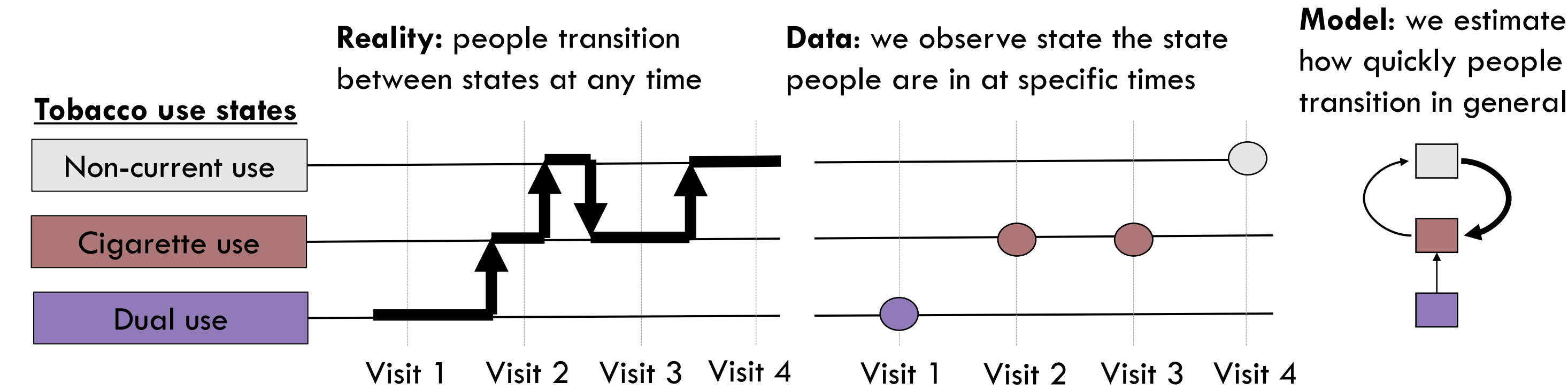
- Sales of ENDS, particularly JUUL, rose substantially in late 2017 and 2018.
- Did transitions between cigarette, ENDS, and dual use change over this period?
- Were adult and youth transitions affected differently?



Methods

Multistate Markov Transition Model Framework

Markov transition models are continuous time stochastic processes models.



Data

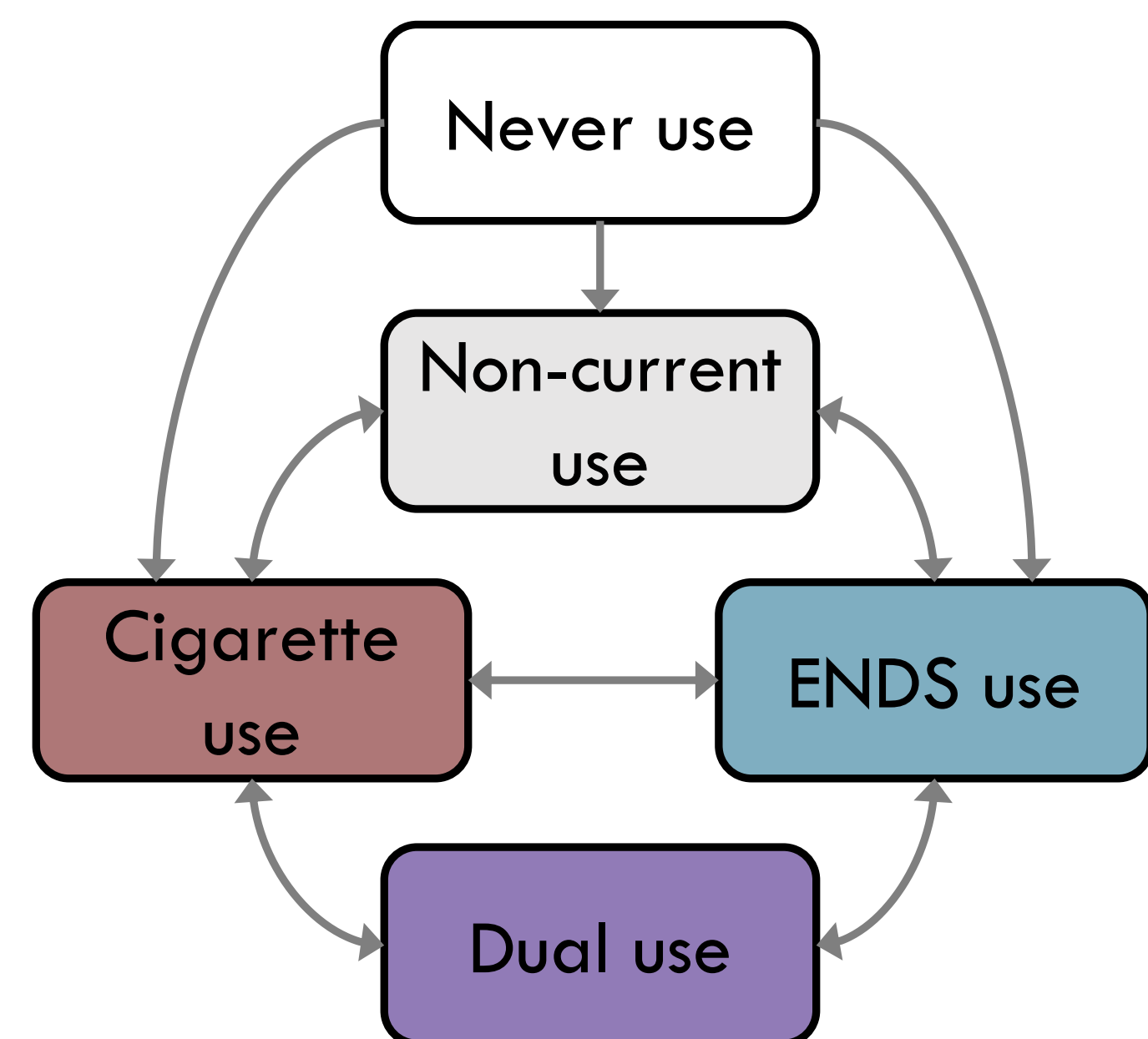
PATH Study

- Nationally representative longitudinal study of tobacco use 2013–2019
- Compare Wave 1 Cohort in Waves 1-4 to Wave 4 Cohort in Waves 4-5
- Through 2017: 24,306 adults (Waves 1-4) and 12,168 youth (Waves 2-4)
- After 2017: 23,709 adults (Waves 4-5) and 12,217 youth (Waves 4-5)

State definitions and transitions

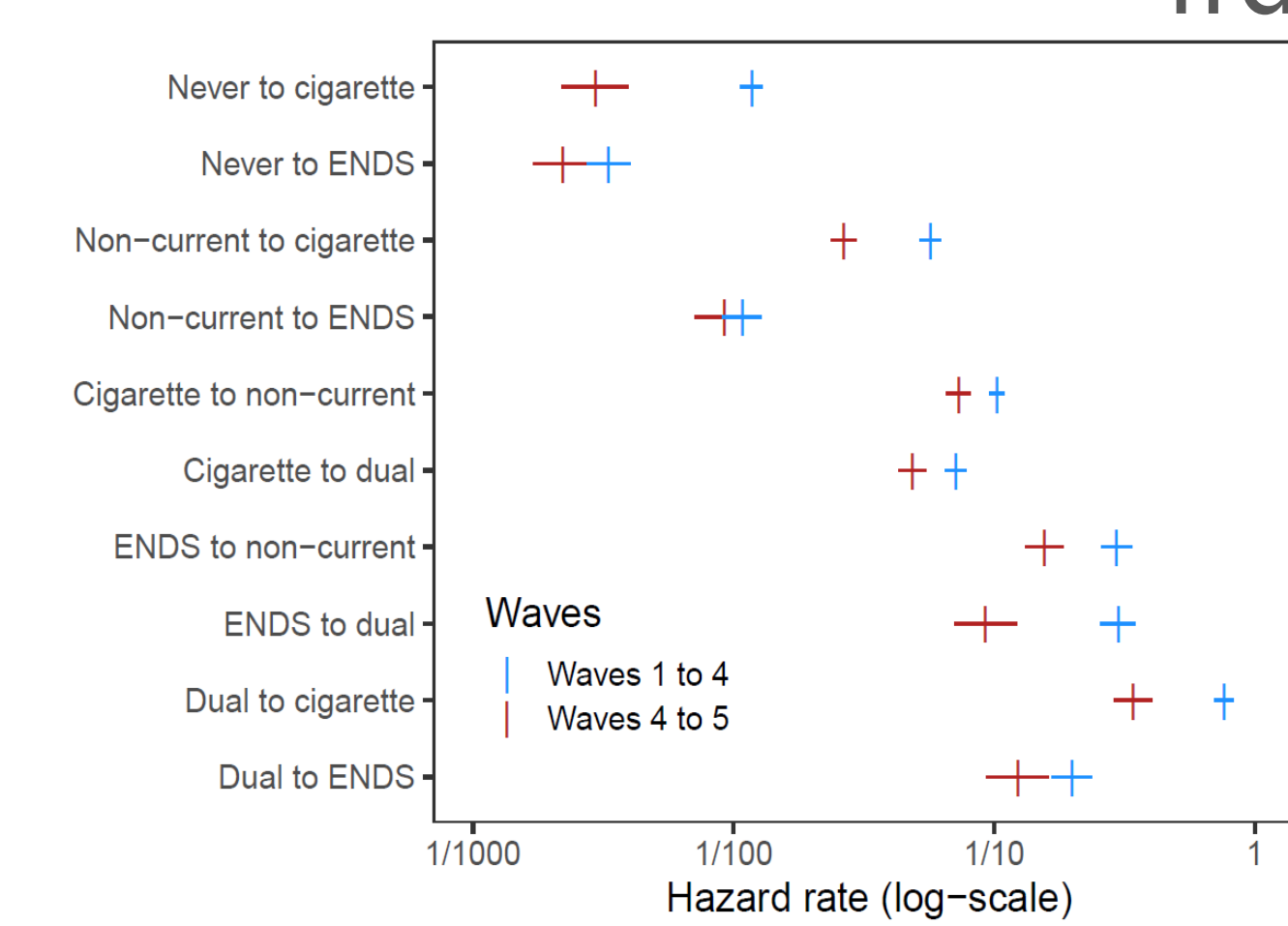
Tobacco use states were defined from:

- Established use criteria for cigarettes (100+ cigarettes in lifetimes) and ENDS (ever fairly regularly used) and
- Current past-30-day use of cigarettes and ENDS

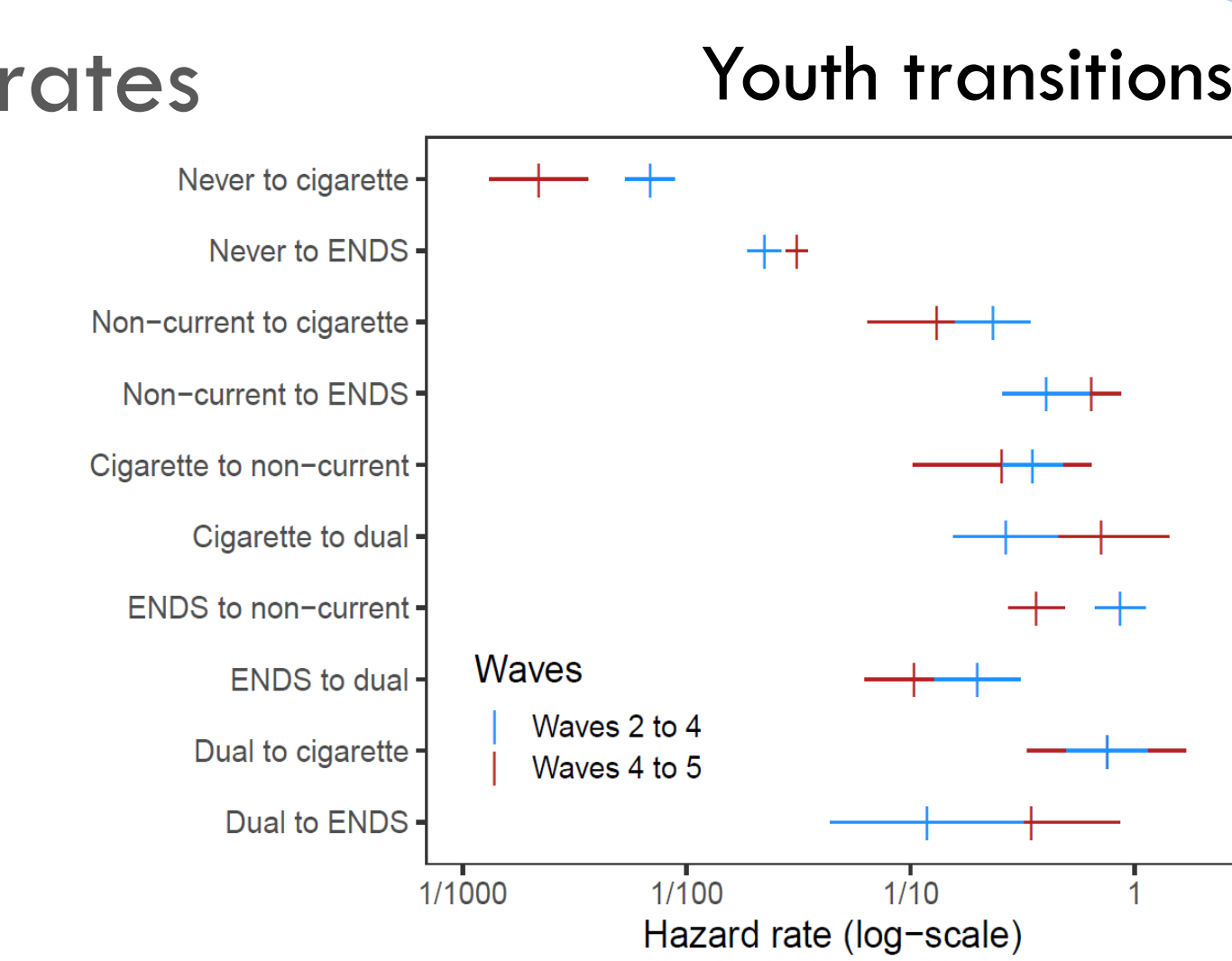


Results

Adult transitions

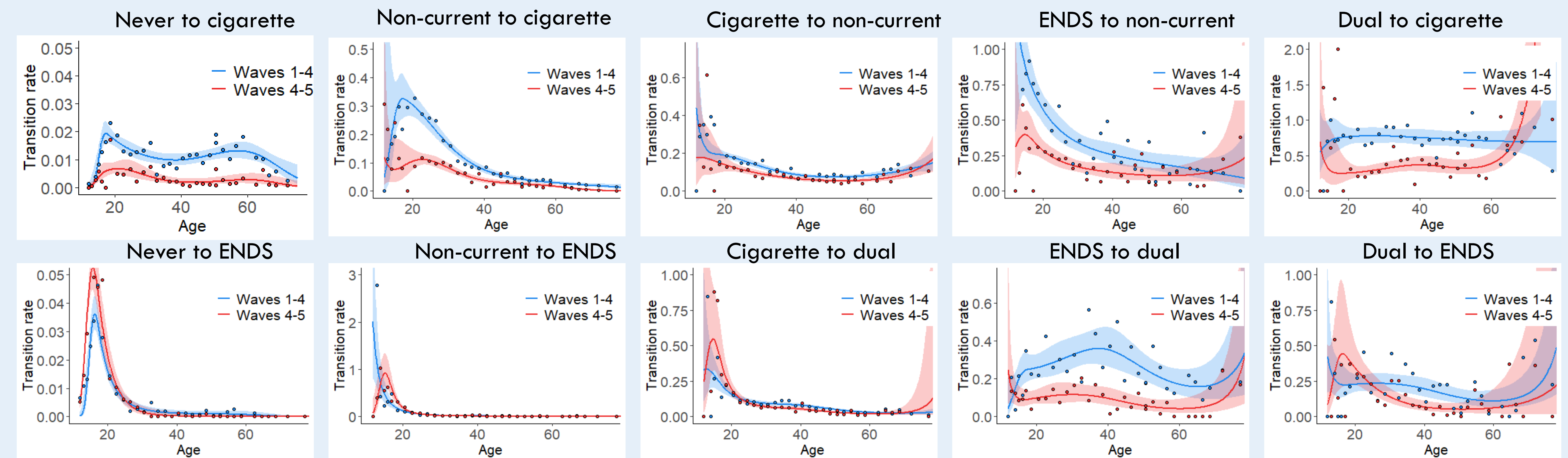


Transition rates



Age-specific transition rates

- Continuous age effects estimated with splines
- Data points are estimates for narrow age groups



Transition probabilities

From	To	Adults Waves 1-4					Adults Waves 4-5				
		1	2	3	4	5	1	2	3	4	5
1. Never user		96.5	2.0	1.1	0.3	0.1	99.0	0.6	0.3	0.2	0.0
2. Non-current user		93.9	5.1	0.8	0.2		96.6	2.4	0.8	0.1	
3. Cigarette user only		9.3	85.4	1.1	4.3		6.8	88.4	1.1	3.7	
4. ENDS user only		21.9	7.2	56.9	14.1		13.6	1.4	78.5	6.5	
5. Dual user		4.4	44.9	9.6	41.0		1.8	25.5	8.8	63.9	

1-wave cumulative transition probability (%)

From	To	Youth Waves 2-4					Youth Waves 4-5				
		1	2	3	4	5	1	2	3	4	5
1. Never user		97.0	0.7	0.6	1.4	0.2	96.2	0.8	0.2	2.6	0.2
2. Non-current user		63.7	14.2	18.8	3.4		53.2	6.6	36.6	3.6	
3. Cigarette user		20.8	61.5	4.2	13.5		12.9	49.0	9.9	28.2	
4. ENDS user only		40.5	8.3	42.4	8.8		20.8	3.0	70.5	5.7	
5. Dual user		9.2	38.0	5.8	47.1		7.1	29.7	19.0	44.1	

1-wave cumulative transition probability (%)

Key Findings

- Adult dual users have become less likely to return to sole cigarette use but not more likely to discontinue cigarettes altogether.
- Youth of all categories have become more likely to become ENDS only users.
- Most transitions are age-dependent, with many highest among youth.
- Estimated smoking initiation in older ages likely driven by transition from self-reported experimental (<100 lifetime cigarettes) to established use