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E-Cigarette Use and Cigarette Quitting Among Adults with no Plans to Ever Quit Smoking: Population Findings from the USA, Canada, England, and Australia

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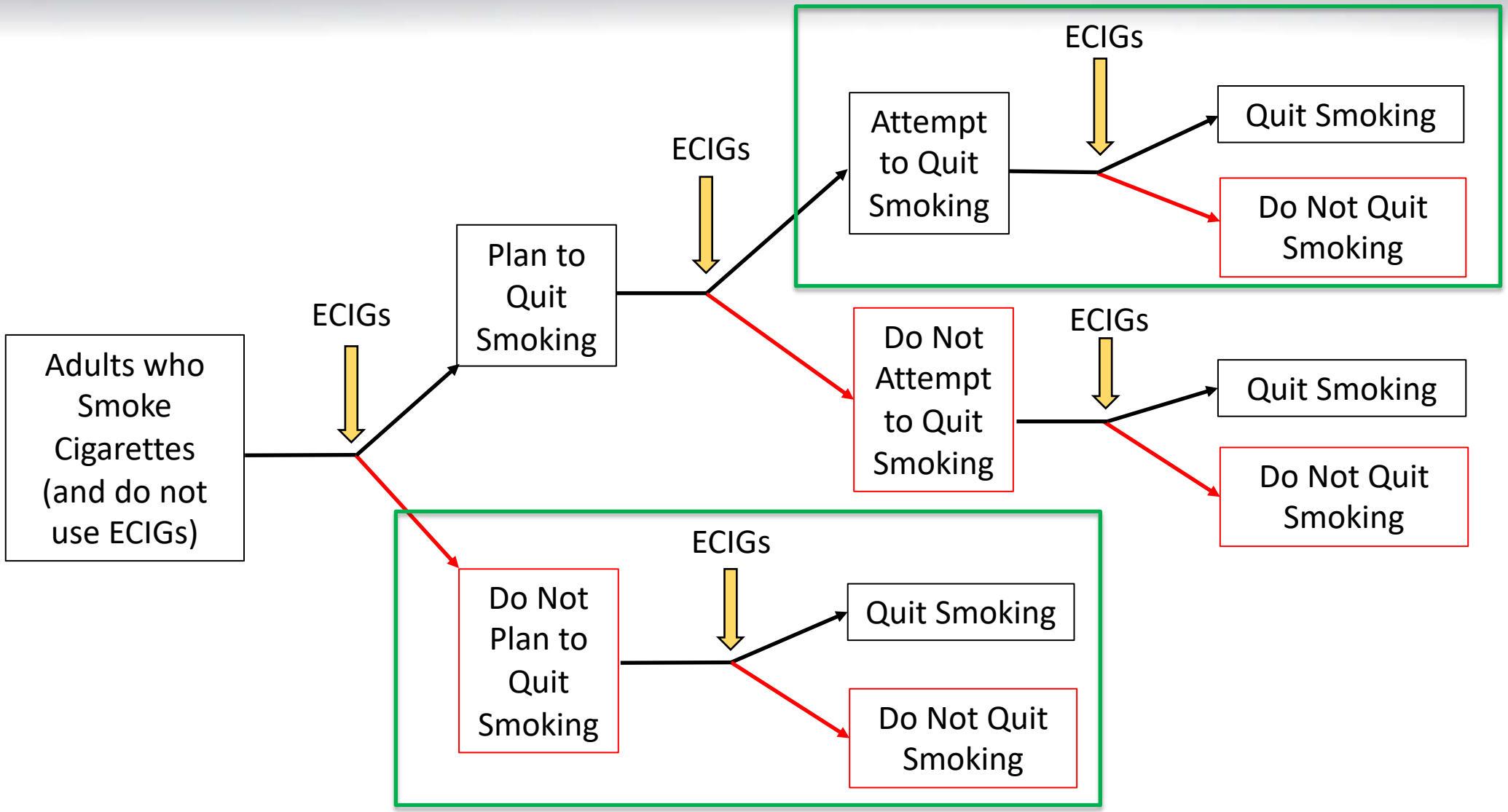
Population-Level Depiction of Junctures at which ECIG Use may Relate to Progression toward Cigarette Quitting



POPULATION-BASED STUDIES

- Mixed findings, though:
  - Studies consider different subsamples of the population
  - Differences in ECIG use frequency/duration considered
  - Differences in when data were collected (alongside rapid expansion of ECIG marketplace)

- Some examples:
  - Pierce JP, Benmarhnia T, Chen R, et al. Role of e-cigarettes and pharmacotherapy during attempts to quit cigarette smoking: The PATH Study 2013-16. PLoS One. 2020;15(9):e0237938.
  - Benmarhnia T, Pierce JP, Leas E, et al. Can e-cigarettes and pharmaceutical aids increase smoking cessation and reduce cigarette consumption? Findings from a nationally representative cohort of American smokers. Am J Epidemiol. 2018;187(11):2397-2404.
  - Glasser A, Vojjala M, Cantrell J, et al. Patterns of e-cigarette use and subsequent cigarette smoking cessation over two years (2013/2014 to 2015/2016) in the Population Assessment of Tobacco and Health (PATH) Study. Nicotine Tob Res. 2020;23(4):669-677.
  - Kalkhoran S, Chang Y, Rigotti NA. Electronic cigarette use and cigarette abstinence over two years among U.S. Smokers in the Population Assessment of Tobacco and Health Study. Nicotine Tob Res. 2020;22(5):728–733.

PATH Study (USA)

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METHODS: PATH Study Data

- Nationally representative longitudinal study of youth and adults in the USA
- Uses a stratified address-based, area-probability sampling design
- Data collected using audio computer-assisted self-interviews conducted in English or Spanish
- We analyzed PATH Study data from Wave 2 (2014/2015), Wave 3 (2015/2016), Wave 4 (2016/2017), Wave 5 (2018/19)
- Sample: Adults (18+) who smoke cigarettes daily, do not use ECIGs, have no plans to ever quit smoking
  - n=2,366 observations contributed by n=1,532 individuals
- Estimates weighted to represent residential population of the USA ages 18+ years at the time of data collection and who were in the civilian, noninstitutionalized population in 2013/14.

METHODS: Key Measures

Measures	Categorizations	Questions Used in Categorizations
Sample-defining measures (assessed at baseline wave of each wave pair)		
Cigarette smoking status	Daily smoking: Smokes cigarettes every day	"Do you now smoke cigarettes…every day/some days/not at all"
Quit intentions	No intentions: Does not plan to ever quit cigarettes/tobacco[a] for good	"Do you plan to ever quit [cigarettes/tobacco[a]] for good?"
ECIG use status	Nonuser: Does not use ECIGs at all	"Do you now use [ECIGs[b]]…every day/some days/not at all"
Predictor measure (assessed at follow-up wave among those who were ECIG nonusers at baseline wave)		
ECIG use status	(1) No ECIG use (2) Nondaily ECIG use (3) Daily ECIG use	"Do you now use [ECIGs[b]]…every day/some days/not at all"

[a]Cigarette smokers who were current users of any other non-ECIG tobacco product and had ever used that tobacco product 'fairly regularly' were asked about intending to quit using "tobacco" rather than specifically about intending to quit smoking "cigarettes."
[b]"ECIGs" refers to all e-products (i.e., e-cigarettes, e-cigars, e-pipes and e-hookah).

METHODS: Key Measures (continued)

Measures	Categorizations	Questions Used in Categorizations
Outcome measures (assessed at follow-up wave among those who smoked cigarettes daily and had no intentions to quit at baseline wave)		
Change in plans to quit at follow-up	(1) Plan to quit smoking within the next 6 months (2) Do not plan to quit smoking within the next 6 months	"Do you plan to ever quit [cigarettes/tobacco[a]] for good?" "When do you plan to quit for good?...in the next 7 days, 30 days, 6 months, next year, >1 year"
Cigarette quitting at follow-up	(1) Cigarette quitting: Did not smoke in the past 12 months or is currently smoking not at all (2) Cigarette smoking: Is currently smoking every day or some days	"In the past 12 months, have you smoked a cigarette, even one or two puffs?" "Do you now smoke cigarettes…every day/some days/not at all"

[a]Cigarette smokers who were current users of any other non-ECIG tobacco product and had ever used that tobacco product 'fairly regularly' were asked about intending to quit using "tobacco" rather than specifically about intending to quit smoking "cigarettes."

[b]"ECIGs" refers to all e-products (i.e., e-cigarettes, e-cigars, e-pipes and e-hookah).

METHODS: Timing of Assessments

“Baseline”

“Follow-up”

Smoke Cigarettes Daily,
No Plans to Ever Quit Smoking,
Not using ECIGs

→

ECIG Use Status: (1) No ECIG use, (2) Nondaily ECIG use, (3) Daily ECIG use

Change in Plans to Quit:
(1) Plan to Quit Within the Next 6 Months
(2) Do Not Plan to Quit Within the Next 6 Months

Smoke Cigarettes Daily,
No Plans to Ever Quit Smoking,
Not using ECIGs

→

ECIG Use Status: (1) No ECIG use, (2) Nondaily ECIG use, (3) Daily ECIG use

Cigarette Quitting:
(1) No smoking at all
(2) Everyday/someday smoking

METHODS: Analyses

- Generalized estimating equations used to evaluate association between uptake of ENDS use and outcomes using three sets of two waves (W2-W3, W3-W4, and W4-W5).
    - GEE allows for the assessment of change between baseline and follow-up from all wave pairs in a single analysis while statistically controlling for interdependence among observations contributed by the same individuals (Liang K-Y & Zeger SL, 1986; Hardin JW & Hilbe JM, 2003).
    - Specified unstructured covariance and within-person correlation matrices and binomial distribution of the dependent variable using the logit link function.
- Analyses adjusted for demographic characteristics, cigarettes smoked per day, and wave.
- Analyses run on the W2–W5 Restricted Use Files (https:// doi.org/10. 3886/ICPSR36231).

PATH Study: Results

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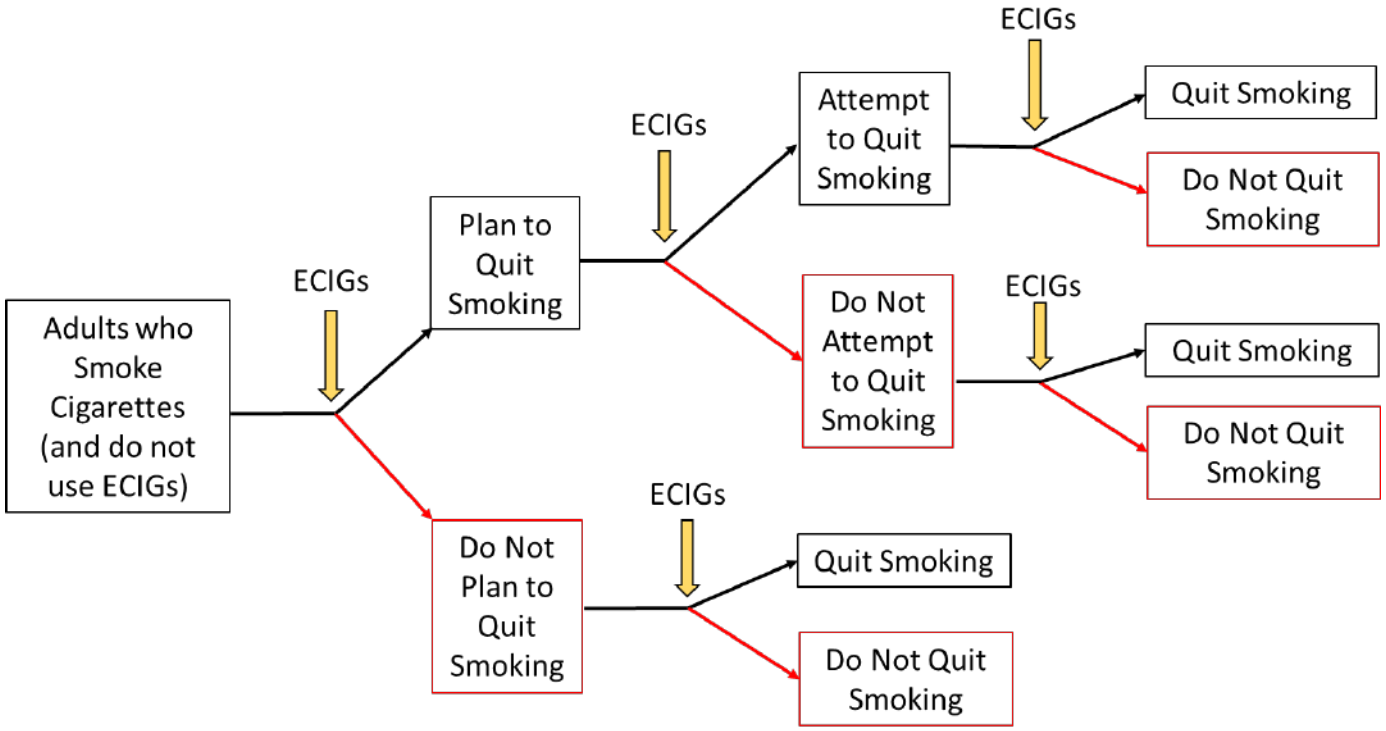
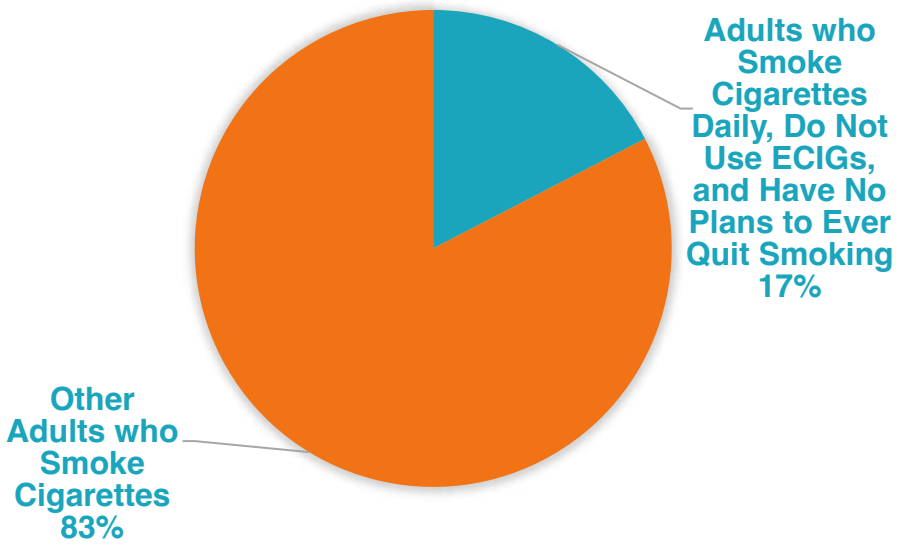
PATH STUDY RESULTS: Proportion of Population





PATH STUDY RESULTS: Characteristics of Smokers Without Plans to Quit

- Race: Non-Hispanic white
- Age: Older age (55+)
- Education: Lower
- Income: Lower
- Heavier smokers

Relatively high risk for experiencing poor health outcomes due to cigarette smoking

PATH STUDY RESULTS: Change in Plans to Quit Smoking

Change to plan to quit cigarette smoking within the next 6 months at follow-up among adults who smoked cigarettes daily, had no plans to ever quit for good, and were not using ECIGs at baseline, as a function of ECIG use at follow-up

		Change to plan to quit within the next 6 months at follow-up				
Sample at baseline wave	**ECIG use at follow-up**	n	%	95%CI	aOR‡	95%CI
Adults who smoke cigarettes daily, were not using ECIGs, and had no plans to ever quit for good at baseline	Overall (n=2,366)	329	13.2	11.4-15.2	-	-
	No use (n=2,167)	286	12.4	10.6-14.5	ref	
	Someday use (n=142)	19	14.8	8.8-23.8	1.3	0.7-2.4
	Daily use (n=57)	24	41.4	27.1-57.3	**5.7**	**2.9-11.2**

Table notes. ns are unweighted and reflect numbers of observations; %s, aORs, and 95%CIs are weighted

PATH STUDY RESULTS: Cigarette Quitting

Cigarette quitting at follow-up among adults who smoked cigarettes daily, had no plans to ever quit for good, and were not using ECIGs at baseline, as a function of ECIG use at follow-up

		Cigarette quitting at follow-up wave (i.e., no cigarette smoking)				
Sample at baseline wave	**ECIG use at follow-up**	n	%	95%CI	aOR‡	95%CI
Adults who smoke cigarettes daily, were not using ECIGs, and had no plans to ever quit for good at baseline	Overall (n=2,504)	158	6.1	5.0-7.5		
	No use (n=2,285)	138	5.8	4.6-7.2	ref	
	Some day use (n=159)	3	3.0†	0.8-11.0	0.5	0.1-3.3
	Daily use (n=60)	17	28.0	15.2-45.9	**8.1**	**3.1-21.0**

Table notes. ns are unweighted and reflect numbers of observations; %s, aORs, and 95%CIs are weighted

†Estimate is based on a denominator sample size of less than 50 or its relative standard error is greater than 30%

ITC 4CV
(USA, Canada, England, Australia)

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METHODS: ITC 4CV Data

- International Tobacco Control Four Country Smoking and Vaping Survey (ITC 4CV): online surveys of adults who currently or formerly smoke cigarettes or vape ECIGs in the USA, Canada, England, Australia

- Wave 1 (July–November 2016); Wave 2 (February–July 2018); Wave 3 (February–June 2020)

- Adults (ages 18+ years) who smoke cigarettes daily, have not vaped in the past 6 months at baseline, have an inter-wave interval between baseline and follow-up of 18-24 months
  n=3,405 observations contributed by n=2,815 individuals

- Estimates weighted using longitudinal weights that were rescaled for country and for cohort

METHODS: Key Measures

Measures	Categorizations	Questions Used in Categorizations
Sample-defining measures (assessed at baseline wave of each wave pair)		
Cigarette smoking status	Daily smoking: Smokes cigarettes daily	"How often, if at all, do you CURRENTLY smoke ordinary cigarettes (either factory-made/packet or roll-your-own)?"
Quit plans	No plans: Does not plan to quit	"Are you planning to quit smoking…" Within the next month; Between 1-6 months from now; Sometime in the future, beyond 6 months; Not planning to quit; Don't know?"
ECIG use status	Nonuser: Has not vaped in the past 6 months	"When was the last time you vaped?"
Predictor measure (assessed using baseline and follow-up waves among those who were ECIG nonusers at baseline wave)		
Inter-wave vaping uptake	(1) No vaping uptake (2) Uptake of only nondaily vaping (3) Uptake of daily vaping	"How often, if at all, do you CURRENTLY use vaping products (i.e. vape)?

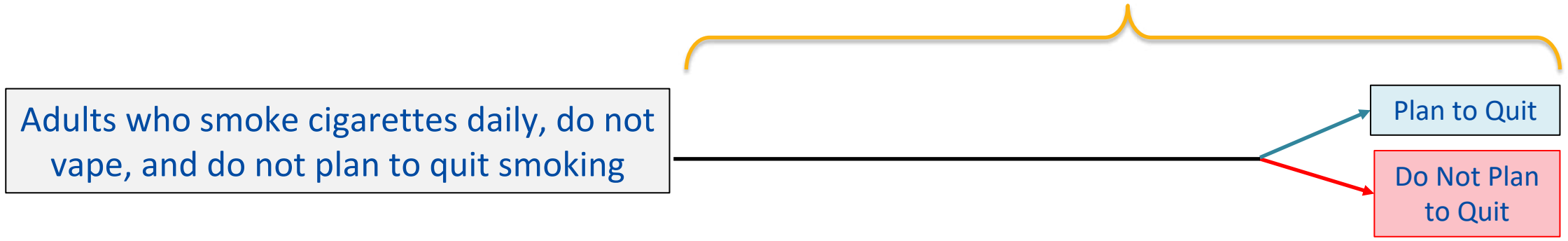
METHODS: Key Measures (continued)

Measures	Categorizations	Questions Used in Categorizations
Outcome measures (assessed at follow-up wave among those who smoked cigarettes daily and had no intentions to quit at baseline wave)		
Change in plans to quit at follow-up	(1) Plan to quit smoking within the next 6 months (2) Do not plan to quit smoking within the next 6 months	"Are you planning to quit smoking…Within the next month; Between 1-6 months from now; Sometime in the future, beyond 6 months; Not planning to quit
Cigarette quitting at follow-up	(1) Cigarette quitting: Smoke cigarettes less than monthly (2) Cigarette smoking: Smoke cigarettes daily/weekly/monthly	"How often, if at all, do you CURRENTLY smoke ordinary cigarettes (either factory-made/packet or roll-your-own)?" Response options: Daily; Less than daily, but at least once a week; Less than weekly, but at least once a month; Less than monthly, but occasionally; I have quit smoking

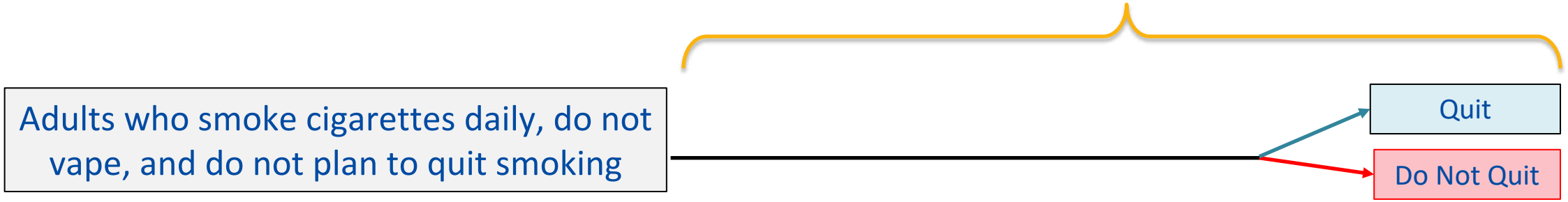
METHODS: Timing of Assessments

“Baseline” **“Follow-up”**

Vaping uptake (inter-wave vaping frequency)



Vaping uptake (inter-wave vaping frequency)



METHODS: Analyses

- Generalized estimating equations used to evaluate the associations using both assessment pairs (i.e., 2016-2018 and 2018-2020); specified unstructured covariance and within-person correlation matrices and the binomial distribution of the dependent variable using the logit link function

- Analyses adjusted for country, sex, race/ethnicity, age group, cigarettes smoked per day, time in sample, and assessment pair; all covariates were assessed at baseline of each assessment pair

- Analyses weighted using longitudinal weights that were rescaled for country and for cohort

ITC 4CV: Results

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ITC 4CV RESULTS: Change in Plans to Quit Smoking

Planning to quit cigarette smoking at follow-up as a function of vaping uptake between baseline and follow-up among adults in the USA, Canada, England, and Australia who smoked cigarettes daily and had not vaped in the past six months at baseline.

		Planning to Quit Smoking within the next 6 months at Follow-up		
Sample at baseline wave	**Vaping Uptake between Baseline and Follow-up** (inter-wave vaping uptake)	n	% (95% CI)	AOR (95% CI)
Adults who smoke cigarettes daily, were not using ECIGs, and had no plans to quit at baseline	Overall: n=937	95	11.0 (8.0,15.0)	-
	No vaping: n=682	58	8.4 (5.5,12.4)	ref
	Nondaily vaping: n=161	9	4.5 (1.9,10.5)	0.72 (0.25,2.06)
	Daily vaping: n=94	28	40.4 (24.7,58.5)	**10.12 (4.46,22.93)**

Table notes. ns are unweighted and reflect numbers of observations; %s, aORs, and 95%CIs are weighted

ITC 4CV RESULTS: Cigarette Quitting

Cigarette quitting at follow-up as a function of vaping uptake between baseline and follow-up among adults in the USA, Canada, England, and Australia who smoke cigarettes daily and had not vaped in the past 6 months at baseline.

		Cigarette Quitting at Follow-up		
Sample at baseline wave	**Vaping Uptake between Baseline and Follow-up** (inter-wave vaping uptake)	n	% (95% CI)	AOR (95% CI)
Adults who smoke cigarettes daily, were not using ECIGs, and had no plans to quit at baseline	Overall: n=937	68	7.1 (4.9,10.1)	-
	No vaping: n=682	40	6.1 (3.7,10.1)	ref
	Nondaily vaping: n=161	5	1.0 (0.4,2.6)	**0.18 (0.06,0.55)**
	Daily vaping: n=94	23	23.5 (13.8,37.3)	**5.81 (2.60,13.00)**

Table notes. ns are unweighted and reflect numbers of observations; %s, aORs, and 95%CIs are weighted

PATH STUDY & ITC 4CV: CONCLUSIONS & IMPLICATIONS

- At the population level (USA, Canada, England, Australia), adults who smoke cigarettes and are not planning to quit experience a strong positive association between daily vaping uptake and cigarette quitting

- Daily vaping uptake is also associated with change in plans to quit cigarette smoking…part of the mechanism through which vaping may impact cigarette quitting could be through motivating interest in quitting

- Excluding those not planning to quit from studies on ECIGs and smoking cessation may underestimate the benefit potential for ECIGs
  - Potential benefit could disproportionately impact those who are older, non-Hispanic white, heavy smokers, and are of low socioeconomic status

PATH STUDY & ITC 4CV: LIMITATIONS

- These observational data do not identify causal associations; bidirectional associations are possible
- There may be self-selection differences between those who took up vaping and those who did not which were not controlled for here
- Relatively small sample sizes, though results are weighted to be nationally representative
- Are these population findings consistent with clinical trial findings among adults who smoke cigarettes and do not plan to quit?

Questions