

# Association between Self-reported Hypertension Incidence and E-cigarette Use

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## Background

- Many smokers believed that vaping can help them quit smoking, and they tended to use E-cigarettes more frequently than FDA-proved cessation aids to reduce cigarette consumption.
- Growing body of evidence showed the detrimental acute effects of E-cigarette on the elevation of blood pressure.
- A lack of evidence of the long-term health effects of E-cigarette on blood pressure (i.e., hypertension).
- This prospective investigation examined the association between E-cigarette use and hypertension, providing longitudinal evidence to fill the gap in the literature on this topic.

## Methods

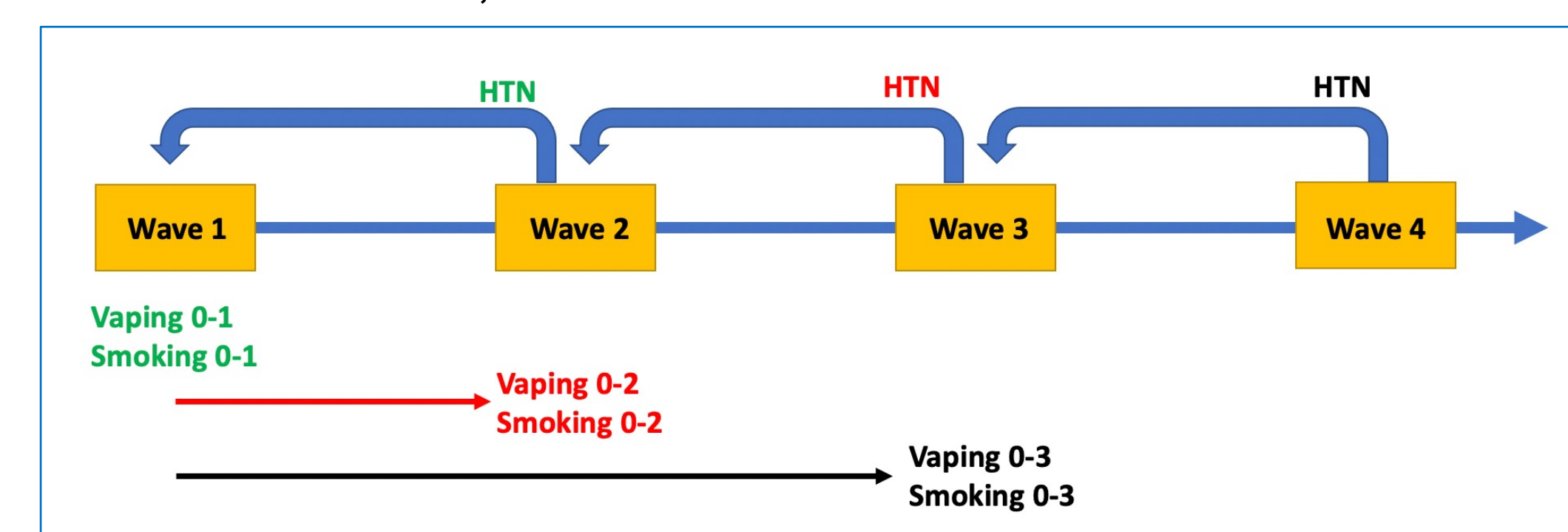
The full join of the PATH Waves 1-4 (September 2013 to January 2018) generated 44107 data.

Primary analytic sample of **11567** data were extracted, after excluding:

- participants without baseline data at Wave 1
- participants without follow-up data through Wave 4
- baseline participants who self-reported ever having diagnosed hypertension
- individuals who did not complete Wave 2 or Wave 3 survey
- individuals who did not report E-cigarette/cigarette use at any wave

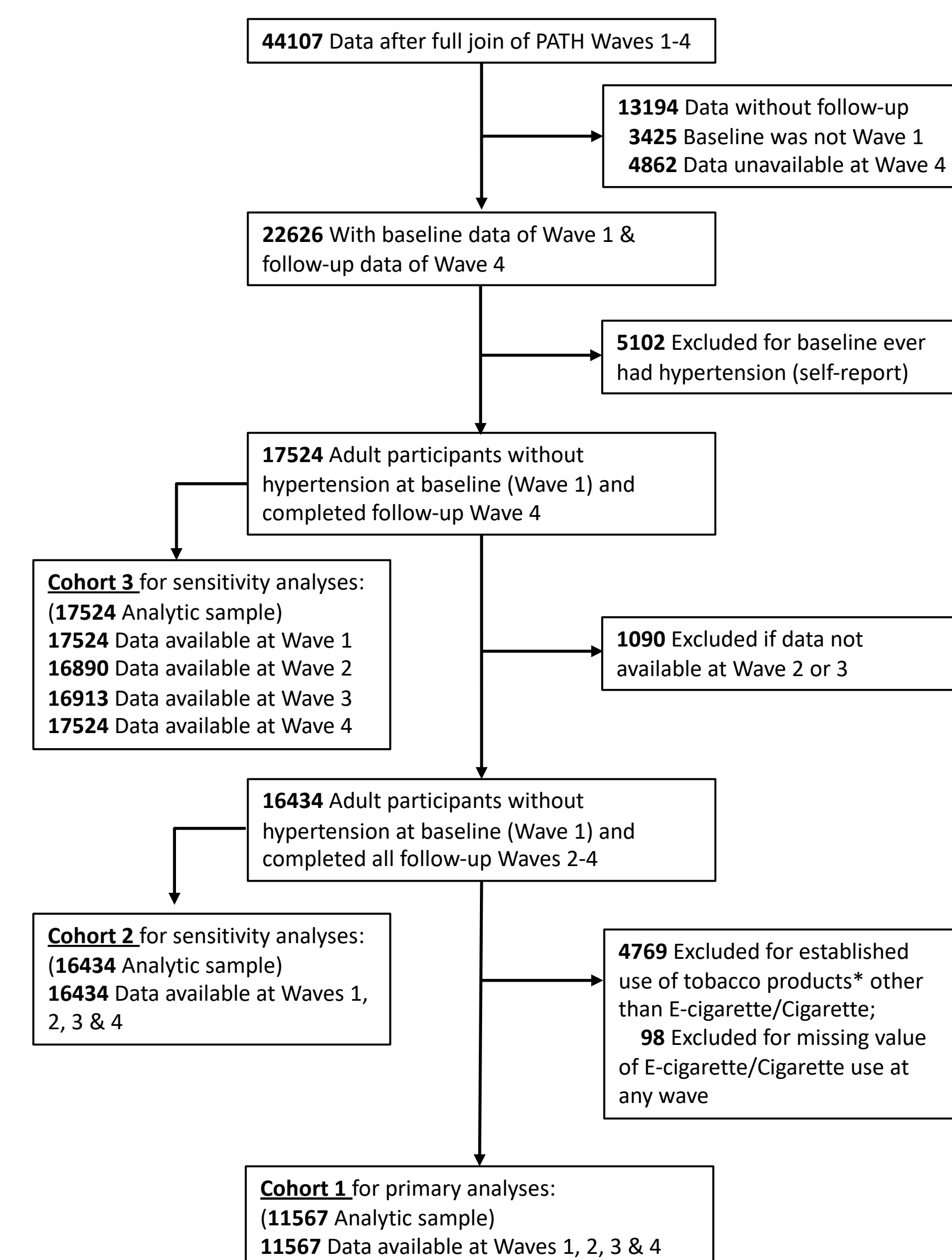
### Variables:

- Outcome: hypertension incidence (Wave 2-4)
- Independent variable: E-cigarette/cigarette use (Wave 1-3)
- Covariates included: age, sex, race/ethnicity, education level, physical activity, body mass index (BMI), heavy alcohol use, hypercholesterolemia, diabetes mellitus, CVDs, and family history of hypertension
- Variables tested but not included: secondhand smoke exposure, substance use, etc.



- Statistical analysis:** 1) Cox regression models with regressors that are:
- time-varying
  - time-lagged
  - time-cumulative

Figure 1.



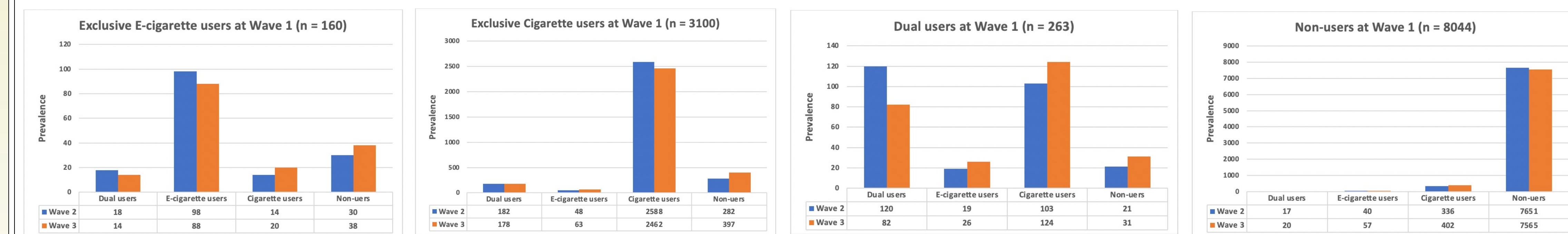
- 2) Strata:
- Sex (female/male)
  - Baseline smoking statuses (established/former/never, or ever/never)

## Results (description)

- Among baseline ever smokers, continuous (vs never) E-cigarette use was associated with an increased likelihood of subsequent hypertension development (HR 1.93; 95%CI 1.07 to 3.49).
- Among females, continuous (vs never) E-cigarette use for baseline former smokers (HR 3.09; 95%CI 1.55 to 6.16), and for baseline ever smokers (HR 2.75; 95%CI 1.38 to 5.47) were associated with the greatest likelihoods of subsequent hypertension development.
- Among males, all the HRs among males were attenuated and non-significant.

## Results (Visualization)

### Prevalence of E-cigarettes/cigarettes use statuses at Waves 1-3



- Most baseline exclusive E-cigarette users, exclusive cigarette users, and non-users did not change their use statuses through Wave 3.
- However, the majority (47.1%) of baseline dual users became exclusive cigarette users at Wave 3.

### Associations of E-cigarette Cumulative Use and Subsequent Self-reported Hypertension Development Stratified by Baseline Smoking Statuses and Sex

E-cigarette cumulative use, Waves 1-3	Associations With Subsequent Hypertension Development, Waves 2-4								
	Baseline never smokers		Baseline former smokers		Baseline established smokers		Baseline ever smokers		
	Hazard Ratio (95%CI)	P Value	Hazard Ratio (95%CI)	P Value	Hazard Ratio (95%CI)	P Value	Hazard Ratio (95%CI)	P Value	
<b>Overall</b>									
Intermittent (vs never) use	1.75 (0.76, 4.06)	0.187	0.36 (0.10, 1.31)	0.120	<b>0.57 (0.33, 0.99)</b>	<b>0.046</b>	0.28 (0.03, 2.22)	0.223	
Continuous (vs never) use	0.43 (0.10, 1.83)	0.251	1.52 (0.81, 2.87)	0.194	0.90 (0.52, 1.53)	0.685	<b>1.93 (1.07, 3.49)</b>	<b>0.030</b>	
<b>Male</b>									
Intermittent (vs never) use	1.17 (0.20, 6.75)	0.860	—	—	0.42 (0.15, 1.17)	0.096	—	—	
Continuous (vs never) use	—	—	1.00 (0.30, 3.31)	0.996	0.62 (0.19, 2.03)	0.426	1.22 (0.37, 4.01)	0.736	
<b>Female</b>									
Intermittent (vs never) use	1.96 (0.76, 5.06)	0.163	0.93 (0.10, 8.63)	0.948	0.61 (0.18, 2.11)	0.429	0.72 (0.09, 5.89)	0.757	
Continuous (vs never) use	0.65 (0.15, 2.88)	0.564	<b>3.09 (1.55, 6.16)</b>	<b>0.002</b>	1.81 (0.38, 8.71)	0.456	<b>2.75 (1.38, 5.47)</b>	<b>0.005</b>	

## Conclusions

- Established exclusive E-cigarette use among females was prospectively associated with subsequent self-reported hypertension, especially for former smokers.
- This large nationally representative cohort study provides new evidence of a prospective association between established E-cigarette use and a greater likelihood of future hypertension development among female adults.

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