

Sex Differences in the Association of E-cigarette and Cigarette Use and Dual Use with Self-reported Hypertension Incidence in US Adults

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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 32320 data.

Primary analytic sample of **16434** 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

Outcome:

- hypertension incidence (Wave 2-4)

Independent tobacco-related variables:

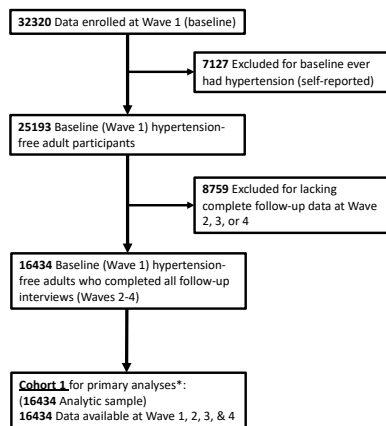
- E-cigarette/cigarette use (Wave 1-3)
- other tobacco products use (Wave 1-3)
- lifetime smoking exposure (pack-year)

Covariates:

- Included: age, sex, race/ethnicity, education level, physical activity, body mass index (BMI), heavy alcohol use, hypercholesterolemia, diabetes mellitus, cardiovascular diseases, and family history of hypertension
- Tested but not included: secondhand smoke exposure, substance use, insurance, marital status

Statistical analysis:

- Cox regression models with regressors that are:
 - time-varying
 - time-lagged
 - time-cumulative
- Missing values:
 - Listwise deletion
 - Weighted hot-deck imputation
 - Consider misclassification

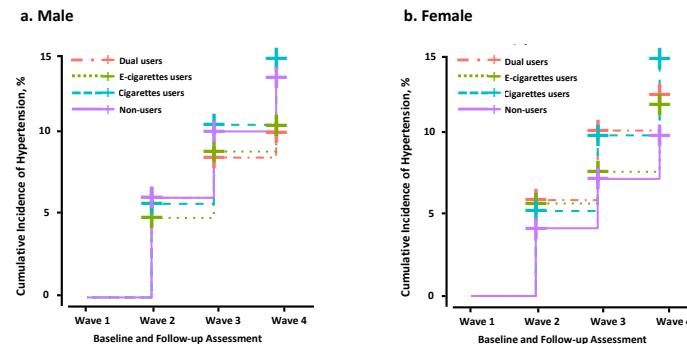


Results (description)

- Weighted cumulative hypertension incidence by Wave 4 varied by Waves 1-3 e-cigarette/cigarette use status in females (non-use [incidence: 9.9%], exclusive e-cigarette use [11.8%], exclusive cigarette use [14.8%], dual use [12.4%]; $P=.003$ for omnibus differences among all groups) but not males (non-use [12.6%], exclusive e-cigarette use [9.7%], exclusive cigarette use [13.7%], dual use [9.3%]; $P=.231$).
- Among females, exclusive cigarette (vs no) use (hazard ratio: 1.69, 95%CI 1.21-2.34; $P=.002$), but not exclusive e-cigarette or dual use, was significantly associated with subsequent hypertension.

Results (Visualization)

Cumulative incidence of hypertension by E-cigarette/cigarette use (reverse Kaplan-Meier plots with hazard curves)



For dual users, exclusive e-cigarette users, exclusive cigarette users, and non-users (as reference) in the preceding waves, the cumulative estimated incidences of self-reporting hypertension at the final assessment (Wave 4) were:

- 9.3%, 9.7%, 13.7%, and 12.6% (reference) among males (a),
- 12.4%, 11.8%, 14.8%, and 9.9% (reference) among females (b).

Associations of E-cigarette/Cigarette Use and Subsequent Self-reported Hypertension onset by Sex

Time-Varying Regressors,	Associations With Subsequent Hypertension Development, Waves 2-4					
	Male (n = 7642)			Female (n = 8792)		
	Hazard Ratio (95%CI)	P Value	Adjusted	Hazard Ratio (95%CI)	P Value	Adjusted
E-cigarette and/or cigarette Use (Waves 1-3)						
Exclusive e-cigarette (vs no) use	1.06 (0.58, 1.94)	0.86	1.00	1.54 (0.96, 2.48)	0.11	0.69
Exclusive cigarette (vs no) use	1.12 (0.84, 1.49)	0.44	1.00	1.69 (1.21, 2.34)	0.002	0.02
Dual (vs no) use	1.02 (0.65, 1.59)	0.93	1.00	1.56 (1.04, 2.34)	0.04	0.34

Conclusions

- The association of e-cigarette and/or cigarette use with hypertension may differ by sex, whereby exclusive cigarette use could be a prospective risk factor for subsequent self-reported hypertension in US adult females but not males.
- Because of statistical power limitations and relatively short period of e-cigarette exposure in this study, further research on the association of e-cigarette use or dual use with hypertension in females is warranted.

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