Association of Exposure to Flavors in Electronic Cigarettes (ECIG) and Dry Cough Among Current and Former Established ECIG Users: Results From the PATH Study Wave 2

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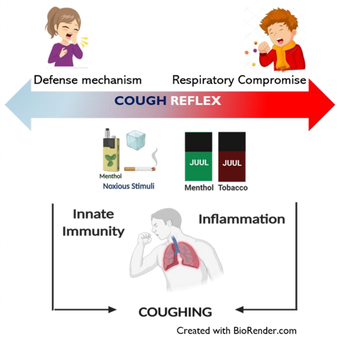
BACKGROUND AND SIGNIFICANCE

- Global use of electronic nicotine delivery systems (ENDS), known as electronic cigarettes, constitutes a challenging public health issue, especially among youth and young adults.
- Flavors play a major role in appealing youth and young people to use ENDS.
- Early reports indicate an association between electronic cigarettes (ECIG) use and elevated risk of wheezing and respiratory symptoms (Li 2019).



- Few studies focus on coughing as a symptom reflecting potential negative effects of ECIG use.
- 40% of the adults and 42.3% of the adolescents reported cough as the commonest symptom attributed to ENDS use (King 2019, King 2020).
- Less is known about cough as a potential toxicological impact of exposure to flavored ENDS.
  - *Cough is suspected to be "the canary in the coal mine" with regards to ENDS lung toxicity (Moazed 2017)*

OBJECTIVE OF THE STUDY

To examine the association between exposure to flavors in ECIG and self-reported dry cough in the past 12 months (P12M) among current and former established ECIG users.

STUDY DESIGN

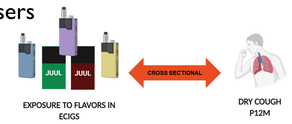
- Cross sectional analysis of the data collected in the Population Assessment of Tobacco and Health (PATH) Study during October 2014-2015 (Wave 2)
- Eligibility criteria
  - New and continuing adults with completed information in Wave 2 (n=24,616)
- Potential confounders:
  - Sex, age, race and ethnicity, educational level, household income, body mass index, disease status, ever-tobacco use, and secondhand smoke exposure status

SCAN ME

VARIABLES AND DATA ANALYSES

Independent Variable

- Current and Former Established ECIG users
  - Menthol or mint
  - Fruit
  - Candy or sweet
  - Multiple
  - Others
- Non-ECIG users



Dependent Variable

- In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?

- Statistical analyses were performed using SAS v9.4
  - Weighted frequency distributions and the Rao-Scott modified likelihood ratio test
  - Balanced repeated replication method to construct replicate weights with Fay's adjustment of 0.3
  - Multivariable weighted logistic regression models to assess unadjusted and adjusted associations

RESULTS – Weighted Prevalence of Cough

- 2.4% were current established ECIG users and 0.8% self-reported as former established ECIG users.
- 72% reported ever using a tobacco product.
- **Table 1** Weighted prevalence of dry cough in the past 12 months among current and former established ECIG users by type of regular flavor used –

Type of ECIG User (n)	Type of Regular Flavor Used (n)	Dry Cough in the Past 12 Months					
		Yes			No		
		Frequency	Weighted Frequency	%	Frequency	Weighted Frequency	%
Non-ECIG Users	No applicable (22,895)	4,171	33,050,386	15.4	18,724	180,911,170	84.6
Current Established (1,237)	Menthol and mint (274)	92	386,947	32.0	182	822,052	67.8
	Fruit (308)	82	333,470	26.7	226	913,595	73.3
	Candy or sweet (129)	31	109,317	19.5	98	451,258	80.5
	Multiple (427)	117	482,490	26.3	310	1,350,783	73.7
	Others (99)	30	139,812	30.0	69	326,426	70.0
Former Established (428)	Menthol and mint (132)	43	177,578	29.6	89	177,578	70.4
	Fruit (94)	20	85,176	20.8	74	323,865	79.2
	Candy or sweet (44)	12	52,521	27.0	32	142,119	73.0
	Multiple (135)	49	186,367	35.1	86	344,101	64.9
	Others (23)	7	23,522	28.8	16	58,271	71.2

Rao-Scott Chi-Square 163.3791, DF=10, p<0.0001

RESULTS – Weighted Associations

- **Table 2** Association between type of regular flavor used and self-reported dry cough in the past 12 months among current and former established adults ECIG users

Type of ECIG User (n)	Type of Regular Flavor Used (n)	Dry Cough in the Past 12 Months: Unadjusted OR (95% CI)	Dry Cough in the Past 12 Months: Adjusted OR (95% CI)
Model 1 (complete sample)			
Non-ECIG Users	No applicable (22,895)	Reference	Reference
Current Established (1,237)	Menthol and mint (274)	2.58 (1.95, 3.40)	**1.90 (1.36, 2.66)**
	Fruit (308)	2.00 (1.53, 2.61)	**1.80 (1.32, 2.46)**
	Candy or sweet (129)	1.33 (0.79, 2.22)	1.06 (0.58, 1.92)
	Multiple (427)	1.96 (1.47, 2.61)	**1.42 (1.02, 1.97)**
	Others (99)	2.34 (1.40, 3.93)	**2.11 (1.21, 3.66)**
Former Established (428)	Menthol and mint (132)	2.30 (1.52, 3.47)	1.57 (0.97, 2.52)
	Fruit (94)	1.44 (0.74, 2.82)	1.25 (0.61, 2.57)
	Candy or sweet (44)	2.02 (0.97, 4.23)	1.70 (0.66, 4.39)
	Multiple (135)	2.97 (2.06, 4.27)	**2.46 (1.65, 3.66)**
	Others (23)	2.21 (0.87, 5.61)	1.77 (0.67, 4.68)
Model 2 (excluding participants with self-reported disease in the past 12 months)			
Non-ECIG Users	No applicable (14,177)	Reference	Reference
Current Established (1,014)	Menthol and mint (151)	2.11 (1.29, 3.47)	1.31 (0.77, 2.20)
	Fruit (210)	3.00 (2.07, 4.34)	**1.77 (1.17, 2.66)**
	Candy or sweet (90)	1.45 (0.77, 2.72)	1.00 (0.52,1.90)
	Multiple (268)	2.68 (1.82, 3.94)	1.48 (0.96, 2.28)
	Others (65)	2.65 (1.19, 5.88)	1.70 (0.74, 3.92)
Former Established (385)	Menthol and mint (76)	3.97 (2.33, 6.77)	**2.11 (1.18, 3.74)**
	Fruit (67)	1.49 (0.59, 3.76)	0.89 (0.33, 2.35)
	Candy or sweet (30)	3.15 (1.06, 9.39)	2.11 (0.52, 8.60)
	Multiple (87)	3.39 (2.32, 4.95)	**2.07 (1.38, 3.11)**
	Others (17)	1.04 (0.14, 7.45)	0.62 (0.08, 4.53)

CONCLUSIONS

ECIG users of fruit, menthol and mint, and multiple flavors were consistently more likely to report dry cough in the past 12 months as compared to non ECIG users.

FUNDING SOURCES

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