

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 1. Percentage (Weighted) of E-Cigarette Use at Wave 1 (n=19,475)

Category	E-cigarette use at Wave 1		
	Never	Former	Current
Combustible tobacco smoker			
Never	35.6%	1.4%	0.6%
Former	50.2%	27.3%	13.9%
Current	14.2%	71.3%	85.5%
Cigarette smoker			
Never	40.7%	3.8%	1.4%
Former	48.9%	33.3%	20.0%
Current	10.4%	62.9%	78.6%

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 2. Lung or Respiratory Conditions at Different Waves^a (Numbers Are Weighted Percentages)

Type of tobacco user	COPD		Chronic bronchitis		Emphysema		Asthma		Any lung disease ^a	
	Yes, %	No, %	Yes, %	No, %	Yes, %	No, %	Yes, %	No, %	Yes, %	No, %
Wave 1 baseline (n=32,320)										
Total ^b	3.3	96.7	3.3	96.7	1.5	98.5	11.1	88.9	15.1	84.9
E-cigarette user										
Never	70.5	82.7	69.6	82.7	65.2	82.6	78.7	82.7	76.5	83.3
Former	18.9	11.9	19.3	11.9	22.3	12.0	15.0	11.8	16.1	11.5
Current	10.6	5.4	11.1	5.4	12.5	5.4	6.3	5.5	7.4	5.7
Combustible tobacco smoker										
Never	8.3	29.2	15.5	29.0	1.7	28.9	26.4	28.8	22.0	29.7
Former	47.1	45.4	43.7	45.5	46.4	45.5	46.2	45.4	46.0	45.4
Current	44.6	25.4	40.8	25.5	51.9	25.6	27.4	25.8	32.0	24.9
Cigarette smoker										
Never	9.2	34.0	16.2	33.8	4.4	33.6	31.6	33.4	25.9	34.5
Former	49.0	45.3	45.5	45.4	48.1	45.4	45.8	45.4	46.3	45.3
Current	41.8	20.7	38.3	20.8	47.5	21.0	22.6	21.2	27.9	20.2
Incident disease at Wave 2 or Wave 3 among people with no lung or respiratory conditions at Wave 1 ^{c,d}										
Total ^b	1.4	98.6	3.0	97.0	0.9	99.1	2.5	97.5	4.5	95.5
E-cigarette user										
Never	69.0	82.9	77.2	82.9	70.6	82.7	74.0	82.9	74.1	83.7
Former	20.5	11.8	15.1	11.8	18.3	11.9	16.8	11.7	17.2	11.2
Current	10.5	5.3	7.7	5.3	11.1	5.4	9.2	5.4	8.7	5.1
Combustible tobacco smoker										
Never	11.2	29.4	25.1	29.1	14.7	29.1	22.0	29.0	21.9	30.1
Former	36.7	46.0	38.6	46.1	33.6	45.9	40.8	45.8	36.8	46.1
Current	52.1	24.6	36.3	24.8	51.6	25.0	37.2	25.2	41.3	23.8
Cigarette smoker										
Never	10.6	34.2	27.8	33.8	13.9	33.7	26.3	33.5	25.9	34.8

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Former	39.0	45.9	40.0	46.1	37.7	45.9	39.9	45.9	37.0	46.1
Current	50.4	19.9	32.2	20.1	48.5	20.4	33.8	20.6	37.1	19.1
Incident disease at Wave 2 among people with no lung or respiratory conditions at Wave 1 ^{c,d}										
Total ^b	0.7	99.3	1.7	98.3	0.5	99.5	1.4	98.6	2.5	97.5
E-cigarette user										
Never	67.6	82.8	77.1	82.8	73.5	82.6	75.1	82.8	74.5	83.5
Former	22.2	11.8	15.1	11.8	16.2	12.0	15.7	11.8	16.5	11.4
Current	10.2	5.4	7.8	5.3	10.3	5.4	9.2	5.4	9.0	5.1
Combustible tobacco smoker										
Never	13.5	29.3	24.8	29.1	15.2	29.0	26.9	28.9	23.6	29.9
Former	36.2	45.8	39.5	45.9	34.3	45.8	37.9	45.7	38.0	45.8
Current	50.3	24.9	35.7	25.0	50.5	25.2	35.2	25.4	38.4	24.3
Cigarette smoker										
Never	12.5	34.0	25.7	33.8	15.2	33.6	31.4	33.4	27.6	34.6
Former	39.3	45.8	42.1	45.9	36.0	45.8	35.9	45.8	36.6	45.9
Current	48.2	20.0	32.2	20.3	48.8	20.6	32.7	20.8	35.8	19.6
Incident disease at Wave 3 among people with no lung or respiratory conditions at Wave 1 ^{c,d}										
Total ^b	1.1	98.9	1.8	98.2	0.6	99.4	1.7	98.3	3.1	96.9
E-cigarette user										
Never	69.0	82.9	76.2	82.9	67.3	82.7	73.9	82.8	74.0	83.6
Former	20.4	11.8	15.4	11.8	20.8	11.9	17.8	11.7	17.5	11.3
Current	10.6	5.3	8.4	5.3	12.0	5.4	8.3	5.5	8.5	5.1
Combustible tobacco smoker										
Never	9.2	29.4	24.3	29.1	12.9	29.0	22.1	29.0	20.3	30.1
Former	37.5	45.9	38.4	46.0	29.1	45.9	40.0	45.7	36.6	45.9
Current	53.3	24.7	37.3	24.9	58.0	25.1	37.9	25.3	43.0	24.0
Cigarette smoker										
Never	8.9	34.1	28.3	33.8	11.3	33.7	26.8	33.5	25.0	34.7
Former	38.7	45.9	38.5	46.0	36.2	45.8	38.6	45.8	36.4	45.9
Current	52.4	20.0	33.2	20.3	52.5	20.5	34.6	20.7	38.6	19.6

^aAny lung or respiratory disease can be less than total of individual disease because one individual can have several different diseases.

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

^bRow percentage.

^cSample sizes differ for different respiratory conditions because respondents who answered each condition were separately tabulated.

^dCOPD (n=22,759); chronic bronchitis (n=22,708); emphysema (n=23,191); asthma (n=20,531); any lung disease (n=19,475).

COPD, chronic obstructive pulmonary disease.

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 3. Measure of Nicotine Addiction Among Current Tobacco Users at Wave 1

Variables at Wave 1	<i>n</i>	Respiratory disease at Waves 2 or 3 (excluding people with respiratory disease at wave 1)		
		Yes, median (IQR)	No, median (IQR)	<i>p</i> -value ^a
Time (minutes) to first tobacco use after waking				
E-cigarette	849	30 (5–120)	60 (15–120)	0.041
Cigarette	6,364	20 (5–60)	30 (10–60)	<0.001
Traditional cigar	504	240 (60–480)	360 (180–600)	0.007
Cigarillo	652	180 (20–300)	240 (60–420)	0.037
Filtered cigar	294	60 (8.8–180)	90 (20–300)	0.088
Pipe	165	90 (26–310)	300 (190–620)	0.136
Hookah	1,640	480 (300–600)	600 (480–720)	<0.001
Frequency of tobacco use per day				
E-cigarette (cartridges/day)	730	1 (1–2)	1 (1–2)	0.004
Cigarette	9,960	13 (7–20)	10 (5–20)	<0.001
Traditional cigar	670	2 (1–3)	1 (1–2)	<0.001
Cigarillo	836	2 (1–4)	2 (1–3)	0.004
Filtered cigar	330	6 (2–14)	3 (1–10)	0.077
Pipe number of bowls/day	162	2 (1–4)	2 (1–3)	0.814
Hookah number of time/day	600	0.15 (0.1–0.42)	0.14 (0.1–0.42)	0.163

Note: Boldface indicates statistical significance (*p*<.05).

^aMann–Whitney Rank Sum Test

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 4. Regular/Last Flavored Tobacco Use Among Current and Former Users at Wave 1

Variables at Wave 1	Respiratory disease at Waves 2 or 3 (excluding people with respiratory disease at wave 1)		
	Yes, %	No, %	p-value ^a
Flavored e-cigarette (n=1,074)			0.850
Yes	66.6	67.7	
No	33.4	32.3	
Flavored cigarette (n=6,709)			0.170
Yes	34.9	38.3	
No	65.1	61.7	
Flavored traditional cigar (n=675)			0.701
Yes	38.5	35.5	
No	61.5	64.5	
Flavored cigarillo (n=1,084)			0.933
Yes	60.2	60.7	
No	39.8	39.3	
Flavored filtered cigar (n=434)			0.298
Yes	73.3	64.7	
No	26.7	35.3	
Flavored pipe (n=208)			0.648
Yes	26.6	33.4	
No	73.4	66.6	
Flavored hookah (n=1,439)			0.161
Yes	81.2	88.1	
No	18.8	11.9	

^a χ^2

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 5. Associations Between E-Cigarette Use and Respiratory Disease Controlling for Cigarette Smoking

Variables	Cross-sectional associations between e-cigarette user and respiratory disease at Wave 1 (baseline)		Longitudinal association between incident respiratory disease (at Wave 2 or 3) and e-cigarette user at Wave 1 excluding people who reported respiratory disease at Wave 1	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
E-cigarette user				
Never	ref		ref	
Former	1.32 (1.21, 1.44)	<0.001	1.24 (1.03, 1.50)	0.026
Current	1.29 (1.15, 1.45)	<0.001	1.23 (1.00, 1.51)	0.050
Cigarette smoker				
Never	ref		ref	
Former	1.25 (1.11, 1.41)	0.003	1.13 (0.86, 1.48)	0.389
Current	1.66 (1.47, 1.87)	<0.001	2.70 (2.10, 3.45)	<0.001
High blood pressure				
Yes	1.38 (1.20, 1.58)	<0.001	1.26 (1.01, 1.57)	0.041
High cholesterol				
Yes	1.26 (1.12, 1.43)	<0.001	1.10 (0.84, 1.45)	0.482
Diabetes mellitus				
Yes	1.39 (1.22, 1.59)	<0.001	1.36 (1.04, 1.79)	0.027
Age in years				
18–24	ref		ref	
25–34	0.72 (0.65, 0.80)	<0.001	0.58 (0.44, 0.77)	<0.001
35–44	0.71 (0.62, 0.82)	<0.001	0.89 (0.67, 1.18)	0.414
45–54	0.72 (0.63, 0.83)	<0.001	1.17 (0.92, 1.47)	0.201
55–64	0.85 (0.71, 1.00)	0.053	1.09 (0.82, 1.47)	0.552
65–74	0.98 (0.84, 1.15)	0.846	0.99 (0.65, 1.52)	0.999
75 and above	1.00 (0.77, 1.29)	0.994	1.70 (1.00, 2.88)	0.052
BMI	1.02 (1.01, 1.03)	<0.001	1.03 (1.02, 1.04)	<0.001
Sex				
Female	1.47 (1.35, 1.60)	<0.001	1.68 (1.40, 2.02)	<0.001

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Poverty level				
At or above poverty	0.79 (0.72, 0.88)	<0.001	0.67 (0.55, 0.83)	<0.001
Race/ethnicity				
White	ref		ref	
Black	0.88 (0.78, 0.99)	0.036	1.42 (1.16, 1.74)	<0.001
Other	1.00 (0.83, 1.20)	<0.993	1.15 (0.82, 1.61)	0.413
Sample size, N	32,320		19,475	
VIF	<1.2		<1.2	

Note: Boldface indicates statistical significance ($p < .05$).

VIF, Variance Inflation Factor.

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 6. Associations Between E-Cigarette Use at Wave 1 and Incident of Respiratory Conditions at Waves 2 and 3

	COPD, excluding people who reported COPD at Wave 1	Chronic bronchitis, excluding people who reported chronic bronchitis at Wave 1	Emphysema, excluding people who reported emphysema at Wave 1	Asthma, excluding people who reported asthma at Wave 1				
Variables at Wave 1	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Disease at Wave 2								
E-cigarette								
Never	ref		ref		ref		ref	
Former	1.82 (1.23, 2.69)	0.004	1.43 (1.02, 2.00)	0.039	1.40 (0.69, 2.83)	0.348	1.23 (0.90, 1.69)	0.200
Current	1.44 (0.79, 2.62)	0.237	1.60 (1.13, 2.27)	0.010	1.60 (0.75, 3.44)	0.229	1.56 (1.10, 2.22)	0.015
Combustible tobacco								
Never	ref		ref		ref		ref	
Former	1.47 (0.42, 5.20)	0.550	0.95 (0.56, 1.59)	0.844	0.85 (0.21, 3.42)	0.831	0.87 (0.53, 1.42)	0.575
Current	5.79 (1.64, 20.44)	0.008	1.96 (1.23, 3.12)	0.005	3.66 (0.98, 13.60)	0.056	1.57 (1.02, 2.42)	0.046
High blood pressure								
Yes	1.67 (0.81, 3.45)	0.168	1.09 (0.70, 1.71)	0.707	1.41 (0.54, 3.68)	0.478	1.12 (0.67, 1.87)	0.648
High cholesterol								
Yes	0.95 (0.56, 1.63)	0.862	1.08 (0.70, 1.66)	0.729	1.50 (0.77, 2.94)	0.235	0.96 (0.55, 1.68)	0.896
Diabetes mellitus								
Yes	2.22 (1.31, 3.77)	0.004	1.42 (0.94, 2.15)	0.097	1.05 (0.50, 2.20)	0.907	2.34 (1.40, 3.89)	0.002
Age in years								
18–24	ref		ref		ref		ref	
25–34	3.61 (0.59, 22.1)	0.169	0.73 (0.44, 1.22)	0.233	0.94 (0.29, 3.06)	0.924	0.50 (0.33, 0.74)	0.001
35–44	9.46 (1.72, 52.1)	0.012	1.53 (0.91, 2.56)	0.109	0.57 (0.17, 1.97)	0.379	0.66 (0.39, 1.09)	0.111
45–54	30.6 (6.34, 148.0)	<0.001	1.76 (1.10, 2.82)	0.021	1.73 (0.66, 4.49)	0.265	1.07 (0.71, 1.62)	0.757
55–64	32.9 (6.76, 159.7)	<0.001	2.18 (1.26, 3.78)	0.007	5.15 (1.92, 13.85)	0.002	0.60 (0.28, 1.27)	0.186
65–74	80.7 (15.1, 432.3)	<0.001	3.39 (1.66, 6.93)	0.001	11.6 (3.10, 43.7)	<0.001	0.54 (0.25, 1.14)	0.108
75 and above	92.9 (16.0, 540.8)	<0.001	3.57 (1.43, 8.90)	0.008	9.72 (1.87, 50.5)	0.008	1.11 (0.25, 4.92)	0.889
BMI	1.03 (0.99, 1.05)	0.076	1.04 (1.02, 1.05)	<0.001	1.01 (0.97, 1.06)	0.546	1.02 (0.99, 1.04)	0.058
Sex								
Female	1.15 (0.62, 2.13)	0.656	1.91 (1.31, 2.78)	0.001	0.61 (0.33, 1.13)	0.119	1.90 (1.36, 2.66)	<0.001
Poverty level								

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

At or above poverty	0.52 (0.30, 0.91)	0.023	0.89 (0.64, 1.24)	0.488	0.49 (0.27, 0.90)	0.024	0.74 (0.53, 1.02)	0.071
Race/ethnicity								
White	ref		ref		ref		ref	
Black	0.61 (0.34, 1.09)	0.102	1.28 (0.86, 1.90)	0.203	1.16 (0.55, 2.47)	0.692	1.41 (0.95, 2.10)	0.094
Other	1.30 (0.26, 6.58)	0.749	1.66 (0.91, 3.03)	0.099	2.44 (0.63, 9.48)	0.200	1.57 (0.96, 2.56)	0.076
Sample size	22,759		22,708		23,191		20,531	
VIF	<1.1		<1.2		<1.1		<1.2	
Disease at Wave 3								
E-cigarette								
Never	ref		ref		ref		ref	
Former	1.52 (1.07, 2.14)	0.020	1.38 (1.01, 1.88)	0.047	2.03 (1.23, 3.34)	0.007	1.31 (0.97, 1.75)	0.077
Current	1.41 (0.86, 2.33)	0.178	1.73 (1.27, 2.37)	0.001	2.06 (1.24, 3.43)	0.006	1.30 (0.87, 1.95)	0.205
Combustible tobacco								
Never	ref		ref		ref		ref	
Former	3.02 (1.15, 7.93)	0.027	1.01 (0.58, 1.75)	0.966	2.11 (0.52, 8.52)	0.295	1.19 (0.75, 1.89)	0.469
Current	14.59 (5.34, 39.90)	<0.001	1.94 (1.26, 2.98)	0.004	8.16 (2.03, 32.7)	0.004	1.89 (1.26, 2.83)	0.003
High blood pressure								
Yes	1.99 (1.32, 2.99)	0.001	1.35 (0.86, 2.12)	0.193	1.56 (0.83, 2.92)	0.166	1.29 (0.88, 1.89)	0.196
High cholesterol								
Yes	0.66 (0.43, 1.02)	0.062	1.16 (0.79, 1.71)	0.441	0.95 (0.51, 1.79)	0.887	1.04 (0.67, 1.62)	0.862
Diabetes mellitus								
Yes	1.46 (0.97, 2.20)	0.074	1.06 (0.65, 1.74)	0.823	1.31 (0.77, 2.22)	0.325	1.33 (0.72, 2.45)	0.359
Age in years								
18–24	ref		ref		ref		ref	
25–34	2.73 (1.08, 6.88)	0.036	0.88 (0.54, 1.43)	0.616	1.94 (0.67, 5.58)	0.222	0.61 (0.38, 0.97)	0.039
35–44	5.11 (2.04, 12.7)	<0.001	1.75 (1.11, 2.75)	0.018	0.56 (0.11, 2.98)	0.501	0.77 (0.45, 1.32)	0.346
45–54	16.7 (6.62, 42.2)	<0.001	1.78 (1.14, 2.77)	0.014	6.69 (2.60, 17.2)	<0.001	1.33 (0.89, 1.98)	0.161
55–64	24.3 (9.59, 61.7)	<0.001	2.29 (1.46, 3.60)	0.001	10.8 (3.65, 31.8)	<0.001	0.99 (0.59, 1.68)	0.983
65–74	47.5 (17.0, 132.5)	<0.001	2.77 (1.41, 5.44)	0.004	28.8 (7.39, 112.5)	<0.001	0.77 (0.44, 1.38)	0.389
75 and above	82.1 (29.8, 226.4)	<0.001	5.22 (1.97, 13.8)	0.001	7.89 (0.72, 86.5)	0.095	1.87 (0.66, 5.30)	0.240
BMI	1.02 (0.99, 1.03)	0.061	1.02 (1.01, 1.04)	0.001	1.00 (0.98, 1.02)	0.985	1.02 (1.01, 1.04)	0.009
Sex								
Female	1.64 (1.13, 2.40)	0.012	2.03 (1.49, 2.75)	<0.001	1.31 (0.79, 2.17)	0.294	1.82 (1.32, 2.50)	<0.001

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Poverty level								
At or above poverty	0.57 (0.37, 0.88)	0.013	0.51 (0.37, 0.70)	<0.001	0.44 (0.23, 0.83)	0.012	0.61 (0.43, 0.87)	0.007
Race/ethnicity								
White	ref		ref		ref		ref	
Black	0.66 (0.43, 1.02)	0.062	1.28 (0.87, 1.88)	0.210	0.97 (0.42, 2.27)	0.949	1.26 (0.87, 1.83)	0.228
Other	0.66 (0.36, 1.19)	0.174	1.16 (0.63, 2.15)	0.641	0.48 (0.23, 0.98)	0.048	1.26 (0.70, 2.25)	0.435
Sample size	22,759		22,708		23,191		20,531	
VIF	<1.1		<1.2		<1.1		<1.2	

Note: Boldface indicates statistical significance ($p<0.05$).

COPD, chronic obstructive pulmonary disease; VIF, Variance Inflation Factor.

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Table 7. Longitudinal Associations Between Combustible Tobacco Use and Respiratory Disease (at Wave 2 or 3), Excluding Respiratory Disease at Wave 1 Among Current Combustible Tobacco Users and Current Dual Users

Variables at Wave 1	AOR (95% CI)	p-value
Combustible tobacco user		
Never e-cigarette or combustible tobacco user	ref	
Current combustible tobacco user and never e-cigarette user	2.82 (2.08, 3.82)	<0.001
Current combustible tobacco and e-cigarette user	3.04 (2.21, 4.17)	<0.001
High blood pressure		
Yes	1.21(0.83, 1.75)	0.316
High cholesterol		
Yes	0.84 (0.57, 1.23)	0.371
Diabetes mellitus		
Yes	1.61 (1.09, 2.36)	0.017
Age in years		
18–24	ref	
25–34	0.72 (0.48, 1.09)	0.124
35–44	1.15 (0.80, 1.65)	0.443
45–54	1.20 (0.82, 1.76)	0.355
55–64	1.17 (0.80, 1.70)	0.422
65–74	1.16 (0.57, 2.36)	0.676
75 and above	1.46 (0.62, 3.45)	0.391
BMI	1.02 (1.01, 1.04)	0.001
Sex		
Female	1.83 (1.39, 2.41)	<0.001
Poverty level		
At or above poverty	0.67 (0.51, 0.89)	0.006
Race/ethnicity		
White	ref	
Black	1.47 (1.11, 1.94)	0.008
Other	1.03 (0.63, 1.59)	0.899
Sample size, N	8,857	
VIF	<1.2	

Note: Boldface indicates statistical significance ($p<0.05$).

VIF, Variance Inflation Factor.

Appendix
Association of E-cigarette Use With Respiratory Disease Among Adults: A Longitudinal Analysis
Bhatta et al.

Appendix Figure 1. Flow diagram for sample.

