

SUPPLEMENTAL MATERIALS

Respiratory Symptoms Among US Adults: A Cross-Sectional Health Survey Study

Roy A. Pleasants, PharmD – University of North Carolina at Chapel Hill, Division of Pulmonary Diseases and Critical Care Medicine and North Carolina Thoracic Society, Chapel Hill, NC (ORCID 0000-0002-9020-2487); Khosrow Heidari, MS, MA, MSUniversity of South Carolina, Arnold School of Public Health, Columbia, SC; Jill Ohar, MD - Wake Forest University Pulmonary, Critical Care, Allergy, Immunologic Diseases, Winston Salem, NC (ORCID 0000-0002-2757-6806); James F. Donohue, MD - UNC at Chapel Hill Division of Pulmonary Diseases and Critical Care Medicine, Chapel Hill; NC; Njira L. Lugogo, MD - University of Michigan, Division of Pulmonary and Critical Care Medicine, Ann Arbor, MI (ORCID 0000-0002-0235-7105); Sarojini M. Kanotra, PhD – Kentucky Department for Public Health, Frankford, KY; Monica Kraft, MD University of Arizona, Department of Internal Medicine, Tucson, AZ (ORCID 0000-0002-6397-5396); David M. Mannino, MD – University of Kentucky, Department of Medicine, Lexington, KY (ORCID 0000-0003-3646-7828); and Charlie B. Strange, MD Medical University of South Carolina, Division of Pulmonary, Critical Care and Sleep Medicine, Charleston, SC. (ORCID 0000-0002-8109-8067)

Corresponding author: Roy A. Pleasants, PharmD at pleas005@email.unc.edu, [UNC at Chapel Hill, Marsico Hall, Room 7202, 125 Mason Farm Rd, Chapel Hill, NC 27599 \(919-475-9060\)](#)

Methods

Survey: The BRFSS is approved as exempt research by the CDC. This study was also approved by the Duke University Institutional Review Board. Survey response rates (proportion of all eligible and likely-eligible persons) were calculated using standards by the American Association of Public Opinion Research Response Rate Formula

#4. (http://www.aapor.org/Standard_Definitions2.htm). The response rates for each state were as follows – landline, cellphone and combined: FL 37.0%, 37.1%, and 37.0%; KY 62.1%, 51.6%, and 59.0%; SC 52.1%, 51.5%, and 50.4%; and TX 32.9%, 41.0%, and 34.4%. The number of respondents were - FL (9,739), KY (8,806), SC (11,607), and TX (14,697). (Detailed information is available through the 2015 BRFSS Summary Data Quality Report at CDC BRFSS) <http://www.cdc.gov/surveillancepractice/reports/brfss/brfss.html>

Tobacco Smoking: All respondents were asked, “Have you smoked at least 100 cigarettes in your entire life?” Those responding “no” were categorized as never smokers. Individuals responding “yes” were asked, “Do you now smoke cigarettes every day, some days, or not at all?” Persons who responded “not at all” were defined as former smokers with the remainder defined as current smokers. Those with a positive smoking history were asked about life-time duration of tobacco smoking (years); smoking intensity (cigarettes/day) was not collected.

BMI: All respondents were asked “about how much (pounds) do you weigh without shoes” and “About how tall (feet and inches) are you without shoes?” BMI was then calculated as kilograms/meter² and grouped into five categories: underweight (<18.5 kg/m²), normal weight (18.5 -24.9 kg/m²), overweight (25.0-25.9 kg/m²), obese (30.0-34.9 kg/m², WHO classification I), and morbidly obese (≥35.0 kg/m², WHO classification II and III).²⁰

Health Impairment: “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” (Frequent defined > 14 days). “Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” (Frequent defined > 14

days). “Would you say that in general your health is excellent, very good, good, fair or poor?” (Fair or poor vs all others). Impaired ambulation was defined by “Do you have serious difficulty walking or climbing stairs?” (Yes).

Supplement Table 1. Age adjusted prevalence of respiratory symptoms and socio-demographics in adults ≥18 years-older) using the 2015 Behavioral Risk Factor Surveillance System health survey in four US states (Florida, Kentucky, South Carolina & Texas)

		SOB			Productive Cough			DOE		
		Severe ^a	Moderate ^b	Minimal ^c	Severe ^d	Moderate ^e	Minimal ^f	Severe ^g	Moderate ^h	Minimal ⁱ
Characteristic	n ^s	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Total	31,895	3.0 (2.6-3.3)	6.5 (5.9-7.0)	56.97 (55.8-58.1)	5.9 (5.4-6.4)	7.0 (6.4-7.6)	53.2 (52.1-54.3)	10.5 (9.8-11.1)	3.4 (3.0-3.8)	50.2 (49.0-51.3)
Gender										
Men	12,449	2.7 (2.2-3.2)	6.2 (5.4-7.0)	57.4 (55.7-59.1)	6.2 (5.5-6.9)	8.2 (7.3-9.2)	51.8 (50.1-53.6)	9.9 (8.99-10.78)	3.1 (2.5-3.7)	51.3 (49.5-53.0)
Women	19,446	3.2 (2.7-3.8)	6.6 (6.0-7.3)	56.52 (54.9-58.1)	5.7 (5.0-6.4)	5.8 (5.2-6.5)	54.4 (52.9-56.0)	11.2 (10.19-12.23)	3.8 (3.2-4.4)	49.0 (47.4-50.6)
Age (Unadjusted)										
18-24 years	926	1.7 (0.0-3.4)	9.2 (4.6-13.7)	89.1 (84.4-93.9)	6.7 (4.1-9.3)	13.2 (8.4-18.0)	80.1 (74.8-85.4)	9.8 (5.1-14.6)	5.5 (2.4-8.6)	84.7 (79.3-90.1)
25-34	1,565	3.7 (0.9-6.6)	5.7 (3.4-7.9)	90.6 (87.0-94.0)	9.5 (5.9-13.0)	9.9 (6.5-13.3)	80.6 (76.0-85.3)	8.9 (5.5-12.4)	7.4 (4.5-10.3)	83.6 (79.3-87.9)
35-44	3,052	3.0	7.3	89.6	5.9	9.4	84.8	14.1	4.5	81.5
		(1.8-4.2)	(5.8-8.8)	(87.8-91.5)	(4.3-7.4)	(7.4-11.4)	(82.3-87.2)	(11.7-16.5)	(3.1-5.8)	(78.8-84.1)
45-54	4,524	4.1 (3.2-5.1)	9.4 (7.6-11.2)	86.4 (84.4-88.4)	7.8 (6.2-9.4)	10.6 (8.8-12.4)	81.5 (79.2-83.8)	17.3 (15.0-19.7)	5.2 (4.0-6.5)	77.4 (74.9-80.0)
55-64	6,464	6.3 (5.2-7.4)	12.3 (10.6-14.0)	81.4 (79.5-83.3)	10.5 (9.0-11.9)	9.4 (8.1-10.7)	80.1 (78.3-82.0)	20.3 (18.3-22.3)	4.9 (3.9-5.9)	74.7 (72.6-76.9)
65-74	6,910	5.5 (4.5-6.6)	12.0 (10.6-13.4)	82.4 (80.7-84.1)	12.0 (10.3-13.6)	11.0 (9.6-12.5)	77.0 (75.0-79.1)	20.6 (18.6-22.6)	6.0 (4.7-7.3)	73.4 (71.1-75.6)
75 +	5,317	7.5 (5.9-9.0)	14.5 (12.9-16.3)	78.0 (75.8-80.2)	14.2 (12.5-15.9)	13.5 (11.7-15.2)	72.3 (70.0-74.5)	23.2 (21.0-25.4)	5.4 (4.2-6.7)	71.4 (69.0-73.8)

Race										
White - NonHispanic	23,166	3.2 (2.7-3.8)	7.0 (6.3-7.8)	60.97 (59.4-62.5)	7.5 (6.7-8.32)	7.9 (7.0-8.7)	55.6 (54.1-57.2)	9.8 (9.0-10.6)	3.7 (3.2-4.3)	56.1 (54.6-57.7)
Black – Non-Hispanic	4,114	4.2 (2.8-5.6)	7.5 (6.0-9.0)	54.99 (51.3-58.7)	4.3 (2.9-5.7)	8.1 (6.0-10.2)	54.4 (49.7-57.1)	10.4 (7.5-11.3)	3.2 (2.1-4.3)	52.3 (48.6-56.0)
Hispanic	2,985	1.9 (1.3-2.5)	5.1 (4.0-6.2)	53.44 (51.1-55.8)	3.8 (2.9-4.7)	5.3 (4.2-6.3)	51.6 (49.2-54.1)	12.1 (10.5-13.7)	3.4 (2.4-4.4)	40.4 (37.9-42.8)
Other race only, Non-Hispanic	605	2.8 (0.6-4.9)	7.7 (4.6-10.9)	46.45 (41.0-51.9)	4.3 (2.2-6.2)	4.6 (2.4-6.7)	47.2 (41.7-52.8)	10.7 (6.9-14.5)	1.0 (0.2-1.8)	42.7 (37.0-48.5)
Multiracial, Non-Hispanic	414	5.7 (2.1-9.3)	6.6 (3.9-9.3)	55.32 (46.8-63.8)	10 (4.5-15.4)	9.1 (4.7-136)	48.0 (40.3-55.7)	13.9 (8.1-19.7)	6.2 (2.2-10.2)	45.4 (36.8-54.0)
Education										
< High School	3,497	6.4 (4.7-8.1)	7.8 (6.5-9.2)	50.23 (46.8-53.6)	7.5 (5.9-9.2)	6.9 (5.7-8.2)	49.9 (46.4-53.4)	17.8 (15.4-20.2)	3.8 (2.5-5.1)	37.3 (33.7-40.8)
High School Graduate	8,864	3.2 (2.6-3.8)	8.0 (6.8-9.1)	56.54 (54.3-58.8)	6.6 (5.5-7.6)	8.0 (6.8-9.3)	52.9 (50.6-65.2)	12.5 (11.2-13.9)	3.1 (2.5-3.8)	50.0 (47.8-52.3)
Some College	8,609	2.6 (2.1-3.2)	6.2 (5.3-7.0)	58.3 (56.2-60.4)	6 (5.2-6.9)	6.6 (5.4-7.7)	54.3 (52.1-54.4)	9.2 (8.1-10.3)	4.0 (3.1-4.9)	52.6 (50.5-54.8)
College Graduate	10,828	0.8 (0.6-1.1)	3.7 (3.1-4.2)	61.7 (59.6-63.8)	3.8 (3.3-4.3)	6.5 (5.3-7.8)	55.7 (53.7-57.8)	4.8 (4.2-5.5)	3.0 (2.4-3.6)	57.2 (55.1-59.4)
Smoking Status										
Current smoker	4,909	7.1 (5.6-8.6)	10.7 (9.1-12.2)	53.41 (50.5-56.3)	14.7 (12.7-16.7)	12.2 (10.5-13.9)	53.4 (50.6-56.3)	18.4 (16.3-20.6)	4.7 (3.6-5.8)	45.9 (43.0-48.7)
Former smoker	9,417	3.3 (2.6-4.0)	7.3 (5.5-9.1)	61.66 (58.8-64.7)	7.4 (5.5-9.2)	9.5 (7.2-11.8)	61.7 (58.6-64.7)	11.5 (10.0-13.1)	3.2 (2.5-4.0)	56.9 (53.8-60.1)
Never smoker	17,360	1.8 (1.4-2.1)	5.5 (4.9-6.2)	60.84 (59.4-62.3)	4 (3.5-4.5)	5.5 (4.9-6.2)	60.8 (59.4-62.3)	8.5 (7.6-9.3)	3.5 (2.9-4.1)	53.2 (51.7-54.8)

DOE, dyspnea on exertion; SOB, shortness of breath

[§] Unweighted sample size (columns do not add up to due to missing information) ^a Shortness of breath all of the time or most of the time in the last 30 days **(All or Most)** ^b Shortness of breath all of the time or most of the time in the last 30 days **(Some)** ^c Shortness of breath a little of the time or none of the time over the last 30 days **(A little or None)** ^d Cough up phlegm or mucus every day or most days in the last 30 days **(Every day or Most days)** ^e Cough up phlegm or mucus every day or most days in the last 30 days **(A few days)** ^f Cough up phlegm or mucus only with colds or never in the last 30 days **(Only with colds or Never)** ^g Agree slightly or strongly that physical activity is affected by shortness of breath over the past year **(Agree strongly or Agree slightly)** ^h Neither Agree or Disagree that physical activity is affected by shortness of breath over the past year **(Neither agree or disagree)** ⁱ Disagree slightly or strongly that physical activity is affected by shortness of breath over the past year **(Disagree slightly or Disagree strongly)**

Underweight (BMI<18.5 kg/m ²)	4.5 (2.3-6.6)	14.0 (6.0-21.9)	81.6 (73.5-90.0)	14.6 (7.6-21.9)	13.2 (6.6-19.8)	71.1 (61.7-80.4)	11.6 (7.8-15.4)	5.8 (1.7-9.9)	75.1 (67.2-94.0)
Normal weight (18.5≤BMI<25 kg/m ²)	4.2 (2.7-5.8)	6.7 (5.6-7.8)	87.9 (85.6-90.1)	9.5 (7.5-11.4)	9.8 (8.2-11.5)	80.2 (77.7-82.6)	11.9 (9.8-14.0)	4.3 (3.0-5.5)	80.4 (78.0-82.9)
Overweight (BMI 25-29.9 kg/m ²)	2.4 (2.0-2.9)	8.4 (6.5-10.3)	88.9 (86.9-90.8)	6.9 (5.7-8.0)	11.8 (9.5-14.1)	80.7 (78.1-83.2)	11.6 (9.9-13.4)	4.7 (3.4-6.1)	80.3 (78.1-82.5)
Obese (BMI 30-34.9 kg/m ²) (WHO Class I)	3.6 (2.7-4.4)	11.5 (9.0-14.1)	84.8 (82.3-87.4)	10.3 (7.6-13.0)	10.4 (7.9-12.9)	78.5 (75.0-81.9)	15.6 (13.6-17.7)	5.2 (3.5-6.8)	76.2 (73.5-79.0)
Obese (BMI ≥35) (WHO classes II and III obesity)	8.4 (6.1-10.7)	15.0 (10.8-19.2)	76.5 (71.9-81.1)	11.4 (9.0-13.8)	9.5 (7.1-12.0)	78.0 (74.6-81.3)	25.6 (20.9-30.3)	8.4 (5.8-11.0)	63.7 (58.7-68.8)

BMI, body mass index; COPD, chronic obstructive pulmonary disease; DOE, dyspnea on exertion; SOB, shortness of breath. DOE; WHO – World Health Organization.

^a SOB all of the time or most of the time in the last 30 days (**All or Most**) ^b SOB all of the time or most of the time in the last 30 days (**Some**) ^c SOB a little of the time or none of the time over the last 30 days (**A little or None**) ^d Cough up phlegm or mucus every day or most days in the last 30 days (**Every day or Most days**) ^e Cough up phlegm or mucus every day or most days in the last 30 days (**A few days**) ^f Cough up phlegm or mucus only with colds or never in the last 30 days (**Only with colds or Never**) ^g Agree slightly or strongly that physical activity is affected by shortness of breath over the past year (**Agree strongly or Agree slightly**) ^h Neither Agree or Disagree that physical activity is affected by shortness of breath over the past year (**Neither agree or disagree**) ⁱ Disagree slightly or strongly that physical activity is affected by shortness of breath over the past year (**Disagree slightly or Disagree strongly**)

Supplement Table 3. Age adjusted prevalence of respiratory symptoms, general health-related quality of life , and limited ambulation in adults ≥ 18 years-older) using the 2015 Behavioral Risk Factor Surveillance System health survey in four US states (Florida, Kentucky, South Carolina & Texas)

	Shortness of Breath			Productive Cough			Dyspnea on Exertion		
	Severe ^a	Moderate ^b	Minimal ^c	Severe ^d	Moderate ^e	Minimal ^f	Severe ^g	Moderate ^h	Minimal ⁱ
Measure	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Fair or poor overall health ^j	58.6 (49.9 - 67.3)	32.4 (32.5-42.3)	13.7 (12.7-14.7)	38.5 34.2 - 42.8)(	21.8 (19.5-24.1)	15.2 (14.0-16.3)	41.8 (37.0-46.6)	23.8 (19.3-28.3)	12.1 (11.1-13.0)
Frequent mental distress ^k	43.4 (35.2 - 51.6)	30.4 (24.4-35.5)	9.7 (8.5 - 10.8)	28.7 (23.7 - 33.7)	19.1 (14.6-23.6)	9.9 (8.7-11.1)	26.3 (21.5-31.2)	21.0 (14.9-27.1)	9.3 (8.1-10.6)
Frequent physical distress ^l	39.9 (32.7 - 47.1)	33.7 (27.5-39.8)	8.6 (7.7 - 9.6)	28.0 (24.0 - 32.0)	16.9 (12.8-20.9)	10.0 (8.9-11.0)	29.1 (24.4-33.7)	15.8 (11.3-22.2)	8.5 (7.6-9.4)
Serious difficulty walking or climbing stairs ^m	45.4 (38.8 - 52.0)	31.6 (27.5-35.8)	10.1 (9.2 - 10.9)	29.2 (25.3 - 33.1)	20.3 (16.7-23.8)	11.2 (10.4-12.0)	30.5 (27.7-33.3)	17.7 (13.6-21.7)	9.6 (8.8-10.5)

^a Shortness of breath (SOB) all of the time or most of the time in the last 30 days ^b

Shortness of breath all of the time or most of the time in the last 30 days ^c

Shortness of breath a little of the time or none of the time over the last 30 days ^d

Cough up phlegm or mucus every day or most days in the last 30 days ^e Cough up phlegm or mucus every day or most days in the last 30 days ^f Cough up phlegm or mucus only with colds or never in the last 30 days

^g Agree slightly or strongly that physical activity is affected by shortness of breath (dyspnea on exertion) over the past year

^h Neither Agree or Disagree that physical activity is affected by shortness of breath over the past year ⁱ Disagree slightly or strongly that physical activity is affected by shortness of breath over the past year ^j Would you say that in general your health is excellent, very good, good, fair or poor? (fair or poor)

^k Number of days mental health not good in last month ≥ 14 days

^l Number of days physical health not good in last month ≥ 14 days ^m Have serious difficulty walking or climbing stairs?