Supplemental Information

Association Between Cigarette Smoking Frequency and Tobacco Use Disorder in US Adults

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NESARC-III Tobacco Use Disorder Symptom Coding Protocol

Tobacco Use Disorder (TUD) was assessed in the NESARC-III using the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS-5), a structured interview to assess DSM-5 criteria for TUD and other disorders.[1,2] TUD severity was coded as none (0-1 symptoms), mild (2-3 symptoms), moderate (4-5 symptoms) or severe (6-11 symptoms). A small number of participants ($n = 47$; 0.7% of otherwise eligible smokers) did not have smoking rate data available and were thus excluded from analyses. The dataset obtained from NIAAA includes variables representing final diagnostic code for each disorder, but the documentation does not include instructions for recreating these diagnoses or for coding individual symptoms. To overcome this, content of individual items was manually reviewed and matched to likely symptoms by the authors. Modifications to this initial scoring algorithm were made until it converged to 100% accurate classification rate with the diagnostic codes provided with the data. This approach is consistent with one used for other substance use disorders.[3] We have subsequently confirmed our scoring algorithm is identical to the one used by other research teams with direct involvement in the NESARC-III study. To ensure the reproducibility of our findings, we present our scoring algorithm below.

DSM Criteria	NESARC Questions	NESARC Coding
1. Tobacco is often taken in larger amounts or over a longer period than intended	N3AQ8B23 - Have a period when you often used tobacco or nicotine more or longer than you intended to?	N3AQ8B23=1
2. There is a persistent desire or unsuccessful efforts to cut down or control tobacco use	N3AQ8B1 – More than once WANT to stop or cut down on your tobacco or nicotine use? N3AQ8B2 – More than once TRY to stop or cut down on your tobacco or nicotine use but found you couldn't do it?	N3AQ8B1=1 OR N3AQ8B2=1
3. A great deal of time is spent in activities necessary to obtain or use tobacco	N3AQ8B6 – Find yourself chain smoking? N3AQ8B33 – Have a period when you spent a lot of time using tobacco or nicotine? N3AQ8B34 – Have a period of time when you spent a lot of time making sure you had enough tobacco or nicotine available?	N3AQ8B33=1 OR N3AQ8B34=1 OR N3AQ8B6=1
4. Craving, or a strong desire or urge to use tobacco	N3AQ8B35 – Have a very strong desire or urge to use tobacco or nicotine? N3AQ8B36 – Want to use tobacco or nicotine so badly that you couldn't think of anything else?	N3AQ8B35=1 OR N3AQ8B36=1
5. Recurrent tobacco use resulting in a failure to fulfill major role obligations at work, school, or home	N3AQ8B28 – Have job or school problems as a result of your tobacco or nicotine use, like problems getting your work done, not doing your job well, being demoted or losing a job or being suspended, expelled or dropping out of school? N3AQ8B29 – Continue to use tobacco or nicotine even though it was causing you problems at school or work? N3AQ8B30 – Have a period when your tobacco or nicotine use often interfered with taking care of your home or family?	N3AQ8B28=1 OR N3AQ8B29=1 OR N3AQ8B30=1
6. Continued tobacco use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of tobacco	N3AQ8B26 – Have arguments or problems with your spouse or partner or family or friends because of your tobacco or nicotine use? N3AQ8B27 – Continue to use tobacco or nicotine even if it was causing you problems with your family or friends?	N3AQ8B26=1 OR N3AQ8B27=1
7. Important social, occupational or recreational activities are given up or reduced because of tobacco use.	N3AQ8B3 – Give up or cut down on activities that you were interested in or that gave you pleasure because tobacco or nicotine use was not permitted at the activity? N3AQ8B4 – Give up or cut down on activities that were important to you – like associating with friends or relatives or attending social activities – because tobacco use was not permitted at the activity?	N3AQ8B3=1 OR N3AQ8B4=1
8. Recurrent tobacco use in situations in which	N3AQ8B25 – More than once use tobacco or nicotine in a situation that could have been dangerous, like smoking in bed, when using	N3AQ8B25=1

	it is physically hazardous	combustible materials like paint thinner, or in any other dangerous situation?	
9.	Tobacco use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by tobacco.	N3AQ8B5 – Continue to use tobacco or nicotine even though you knew it was causing you a health problem or making a health problem worse? N3AQ8B24 – Continue to use tobacco or nicotine even though you knew it made you nervous, jittery, anxious or depressed?	N3AQ8B5=1 OR N3AQ8B24=1
10.	Tolerance, as defined by either A) A need for markedly increased amounts of tobacco to achieve the desired effect or B) A markedly diminished effect with continued use of the same amount of tobacco	N3AQ8B21 – Find that you had to use much more tobacco or nicotine than you once did to get the effect you wanted? N3AQ8B22 – Increase your tobacco or nicotine use because the amount you used to use didn't give you the same effect anymore?	N3AQ8B21=1 OR N3AQ8B22=1
11.	Withdrawal, as manifested by either A) The characteristic tobacco withdrawal syndrome or B) Tobacco is taken to relieve or avoid withdrawal symptoms.	**Characteristic Withdrawal Syndrome:** Within days after stopping or cutting down on your tobacco use, did you EVER… N3AQ8B7 – Feel depressed? N3AQ8B8 – Have difficulty falling asleep or staying asleep? N3AQ8B9 – Have difficulty concentrating? N3AQ8B10 – Eat more than usual or gain weight? N3AQ8B11 – Become easily irritated, angry or frustrated? N3AQ8B12 – Feel anxious or nervous? N3AQ8B13 – Feel your heart beating more slowly than usual? N3AQ8B14 – Feel more restless than usual? **Tobacco taken to relieve withdrawal:** N3AQ8B17 – Use tobacco or other sources of nicotine like gum or patch to relieve or avoid any of these bad aftereffects after you stopped or cut down on your tobacco or nicotine use? N3AQ8B18 – Wake up in the middle of the night to use tobacco or nicotine? N3AQ8B19 – Often use tobacco or nicotine just after getting up or shortly after getting up in the morning? N3AQ8B20 – Find yourself using tobacco or nicotine JUST AFTER being in a situation where tobacco or nicotine use was not permitted? N3AQ8B37 – Use tobacco or nicotine within 30 minutes of waking up?	**Characteristic Withdrawal Syndrome:** 1. Recode classic withdrawal symptoms (1=1, Else =0; see list to left) 2. Sum N3AQ8B7 through N3AQ8B14 3. If sum > 3, characteristic withdrawal syndrome = Yes **Tobacco taken to relieve withdrawal:** N3AQ8B17 = 1 OR N3AQ8B18 = 1 OR N3AQ8B19 = 1 OR N3AQ8B20 = 1 OR N3AQ8B37 =1 **Overall Endorsement** NumSymptoms_Sum >3 OR Relieve_Withdrawal = 1

Additional Information on Statistical Analysis

All analyses were conducted using SAS 9.4. Individual symptom criteria were coded using the method outlined above and the number of endorsed symptoms was calculated as an index of severity. The PROC SURVEYFREQ procedure was used to calculate proportions with DOMAIN statements applied to ensure correct calculation of confidence intervals. A similar approach using PROC SURVEYMEANS was applied for continuous variables. Sample weights were used in all analyses and Binomial confidence intervals were calculated using the Wilson method, which recent evidence indicates offers optimal performance relative to alternatives.[4]

Table S1 – Association Between Smoking Rate and Tobacco Use Disorder

Frequency	CPD	N (raw)	% Meeting TUD Criteria (Any Severity)	% Meeting TUD Criteria (Mild)	% Meeting TUD Criteria (Moderate)	% Meeting TUD Criteria (Severe)	# Symptoms Endorsed
< 1 day per week	1+	649	26.26 [22.13 – 30.85]	18.67 [15.37 – 22.48]	6.01 [3.92 – 9.10]	1.58 [0.81 – 3.07]	1.05 [0.90 – 01.20]
1-2 days per week	1+	274	47.41 [40.15 – 54.79]	31.02 [24.90 – 37.88]	9.34 [6.25 – 13.72]	7.05 [4.44 – 11.02]	1.92 [1.65 – 2.19]
3-6 days per week	1+	614	64.10 [58.80 – 69.07]	29.86 [25.72 – 34.35]	17.59 [13.82 – 22.13]	16.65 [13.29 – 20.66]	2.87 [2.60– 3.13]
Every Day	1-4	524	65.33 [59.94 – 70.36]	29.93 [25.83 – 34.38]	22.07 [18.10 – 26.62]	13.34 [9.84 – 17.84]	2.81 [2.54 – 3.08]
Every Day	5	424	75.25 [68.42 – 81.01]	30.72 [26.47 – 35.32]	28.83 [23.53 – 34.80]	15.70 [12.08 – 20.15]	3.34 [3.05 – 3.63]
Every Day	6-9	593	81.64 [77.60 – 85.09]	32.63 [27.76 – 37.90]	28.75 [24.26 – 33.71]	20.26 [16.20 – 25.03]	3.65 [3.41 – 3.89]
Every Day	10	1310	83.25 [79.75 – 86.24]	28.67 [25.52 – 32.04]	28.23 [24.97 – 31.73]	26.36 [23.60 – 29.31]	3.98 [3.81 – 4.15]
Every Day	11-15	466	89.79 [86.38 – 92.41]	28.30 [23.98 – 33.06]	30.10 [25.55 – 35.08]	31.39 [26.62 – 36.58]	4.29 [4.03 – 4.54]
Every Day	16-20	1578	91.07 [88.99 – 92.79]	24.21 [21.56 – 27.07]	31.33 [28.57 – 34.23]	35.53 [32.62 – 38.55]	4.61 [4.46 – 4.76]
Every Day	21+	361	91.33 [85.47 – 94.96]	17.10 [12.94 – 22.25]	33.57 [28.01 – 39.61]	40.66 [34.94 – 46.64]	5.02 [4.67 – 5.37]

Notes. CPD = Cigarettes per day on smoking days. TUD = Tobacco Use Disorder per DSM-5. The Wilson method was used to calculate confidence intervals for binomial data. Note that this information replicates the contents of Figure 1.

TABLE S2 - Association Between Smoking Rate and Tobacco Use Disorder for Non-Daily Smokers

Frequency	CPD	N (raw)	% Meeting TUD Criteria (Any Severity)	% Meeting TUD Criteria (Mild)	% Meeting TUD Criteria (Moderate)	% Meeting TUD Criteria (Severe)	# Symptoms Endorsed
< 1 day per week	1-2	449	18.33 [13.65 – 24.15]	14.06 [10.26 – 18.96]	3.51 [1.93 – 6.30]	0.76 [0.17 – 3.28]	0.78 [0.62 – 0.94]
< 1 day per week	3+	200	44.55 [36.76 – 52.62]	29.29 [21.70 – 38.25]	11.77 [6.91 – 19.34]	3.49 [1.70 – 7.03]	1.67 [1.40 – 1.94]
1-2 days per week	1-2	130	41.57 [31.68 – 52.20]	31.34 [22.69 – 41.51]	7.82 [3.97 – 14.81]	2.42 [0.61 – 9.13]	1.55 [1.18– 1.91]
1-2 days per week	3+	144	53.25 [42.43 – 63.77]	30.70 [23.28 – 39.28]	10.85 [6.43 – 17.75]	11.69 [7.24 – 18.34]	2.29 [1.85 – 2.74]
3-6 days per week	1-2	154	41.10 [31.66 – 51.25]	23.80 [16.06 – 33.77]	11.59 [6.36 – 20.18]	5.72 [2.50 – 12.53]	1.74 [1.37 – 2.10]
3-6 days per week	3+	460	70.88 [64.45 – 76.57]	31.64 [26.65 – 37.09]	19.37 [14.97 – 24.68]	19.87 [15.80 – 24.69]	3.20 [2.90 – 3.50]

Notes. CPD = Cigarettes per day on smoking days. TUD = Tobacco Use Disorder per DSM-5. The Wilson method was used to calculate confidence intervals for binomial data.

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