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Q2 Softening Among U.S. Smokers With Psychological
Distress: More Quit Attempts and Lower Consumption
as Smoking Drops

Margarete C. Kulik, PhD, Stanton A. Glantz, PhD

Introduction: It has been argued that as smoking prevalence declines, the remaining smokers represent a “hard core” who are unwilling or unable to quit, a process known as hardening. However, as recently shown, the general smoking population is softening not hardening (i.e., as prevalence falls, more quit attempts and lower consumption among continuing smokers). People with psychological distress smoke more, so they may represent hard-core smokers.

Methods: Using cross-sectional time series analysis, in 2016–2017 changes in quit attempts and cigarette consumption were evaluated over 19 years among smokers with serious psychological distress (Kessler-6 score ≥ 13) based on the National Health Interview Survey (1997–2015), controlling for sociodemographic variables.

Results: People with psychological distress had higher smoking prevalence and consumed more cigarettes/day than people without distress. The percentage of those with at least one quit attempt was higher among those with psychological distress. The increase in quit attempts over time was similar among smokers in each of the distress levels. For every 10 years, the OR of a quit attempt increased by a factor of 1.13 (95% CI=1.02, 1.24, $p < 0.05$). Consumption declined by 3.35 (95% CI= -3.94, -2.75, $p < 0.01$) cigarettes/day for those with serious psychological distress.

Conclusions: Although smoking more heavily than the general population, smokers with psychological distress, like the general population, are softening over time. To improve health outcomes and increase health equity, tobacco control policies should continue moving all subgroups of smokers down these softening curves, while simultaneously incorporating appropriately tailored quitting help into mental health settings.

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INTRODUCTION

The concept of hardening of the smoking population has been described as the smoking population, on average, becoming less willing to or less capable of quitting as smoking prevalence declines, implying that hard-core smokers would increasingly comprise the smoking population.^{1–5} However, several studies from around the world have found that softening, not hardening, is occurring.^{6–8} Over time, as smoking prevalence fell, continuing smokers were making more quit attempts and consumed fewer cigarettes.

Because those with psychological distress smoke more,^{9,10} some have identified them as hard-core smokers.^{11,12}

Nineteen years of data from the U.S. National Health Interview Survey (NHIS) are used to examine smoking prevalence levels and the associations between (1) the proportion of smokers who made at least one quit attempt in the past 12 months and (2) the number of cigarettes

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smoked per day (CPD) among the remaining smokers as dependent variables, and time (as smoking prevalence decreased) as the independent variable among people with different levels of psychological distress as measured by the Kessler Psychological Distress Scale (K6).^{13,14} As with the general population and people without psychological distress, smoking patterns are softening among people with mental distress, albeit from a higher baseline than among people without distress.

METHODS

Study Sample

Annual individual level data from 19 waves of the NHIS were used, the principal survey collecting health information on the U.S. civilian and non-institutionalized population¹⁵ for 1997 through 2015 (Appendix Table 1, available online).

Measures

A current smoker was defined as someone who has smoked ≥ 100 cigarettes in his or her lifetime and currently smokes every day or some days, a total of 118,604 in the 19 waves. Current smokers were asked how many cigarettes they smoked per day, allowing for an answer between 1 and ≥ 95 . These smokers were asked if they had tried quitting smoking for a day or longer in the past 12 months. Those answering *yes* were characterized as having made a quit attempt.

The K6^{13,14} questions included in the NHIS were used to measure psychological distress among the smokers in the survey. The K6 consists of six questions asking about the respondent's level of feeling sad, nervous, restless, hopeless, worthless, and whether everything felt like an effort in the past 30 days. Possible answers range from *none of the time*, to *a little*, to *some*, to *most*, to *all of the time*. The *none of the time* was scored to be 0 and *all of the time* to be 4; the points were then summed for all six questions to obtain an aggregate score between 0 and 24. Following Prochaska et al.,¹⁶ respondents were assigned to three categories: no distress (total score 0–4); moderate distress (5–12); and serious psychological distress (13–24). Out of the total of 586,509 respondents, 11,819 (2%) had missing information for at least one K6 question, which resulted in 574,690 persons for analysis (Appendix Table 1, available online).

The sociodemographic variables in the adjusted models were sex (male/female); age (continuous variable in years 18 to ≥ 85); marital status (married/living with partner, never married, widowed/divorced/separated); alcohol use (current drinker [one or more drinks in past year], former drinker [no drinks in past year], lifetime abstainer [< 12 drinks in lifetime]); educational level (0–11 years of education/12 years without diploma, high school diploma/GED or equivalent, some college/associate's degree, bachelor's degree and higher); and race and ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic all other race groups).

Statistical Analysis

All data from the annual adult samples of the NHIS between 1997 and 2015 were pooled, accounting for the complex survey data design of the NHIS, including Primary Sampling Unit and

strata^{17,18} for smokers in each of the three K6 categories and computed smoking prevalence, the percentage of smokers with at least one quit attempt in the past 12 months, and the number of cigarettes smoked (Figure 1).

Logistic regression was used to assess changes in quit attempts and linear regression for CPD over time in unadjusted and adjusted models controlling for all sociodemographic variables. Because of collinearity between time (in 10-year increments, centered on the mean [2006]) and smoking prevalence (prevalence dropped over time, Figure 1), time was used as the independent variable in the final analysis. Analyses were run for each of the K6 categories, as well as for all smokers combined, controlling for K6 category. To assess whether time trends in quit attempts and cigarette consumption were the same in each of the distress subgroups, additional analyses were carried out for all smokers combined including interactions for decade X K6 category (Appendix Table 3, available online).

Analysis was done with Stata, version 14, in 2016–2017.

RESULTS

Smoking prevalence declined between 1997 and 2015 for the general population and all three psychological

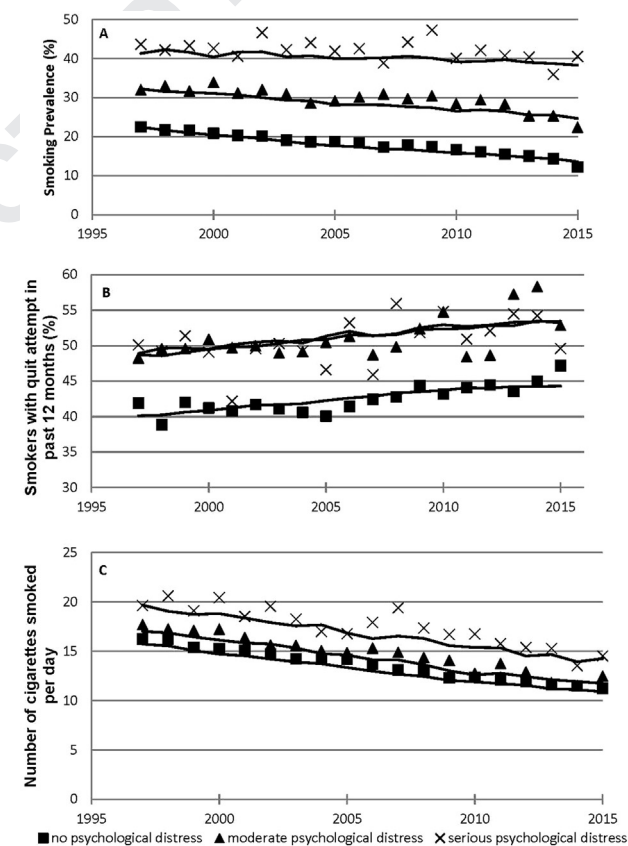


Figure 1. Smoking prevalence declines over time, quit attempts increase, and cigarettes smoked per day decrease in those with and without psychological distress, 1997–2015. Note: Lines based on fitted values from adjusted regressions (details of regressions are in Appendix Table 2, available online).

174 distress groups ($p < 0.01$ for all groups in unadjusted
175 model), with higher prevalence among those with more
176 psychological distress (Figure 1A; Appendix Table 2,
177 available online). The declines were slower among those
178 with psychological distress (interaction terms in
179 Appendix Table 3, available online). Among those with
180 serious psychological distress the unadjusted smoking
181 prevalence fell by a factor of 0.92 (95% CI=0.86, 0.98,
182 $p < 0.01$) per decade, but the adjusted prevalence did not
183 fall significantly.

184 The proportion of smokers with at least one quit
185 attempt in the past 12 months increased over time in all
186 subgroups of smokers ($p < 0.01$ for all groups; Figure 1B
187 and Table 1) in both the unadjusted and adjusted models.
188 The OR of a quit attempt increased by factors of 1.39
189 (95% CI=1.34, 1.44) and 1.43 (95% CI=1.35, 1.53) for
190 those with moderate and serious psychological distress
191 compared with those without distress, respectively, in the
192 fully adjusted model ($p < 0.01$; Table 3). The percentage
193 of those with at least one quit attempt was higher among
194 those with psychological distress (Figure 1B). The
195 increase in quit attempts over time was similar among
196 smokers with all distress levels (interaction terms in
197 Appendix Table 3, available online).

198 CPD declined over time for all K6 categories of
199 smokers ($p < 0.01$; Figure 1C and Table 2). Cigarette
200 consumption was higher among smokers with serious
201 distress (19.6 CPD in 1997, falling to 14.5 CPD in 2015)
202 than among those without distress (16.3 CPD in 1997,
203 falling to 11.2 in 2015). In the fully adjusted model,
204 smokers with moderate distress smoked 1.37 (95%
205 CI=1.19, 1.54) and smokers with serious distress 3.69
206 (95% CI=3.36, 4.03) more CPD than those without
207 distress ($p < 0.01$; Table 3). People with moderate psy-
208 chological distress reduced CPD faster than people
209 without psychological distress ($p < 0.05$), whereas people
210 with serious distress reduced consumption at a similar
211 rate as people without distress based on interaction terms
212 in Appendix Table 3 (available online). In a sensitivity
213 analysis that treated K6 level as a continuous variable, a
214 significant effect was found ($p = 0.006$) for the interaction
215 of K6 level X time (not shown).

216 The changes with time were essentially the same in the
217 adjusted and unadjusted models for both outcomes,
218 indicating that the demographic factors were not con-
219 founding variables.

220 DISCUSSION

221 The analyses showed that, consistent with other liter-
222 ature,¹⁹ over time smoking prevalence among those with
223 psychological distress declined, albeit slower than in
224 people without psychological distress. Although smoking
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227 more heavily than people without psychological distress,
228 like people without psychological distress and the general
229 population,⁶⁻⁸ smokers with psychological distress are
230 softening over time. Between 1997 and 2015, smokers
231 with both moderate and with serious psychological
232 distress showed significant increases in quit attempts
233 and significant decreases in the average number of
234 cigarettes smoked. These results reject the hypothesis of
235 hardening over time and, instead, support softening
236 among smokers with psychological distress.

237 The finding that the proportion of those with at least
238 one quit attempt in the past 12 months is higher among
239 those with psychological distress compared with those
240 without might reflect the fact that although this subgroup
241 of smokers is motivated and willing to quit, they may
242 have a harder time quitting successfully. Cooper and
243 colleagues²⁰ found using a population-based sample that
244 smokers with depressive symptoms make more quit
245 attempts and might have a higher motivation to quit,
246 but are also more likely to relapse within 30 days. Smith
247 et al.²¹ similarly found a lower likelihood of long-term
248 cessation success among those with mental illness
249 compared with those without, with cessation rates
250 varying by different diagnoses.

251 Mental health providers have often been reluctant to
252 treat tobacco dependence in mental health and addiction
253 treatment settings because of the incorrect assumption
254 that treating nicotine addiction complicates treating
255 other substance abuse or mental health issues.²² Pro-
256 chaska and others²³⁻²⁶ showed that prioritizing smoking
257 cessation is consistent with good clinical practice among
258 depressed smokers. Likewise, smoking cessation often
259 improves clinical outcomes in people in substance abuse
260 treatment and recovery and can even enhance long-term
261 sobriety.²⁷⁻²⁹ In a systematic review and meta-analysis,
262 Taylor et al.³⁰ showed that both in the general population
263 and in a clinical setting, quitting smoking is associated
264 with improved positive mood and quality of life,³¹ which
265 should reassure smokers with psychological distress as
266 well as their healthcare providers to make quitting one of
267 their priorities.

268 A major strength of the analyses is the long period of
269 time under analysis. Another strength is the large sample
270 size of this national population representative sample
271 that allowed to not just differentiate between those with
272 and without serious psychological distress (K6 scores of
273 0-12 vs 13-24), but to also make a distinction between
274 those with moderate and serious distress. These two
275 subgroups of smokers vary in their levels of smoking
276 prevalence between each other and when compared with
277 those without distress (Figure 1). Although quit attempts
278 do not vary over time between the three groups, for CPD
279 there was a significant difference in time trends between

Table 1. Proportion With At Least One Quit Attempt in the Past 12 months (OR and 95% CIs From Logistic Regression)

Covariates and model fit	No psychological distress		Moderate psychological distress		Serious psychological distress	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Time (per 10 years) ^a	1.12 (1.08, 1.16)**	1.13 (1.10, 1.17)**	1.13 (1.07, 1.20)**	1.14 (1.08, 1.21)**	1.12 (1.01, 1.23)*	1.13 (1.02, 1.24)*
Gender						
Male		1		1		1
Female		1.11 (1.07, 1.15)**		1.00 (0.94, 1.07)		1.03 (0.92, 1.16)
Age		0.99 (0.98, 0.99)**		0.99 (0.98, 0.99)**		0.99 (0.99, 0.99)**
Marital status						
Married/living with partner		1		1		1
Never married		0.93 (0.89, 0.97)**		0.95 (0.87, 1.04)		0.84 (0.72, 0.99)*
Widowed/divorced/separated		0.99 (0.95, 1.04)		1.06 (0.99, 1.14)		0.99 (0.87, 1.13)
Alcohol use						
Current drinker		1		1		1
Former drinker		1.00 (0.95, 1.32)		1.03 (0.94, 1.11)		1.01 (0.88, 1.16)
Lifetime abstainer		0.81 (0.76, 0.87)**		1.01 (0.91, 1.13)		0.96 (0.78, 1.18)
Educational level						
0–11 years/12 years without diploma		1		1		1
HS diploma/GED or equivalent		1.03 (0.97, 1.08)		1.16 (1.06, 1.27)**		1.02 (0.89, 1.17)
Some college/AA degree		1.31 (1.24, 1.38)**		1.30 (1.18, 1.42)**		1.20 (1.04, 1.40)*
BA degree and higher		1.28 (1.21, 1.36)**		1.29 (1.14, 1.45)**		1.28 (0.98, 1.66)
Race/ethnicity						
Non-Hispanic white		1		1		1
Non-Hispanic black		1.30 (1.23, 1.37)**		1.41 (1.28, 1.54)**		1.50 (1.28, 1.76)**
Hispanic		1.13 (1.06, 1.19)**		1.20 (1.09, 1.33)**		1.47 (1.23, 1.75)**
Non-Hispanic all other race groups		1.14 (1.04, 1.25)**		1.22 (1.02, 1.47)*		1.10 (0.74, 1.62)
Constant	0.74 (0.72, 0.75)	1.12 (1.03, 1.21)**	1.04 (1.01, 1.08)	1.46 (1.28, 1.67)**	1.03 (0.97, 1.09)	1.39 (1.07, 1.80)*
Model fit <i>p</i> -value	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01

Note: Boldface indicates statistical significance (**p* < 0.05; ***p* < 0.01).

^aYear centered on 2006 (–9 to 9), and divided by 10.

AA, associate's; BA, bachelor's; GED, General Educational Development (high school equivalency) test; HS, high school.

Table 2. Consumption of Cigarettes/Day (Coefficients and 95% CIs From Linear Regression)

Covariates and model fit	No psychological distress		Moderate psychological distress		Serious psychological distress	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Time (per 10 years) ^a	-2.88 (-3.06, -2.71)**	-2.77 (-2.92, -2.62)**	-3.28 (-3.58, -2.97)**	-3.16 (-3.43, -2.88)**	-3.25 (-3.87, -2.63)**	-3.35 (-3.94, -2.75)**
Gender						
Male		1		1		1
Female		-3.00 (-3.17, -2.84)**		-2.64 (-2.95, -2.34)**		-3.57 (-4.18, -2.96)**
Age		0.09 (0.08, 0.10)**		0.09 (0.08, 0.10)**		0.08 (0.05, 0.10)**
Marital status						
Married/living with partner		1		1		1
Never married		-1.34 (-1.53, -1.15)**		-1.41 (-1.76, -1.05)**		-1.00 (-1.89, -0.11)*
Widowed/divorced/separated		0.23 (0.04, 0.42)*		0.19 (-0.21, -0.59)		-0.46 (-1.16, 0.25)
Alcohol use						
Current drinker		1		1		1
Former drinker		1.25 (1.00, 1.49)**		0.95 (0.52, 1.37)**		0.45 (-0.30, 1.21)
Lifetime abstainer		-0.10 (-0.38, 0.17)		-0.35 (-0.91, 0.21)		0.19 (-0.90, 1.28)
Educational level						
0-11 years/12 years without diploma		1		1		1
HS diploma/GED or equivalent		-0.83 (-1.08, -0.59)**		-0.81 (-1.21, -0.41)**		-1.48 (-2.35, -0.62)**
Some college/AA degree		-2.22 (-2.47, -1.97)**		-1.87 (-2.28, -1.45)**		-1.67 (-2.58, -0.76)**
BA degree and higher		-4.89 (-5.18, -4.61)**		-4.70 (-5.25, -4.15)**		-4.70 (-6.05, -3.35)**
Race/ethnicity						
Non-Hispanic white		1		1		1
Non-Hispanic black		-5.27 (-5.47, -5.07)**		-5.36 (-5.73, -4.99)**		-6.56 (-7.39, -5.73)**
Hispanic		-7.84 (-8.08, -7.61)**		-7.58 (-8.00, -7.16)**		-8.36 (-9.25, -7.47)**
Non-Hispanic all other race groups		-4.48 (-4.87, -4.09)**		-3.88 (-4.67, -3.09)**		-4.99 (-7.37, -2.60)**
Constant	13.60 (13.50, 13.70) **	17.37 (16.93, 17.82) **	14.77 (14.60, 14.94) **	18.00 (17.23, 18.77) **	17.50 (17.14, 17.85) **	23.08 (21.47, 24.69) **
Model fit R ²	0.02	0.17	0.03	0.15	0.02	0.13
Model fit p-value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Note: Boldface indicates statistical significance (*p < 0.05; **p < 0.01).

^aYear centered on 2006 (-9 to 9), and divided by 10.

AA, associate's; BA, bachelor's; GED, General Educational Development (high school equivalency) test; HS, high school.

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Table 3. Proportion With At Least One Quit Attempt in the Past 12 Months and Consumption of Cigarettes/Day in the Entire Sample

Covariates and model fit	Proportion with at least one quit attempt in past 12 months (Logistic regression)			Consumption of cigarettes/day (linear regression)		
	Unadjusted	Including K6	Fully adjusted	Unadjusted	Including K6	Fully adjusted
Time (per 10 years) ^a	1.14 (1.11, 1.18)**	1.12 (1.09, 1.16)**	1.13 (1.10, 1.17)**	-2.91 (-3.07, -2.74)**	-3.00 (-3.16, -2.84)**	-2.89 (-3.03,-2.76)**
Psychological distress status: Kessler 6 scale						
No distress (0–4 points)		1	1		1	1
Moderate psychological distress (5–12 points)		1.41 (1.36, 1.47)**	1.39 (1.34, 1.44)**		1.17 (0.99, 1.36)**	1.37 (1.19, 1.54)**
Serious psychological distress (13–24 points)		1.39 (1.31, 1.48)**	1.43 (1.35, 1.53)**		3.89 (3.53, 4.25)**	3.69 (3.36, 4.03)**
Gender						
Male			1			1
Female			1.08 (1.05, 1.12)**			-2.96 (-3.10, -2.82)**
Age			0.99 (0.99, 0.99)**			0.09 (0.08, 0.10)**
Marital status						
Married/living with partner			1			1
Never married			0.93 (0.89, 0.97)**			-1.34 (-1.50, -1.17)**
Widowed/divorced/separated			1.01 (0.97, 1.05)			0.16 (-0.1, 0.34)
Alcohol use						
Current drinker			1			1
Former drinker			1.00 (0.96, 1.04)			1.10 (0.88, 1.31)**
Lifetime abstainer			0.86 (0.81, 0.91)**			-0.13 (-0.38, 0.11)
Educational level						
0–11 years/12 years without diploma			1			1
HS diploma/GED or equivalent			1.05 (1.01, 1.10)*			-0.87 (-1.07, -0.67)**
Some college/AA degree			1.30 (1.24, 1.36)**			-2.12 (-2.32, -1.91)**
BA degree and higher			1.29 (1.22, 1.36)**			-4.86 (-5.11, -4.62)**
Race/ethnicity						
Non-Hispanic white			1			1
Non-Hispanic black			1.33 (1.27, 1.40)**			-5.36 (-5.54, -5.19)**
Hispanic			1.16 (1.10, 1.22)**			-7.82 (-8.03, -7.61)**
Non-Hispanic all other race groups			1.16 (1.06, 1.26)**			-4.38 (-4.74, -4.03)**
Constant	0.81 (0.80, 0.83)	0.74 (0.72, 0.75)	1.09 (1.02, 1.17)*	14.13 (14.04, 14.23)**	13.60 (13.50, 13.70)**	17.31 (16.93, 17.69)**
Model fit R ² , p-value				0.02	0.03	0.17
Model fit p-value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Note: Boldface indicates statistical significance (* $p < 0.05$; ** $p < 0.01$).

^aYear centered on 2006 (–9 to 9), and divided by 10.

AA, associate's; BA, bachelor's; GED, General Educational Development (high school equivalency) test; HS, high school.

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those without and with moderate distress, and a marginal one between those without and with serious distress (Appendix Table 3, available online), a result confirmed in a sensitivity analysis that treated K6 level as a continuous variable and found a significant effect for the interaction of K6 level X time.

Limitations

A potential limitation of this study is that the NHIS is a survey of the non-institutionalized population, so it does not include institutionalized smokers who may have more severe diagnoses of depression and mental distress, with the result that these people are excluded from the analyses. Second, whereas the K6 scale is a validated instrument, it is a self-assessment of mental distress symptoms, which might be less reliable than a physician-verified diagnosis of depression. The R^2 values for the unadjusted models for CPD, although highly significant, were low. Third, because quit attempts were measured in the past 12 months, whereas psychological distress questions referred to the past 30 days, it is not possible to assess whether these two conditions coincided directly.

CONCLUSIONS

Even smokers with serious psychological distress are willing to quit and to reduce consumption over time, just like the population of those without distress, albeit from higher baseline prevalence and consumption rates. With appropriate tailored interventions and quitting help, these heavier smokers can successfully quit smoking. To achieve this goal in mental health settings, more attention has to be paid to quitting smoking. To improve health outcomes and increase health equity, tobacco control policies should continue moving all subgroups of smokers down these softening curves.

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MCK collected the data, computed the statistics, and drafted the manuscript. SAG advised on data analysis and revised the manuscript.

No financial disclosures were reported by the authors of this paper.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/10.1016/j.amepre.2017.08.004>.

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