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Authors

Kulik, Margarete C
Lisha, Nadra E
Glantz, Stanton A

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RESEARCH ARTICLE

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

From the Center for Tobacco Control Research and Education, and Department of Medicine, University of California, San Francisco, San Francisco, California

Address correspondence to: Stanton A. Glantz, PhD, Center for Tobacco Control Research and Education, University of California, San Francisco, 530 Parnassus, Suite 366, San Francisco CA 94143. E-mail: glantz@medicine.ucsf.edu.

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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 population[15] 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). F1

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

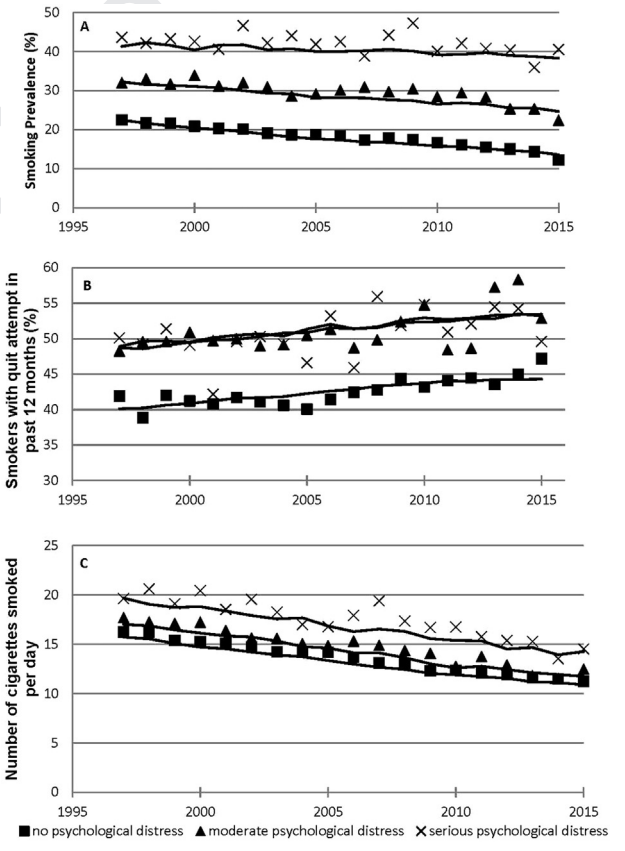

Figure 1. Smoking prevalence declines over time, quit attempts increase, and cigarettes smoked per day decrease in those with and without psychological distress, 1997–2015.
Note: Lines based on fitted values from adjusted regressions (details of regressions are in Appendix Table 2, available online).

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

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

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

The changes with time were essentially the same in the adjusted and unadjusted models for both outcomes, indicating that the demographic factors were not confounding variables.

DISCUSSION

The analyses showed that, consistent with other literature,[19] over time smoking prevalence among those with psychological distress declined, albeit slower than in people without psychological distress. Although smoking more heavily than people without psychological distress, like people without psychological distress and the general population,[6–8] smokers with psychological distress are softening over time. Between 1997 and 2015, smokers with both moderate and with serious psychological distress showed significant increases in quit attempts and significant decreases in the average number of cigarettes smoked. These results reject the hypothesis of hardening over time and, instead, support softening among smokers with psychological distress.

The finding that the proportion of those with at least one quit attempt in the past 12 months is higher among those with psychological distress compared with those without might reflect the fact that although this subgroup of smokers is motivated and willing to quit, they may have a harder time quitting successfully. Cooper and colleagues[20] found using a population-based sample that smokers with depressive symptoms make more quit attempts and might have a higher motivation to quit, but are also more likely to relapse within 30 days. Smith et al.[21] similarly found a lower likelihood of long-term cessation success among those with mental illness compared with those without, with cessation rates varying by different diagnoses.

Mental health providers have often been reluctant to treat tobacco dependence in mental health and addiction treatment settings because of the incorrect assumption that treating nicotine addiction complicates treating other substance abuse or mental health issues.[22] Prochaska and others[23–26] showed that prioritizing smoking cessation is consistent with good clinical practice among depressed smokers. Likewise, smoking cessation often improves clinical outcomes in people in substance abuse treatment and recovery and can even enhance long-term sobriety.[27–29] In a systematic review and meta-analysis, Taylor et al.[30] showed that both in the general population and in a clinical setting, quitting smoking is associated with improved positive mood and quality of life,[31] which should reassure smokers with psychological distress as well as their healthcare providers to make quitting one of their priorities.

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

	No psychological distress		Moderate psychological distress		Serious psychological distress	
Covariates and model fit	**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 *p*-value	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01

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

	No psychological distress		Moderate psychological distress		Serious psychological distress	
Covariates and model fit	**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 (*$p<0.05$; **$p<0.01$).
[a]Year 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 3. Proportion With At Least One Quit Attempt in the Past 12 Months and Consumption of Cigarettes/Day in the Entire Sample

	Proportion with at least one quit attempt in past 12 months (Logistic regression)			Consumption of cigarettes/day (linear regression)		
Covariates and model fit	**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 (*$p<0.05$; **$p<0.01$).
[a]Year 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.

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.

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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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