**Title**: Losing jobs and lighting up: Employment experiences and smoking in the Great Recession

## 1. Introduction

At the end of the Great Recession, one out of every ten people in the labor force wanted to work but could not find a job. In the majority of these cases, unemployment was the result of an involuntary job loss  (Theodossiou & Hipple, 2011). Losing work or being unemployed is a stressful life event with potential negative ramifications for mental and physical health (Catalano et al., 2011; Dooley, Fielding, & Levi, 1996) .

Measuring the impact of changing employment on health can be difficult, however, as many outcomes like chronic diseases take years to develop. Routine health-related behaviors can be more rapidly susceptible to employment shocks, and provide an early indication of future health needs. In this study, therefore, we explore whether involuntary job loss triggers short-term changes to smoking behavior, and whether this effect varies by employment status. Smoking is considered the leading preventable cause of mortality in the United States, due to its association with nearly one out of every five deaths each year (Mokdad, Marks, Stroup, & Gerberding, 2004).  Smoking-related mortality risks accumulate over time and correlate with total tobacco exposure (US Department of Health and Human Services, 2004), suggesting that all smoking transitions can impact health. More than 40% of U.S. adults report having smoked at least 100 cigarettes in their lifetime, and 18% of adults currently smoke on some or most days (Agaku, 2012). A recent national survey found that nearly 70% of current smokers want to quit, more than half made a quit attempt in the past year, but less than 7% succeeded (Malarcher, 2011).

Although smoking prevalence has generally decreased over the last few decades, progress has tapered, and smoking rates actually increased slightly during the height of the recession. In 2007, 19.8% of adults smoked regularly or periodically. This rate increased to 20.6% in 2008

and 2009. Although adult smoking prevalence fell to 19.0% in 2011, it remains well above the Healthy People 2020 goal of 12% (Agaku, 2012). Job losses in the recent downturn could explain some of this slowdown if they resulted in financial or emotional shocks to individuals which in turn impacted their smoking behaviors, especially if these shocks are sustained through longer periods of not working. Understanding whether and why smoking behavior changes following an involuntary job loss can help health professionals target smoking-related prevention and cessation resources, and better plan for the long-term health ramifications of economic downturns. We leverage repeated measures of employment experience and smoking from the 2001-2011 waves of the Panel Study of Income Dynamics (PSID), a nationally representative dataset, to assess relationships between recent employment experiences and smoking, and explore whether changes in family income or psychological distress explain these associations.

## 2. Previous research

Within a larger body of literature assessing relationships between labor market experiences and health, several studies have explicitly examined the impact of job displacement on smoking. Some analyses find higher odds of smoking among the unemployed, compared to the employed (De Vogli & Santinello, 2005; Montgomery, Cook, Bartley, & Wadworth, 1998; Prochaska, Shi, & Rogers, 2013), but these are cross-sectional studies. Consequently, they cannot rule out the possibility that smokers may be more likely to lose work, if employers view smoking as a negative quality in employees. Empirical work finds that unhealthy people are more likely to be displaced (Böckerman & Ilmakunnas, 2009; Jin, Shah, & Svoboda, 1995), and that smoking, especially among men, is associated with higher rates of abstenteeism (Leigh, 1996), sick leave (Lundborg, 2007) and future unemployment (Jusot, Khlat, Rochereau, & Serme, 2008). Estimates of the impact of displacement on smoking could therefore be inflated if

they fail to account for high selection of smokers into involuntary job loss.

Four studies to date have utilized panel data to measure impacts of job loss or unemployment on smoking. Panel data, which consists of repeated observations of the same individuals over time, can strengthen causal estimation by ensuring that employment changes pre-date changes in smoking. Using two waves of a national sample of older adults in the US, Falba and colleagues (2005) found that former smokers who lost work had more than twice the odds of relapsing, compared to their peers who remained working, and that individuals who smoked at baseline consumed an average of about five more cigarettes per day after a job loss, if not re-employed. Similarly, Weden, Astone and Bishai (2006) explored 11 years of data from the National Longitudinal Survey of Youth and found evidence for a decreased likelihood of smoking cessation among the non-employed, but only for European American women. A recent study of Korean men found no statistically significant relationship between unemployment and smoking status, smoking intensity or quitting, but did find that the odds of re-initiating smoking was 66% higher among the unemployed compared to standard workers (Jung, Oh, Huh, & Kawachi, 2013). Finally, using eight waves of data from the Framingham Heart Study Offspring Cohort, Arcaya and colleagues (2014) found that being unemployed nearly doubled the odds of smoking, though the effect was only statistically significant among men.

Each of these studies, however, has limitations which we aim to address in this analysis. Two only analyze men's experience, and a third relies on data collected in the 1980s and 1990s. Although the fourth study uses more recent data, the last analyzed panel is from 2005, before the recent economic crisis. During the Great Recession rates of both all and long-term unemployment peaked, and individuals spent more time looking for work before finding it, and by the end of 2009, more than 1% of people who were officially outside the labor force indicated

they were interested in working but had gotten discouraged from searching (Allegretto & Lynch, 2010; Theodossiou & Hipple, 2011). The income and psychological ramifications of involuntary job loss may have particularly strong in recent years, especially among those individuals who were unable to find work following the loss. Analyses that are generalizable to the US population in the current context, and that consider employment status following a job loss as part of the employment experience, are needed to provide the best estimates of the impact of recent recessionary periods on smoking.

Additionally, some researchers argue that individuals who experience involuntary job loss or bouts of unemployment may differ in key, health-relevant ways from those who do not (Roelfs, Shor, Davidson, & Schwartz, 2011). Even though each of the studies described here employed longitudinal analysis to control for reverse causation, none employed techniques to control for bias from unmeasured characteristics of individuals who lose their jobs. Authors acknowledged that selection biases can remain if such characteristics, like a proclivity for risk-taking, are associated with both smoking and other behaviors that could jeopardize employment.

Finally, the studies we reviewed only assessed whether employment shifts or job losses are associated with smoking outcomes, and did not test the mechanisms which might mediate the relationship between job loss and smoking. Although governments and organizations can take actions to try to decrease levels of job loss, there will always be people who experience involuntary job displacement. A better understanding of how these shocks impact health behaviors can help public health professionals better target prevention resources.

## 3. Mechanisms through which job loss or employment may impact smoking

We hypothesize that involuntary loss of work impacts smoking through two potential mechanisms that operate in opposite directions: an income effect that could suppress smoking

rates, and a psychological distress effect that could enhance them. Neither of these hypotheses is universally supported by the published literature (Catalano et al., 2011), so we review arguments both in favor and opposed to them here.

*3.1 Income Declines*

Job loss is associated with a decline in income, with effects persisting several years into the future (Ruhm, 1991; Stevens, 1997). As individuals lose income, economic theory suggests they decrease their purchase of all normal goods, including cigarettes. Individuals may give up smoking following an involuntary job loss, if they target limited resources toward other goods. As a result, job loss may be associated with decreased smoking probabilities. Even if individuals rely on savings or other resources to smooth their tobacco consumption behavior (Morduch, 1995), they may quit smoking if no additional work is found, and income losses are sustained.

The nicotine found in tobacco products, however, is addictive for many people (Stolerman & Jarvis, 1995), perhaps making it difficult for individuals to reduce or quit smoking, even if they would prefer to do so in light of lost income. As a result, cigarette consumption may be income inelastic, or relatively insensitive to recent changes in income. In addition, tests of rational addiction models of smoking find that people alter consumption in advance of a price change (Gruber & Koszegi, 2000); if the same is true for expected income declines, post-job loss responsiveness could be minimized. A meta-analysis finds that a one percent loss of income is associated with only a 0.28 percent decrease in cigarette demand in the short run (Gallet & List, 2003).

*3.2 Psychological distress*

Involuntary loss of work may also trigger higher levels of psychological distress, which could increase the likelihood that people smoke if smoking is a coping strategy. Several research

studies find that higher levels of anxiety, lower levels of subjective well-being, loss of a sense of personal control, less favorable self images, the disruption of social networks, and declining mental health follow job loss (Brand & Burgard, 2008; Paul & Moser, 2009; Price, Choi, & Vinokur, 2002). Chronic stress, financial anxiety and depression may spur coping mechanisms, including unhealthy behaviors such as smoking (Juster, McEwen, & Lupien, 2010; Shaw, Agahi, & Krause, 2011). Loss of self esteem and social support, both documented protective factors for smoking (Croghan et al., 2006; Mermelstein, Cohen, Lichtenstein, Baer, & Kamarck, 1986), could do the same.

Some researchers, however, argue that work is a source of stress, particularly if working environments require long hours and allow little autonomy (Clougherty, Souza, & Cullen, 2010; Daniels & Guppy, 1994). If the result of a job loss is a decrease in stressful employment conditions, stress-related smoking responses could decline instead of rise. Furthermore, this could be offset by a quick return to work. Recent empirical work has documented positive associations between working conditions or longer work hours and poor mental health (Clumeck et al., 2009; Virtanen et al., 2011) and risky health behaviors (Escoto et al., 2010).

## 4. Contributions

Our study contributes to the current literature in four key ways. First, we capture smoking responses to employment experiences among a nationally representative sample during a period that includes the Great Recession. This provides an up-to-date estimate of some potential health impacts of the recent economic crisis. Second, we consider whether the impact of job loss differs based on whether an individual subsequently finds work, allowing us to distinguish differences between job loss experience and employment status. Third, we use a panel dataset and individual fixed effects methods to control for some unobserved confounders of the employment-smoking

relationship, and thus improve on previous causal estimations. Finally, by incorporating additional measures of income and psychological distress, we begin to explore potential reasons why job loss might influence smoking.

## 5. Data and methods

*5.1. Samples*

Individual- and family-level information about smoking behaviors, recent job losses, employment status, income, psychological distress and demographic characteristics are derived from the six waves of the nationally representative, longitudinal PSID administered biennially between 2001 and 2011 (Panel Study of Income Dynamics, 2014). The primary purpose of the PSID is to track economic and demographic behavior, and the survey instrument includes detailed questions about employment status and transitions.

The PSID is designed to collect information about a family from a single representative of that family. In most cases, the interviewee answers questions in reference to his or her own work, behavior and resources, as well as those for his cohabitating partner or spouse. In the six waves of data used for this analysis, 15,114 unique household heads and partners were working in at least one wave, and were therefore potentially exposed to job loss. Since our analyses rely on multiple observations of each participant, we eliminated the 1,374 individuals (9%) who had only participated in one wave of data collection. An additional 169 respondents (1%) failed to provide key covariate information, and were dropped, resulting in a final full analytic sample of 13,571 individuals. Demographic information about members of the full analytic sample is available in Table 1.

One of the potential mediators explored in this analysis, psychological distress, was assessed only for the primary respondent and not the respondent's spouse. In addition,

psychological distress measures were not included in the 2005 PSID questionnaire. We therefore created a restricted sample for use when analyzing psychological distress, made up of those 7,769 individuals in the full analytic sample who reported emotional distress data at more than one wave. A series of t-tests comparing individuals in the restricted and full samples indicate that those in the restricted sample were: significantly younger; had lower family incomes; were more likely to be women, African American, and single; and were more likely to have experienced bouts of unemployment or labor market departure during the analysis period. Smoking prevalences in each sample were similar.

*5.2 Measures*

The key outcome variable for these analyses, smoking status, is measured dichotomously for each individual based on a question about whether the respondent (or his/her partner) currently smokes cigarettes. Previous research suggests that family member proxy reports of smoking status are reliable (Gilpin et al., 1994), and that self report of smoking behavior corresponds relatively well to biochemical indicators of smoking (Patrick et al., 1994).

The PSID collects detailed information about jobs that earned income for respondents and their partners in the two years prior to the survey, including the reasons that jobs ended. Recent involuntary job loss was measured dichotomously, based on whether an individual left a job in the last two years due to plant or company closure, layoff, firing or strike (=1), or quit work, retired, wanted a change, or remained in the same job (=0). Strictly categorizing job loss reasons as involuntary or voluntary is difficult, especially if individuals who take early retirement packages as alternatives to layoffs or who resign to avoid being fired are categorized as voluntary job leavers, when in reality external pressure caused the job loss. In sensitivity tests, therefore, we also employed a dichotomous indicator of any job loss that included all individuals

who left a job in the last two years for any reason.

To further examine the impact of job loss on smoking by taking into account the context of a respondent's employment status at the time of survey, we created a six category *employment experience* variable based on different combinations of recent job loss experience (yes or no) and current employment status (employed, unemployed, out of the labor force). Current employment status is determined by whether an individual reports he or she is working (including on temporary leave), unemployed (not working, but actively job searching) or not in the labor force (all others) at the time they were surveyed.

To measure total family income, we use a PSID composite measure of the total taxable, transferable and social security income of household heads, married or cohabitating partners, and other family unit members in the year prior to interview. To account for inflation, we adjust family income measures to reflect real prices in 1999 using the Consumer Price Index-Urban, available from the Bureau of Labor Statistics (BLS). For ease of interpretation, we measure income in tens of thousands of dollars, and to account for skewness in the income distribution we employ a log transformation.

The PSID measures levels of non-specific psychological distress of the respondent using the K6 scale (Kessler et al., 2002). The six items ask the respondent to indicate, how often, in the past thirty days, he or she felt sad, nervous, restless, hopeless, like everything was an effort, and worthless. Likert responses to these items are summed using reference weights to create a scale, in accordance with scoring recommendations from scale developers. High scores indicate high levels of psychological distress.

To control for time-varying characteristics of sample members and their environments in our fixed-effect models, we include measures of a participant's age at the time of survey (linear

and quadratic) and partnership status (cohabitating with a spouse or partner vs. not cohabitating), as well as the unemployment rate in the respondent's state during the three months leading up to the survey month, an indicator for the survey year, and an indicator for whether a participant was the respondent or partner of a respondent in a given wave. In bivariate and random effects models in which fixed effects are not used, we also include PSID indicators of an individual's gender (male or female), race (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other Non-Hispanic), and educational level (< high school, high school graduate, some college, college graduate).

*5.3 Analysis*

After documenting trends in key variables over time, we assess relationships among involuntary job loss, employment status, income, psychological distress and smoking behavior in several ways. First, we evaluate differences in means of observable characteristics between those who experienced at least one involuntary job loss during the analysis period and those who did not. We look at differences in smoking prevalence, but also examine differences in demographic, employment, income and psychological measures, to ascertain potential confounders in the job loss-smoking relationship.

We hypothesize that job loss could impact smoking through changes in either income or psychological distress. To examine this hypothesis we conduct three sets of regression models. First, we use linear regression models to assess whether a recent job loss experience was associated with lower family income, or higher levels of psychological distress, and whether these effects appear modified by current employment status. We then evaluate smoking as a function of job loss and employment experience using linear probability models, both with and without measures of income and distress included in analyses. If hypothesized mediators explain

relationships between involuntary job loss and smoking, we would expect job loss to significantly predict the mediator in the first analyses, as well as smoking in the reduced form model, and for these impacts on smoking to be reduced or eliminated when the potential mediator is added to the model (Baron & Kenny, 1986). Conclusions about indirect effects of key variables through mediators require additional analyses using tools such as two-part of structural equation models (Preacher, Rucker, & Hayes, 2007); we explored these if total and direct effects from regression models differed substantively.

On advantage of multivariate regression analyses is that they can help isolate the effect of involuntary job loss by controlling for observed variables. Even in these models, however, important unobserved differences between these individuals may remain. To address this concern, we employ individual participant fixed effects in each of our regression models. Fixed effect models control for time-invariant unobserved individual characteristics by assessing change within individuals over time. Before choosing the fixed effects model, we also considered random effects models which assume that there is no correlation between independent variables and the error terms. However, results of a Hausman test comparing the random and fixed effects models found that the estimates derived from the two models differed significantly ($X^2$=533.4, p=0.00), suggesting the larger coefficients observed in the random effects model could be biased. The final econometric specification is:

$$S_{it} = \alpha_0 + \text{Emp}_{it}\,\beta_1 + X_{it}\,\beta_2 + Y_t\,\beta_3 + \mu_i\alpha_1 + \varepsilon_{it}$$

where $S_{it}$ is the probability of being a smoker for individual $i$ at time $t$; $\text{Emp}_{it}$ represents the dichotomous indicator of job loss or the categorical variable measuring employment experience; $X_{it}$ is a vector of other individual characteristics and the state unemployment rate; $Y_t$ is a vector of observation year indicators; $\mu_i$ is a vector of time-invariant, unobserved individual

characteristics; and $\varepsilon_{it}$ is an error term.

To examine whether observed effects are distinct to a particular combination of job loss experience and employment status we conduct a series of Wald tests comparing the different coefficients derived from the fixed effects models. To ensure that our results are not masking gender effects, we examine models stratified by gender to explore any major differences. All analyses were conducted using panel regression techniques in STATA 13 (Statacorp, College Station, Tex), and were estimated with robust standard errors adjusted for clustering at the individual level. The UNC Institutional Review Board approved this study.

## 6. Results

Although smoking prevalence generally decreased in the PSID sample between 2001 and 2011, individuals who had experienced a recent involuntary job loss consistently smoked at higher rates than their peers who had not experienced a recent loss (Figure 1). Smoking prevalence among people without a recent job loss steadily fell from a high in 2001 of 22% to a low in 2011 of 18%. During the same period, smoking prevalence among individuals who recently lost work rose from 35.8% in 2001 to 37.1% in 2003, then gradually fell to 30.2% in 2011.

*6.1 Differences in people who did and did not experience job loss*

In bivariate analyses, people who experienced an involuntary job loss at some point during the observation window differed significantly from their never-displaced peers in several key ways (Table 1). First, displaced workers were much more likely to smoke during the observation window, either continuously (20% vs. 12%) or periodically (21% vs. 15%). Almost 60% of ever-displaced workers were consistent non-smokers, whereas nearly three quarters (73%) of never-displaced workers were consistently smoke-free.

Second, statistical tests indicate that involuntary job loss was associated with most demographic characteristics and resource levels in the PSID sample. People who experienced involuntary job loss between 2001 and 2011 were significantly more likely to be male, Black, Hispanic, and less well-educated than people who reported no recent involuntary job losses during the analysis period. People who lost work were also more likely to experience bouts of unemployment (48% vs. 10%), be younger (40 vs. 43), have no partner in the house (25% vs. 18%), have lower average family incomes ($70,000 vs. $100,000), and be more psychologically distressed over time (average score of 3.7 vs. 2.7) than their non-displaced peers.

The breadth of differences in observed characteristics between those people who did and did not experience a job loss during the analysis period underscores the possibility that unobserved characteristics of people who experience a job loss could impact their subsequent family income, psychological distress and smoking status as well. To examine how a recent job loss experience might impact each of these, while controlling for such characteristics, we turn to the results of the fixed effects regression models.

*6.2 Associations of employment experience with family income and emotional distress*

We first explore whether job loss or employment experience significantly predicts increases in smoking risk factors. Regression models indicate that experiencing an involuntary job loss was associated with a 13% *increase* in total family income up to two years later (Table 2, Model 1a) on average, but models that incorporate employment status indicate that involuntary job loss only tells part of the story. Individuals who were not displaced within 2 years of the survey but who were unemployed and out of the labor force had incomes that were 88% and 35% *lower* than when they were working. The only displaced worker group who experienced higher incomes were those who were unemployed at the time of the survey (Table 2,

Model 1b).

Involuntary job loss was also associated with a 0.29 point increase on the psychological distress score (Table 2, Model 2a). but people who are working within two years of their job loss fare no worse than if they worked continuously without a job loss (Model 2b). Looking for work or being out of the labor force was associated with distress scores that were elevated by 0.6-0.8 points, regardless of job loss experience.

Sensitivity tests using the indicator of any, rather than involuntary, job loss produce mostly similar results, except that job loss followed by employment at the time of observation is associated with a 4% decrease in income and a 0.11 point increase in psychological distress ($p<0.05$), and the significant, positive effect of being unemployed following a job loss on income disappears ($b=-0.01$, $p=0.74$). Stratified analyses indicate only two gender differences. The observed income effect that occurs during unemployment following a job loss is only significant for women ($b_{female}=0.15$ $p=0.03$; $b_{male}=0.04$, $p=0.39$), whereas the distress effect that occurs when someone leaves the labor force following a job loss is only significant for men ($b_{male}=1.16$ $p=0.00$; $b_{female}=0.44$, $p=0.12$).

*6.3 Reduced form models of recent job loss and smoking*

We next model reported smoking status as a function of recent involuntary job loss, controlling only for demographic characteristics and individual fixed effects. In these analyses, involuntary job loss experienced within the past two years is associated with a 1.2 percentage point increase in the probability of reporting smoking among the full analytic sample (Table 3, Model 1), and a 1.5 percentage point increase in smoking probability among the restricted sample of individuals who also reported emotional distress levels (results not shown). When job loss experience is interacted with current employment status using the employment experience

categories, only two employment experiences result in a significantly different probability of smoking when compared to the referent group of people who are working and experienced no involuntary job loss within the past two years. Being out of the labor force without a recent job loss decreases the probably of smoking by 1.9 percentage points, whereas working in the context of a recent job loss is associated with a 1.4 percentage point increase in the likelihood of smoking (Table 3, Model 2). People were no more or less likely to smoke when unemployed, compared to when they were working, regardless of whether they experienced a job loss within the past two years, and Wald tests confirm that the coefficient on the two unemployed terms did not differ significantly from each other. Similar results are found among the restricted sample of individuals who also reported emotional distress levels (results not shown).

Employing a more expansive definition of job loss that includes voluntary departure results in similar findings, with one exception. In this model labor market departure following a job loss also results in lower smoking probabilities (b= -0.017, p=0.00) in the full model; a similar, but only marginally significant effect is found in the restricted sample (b= -0.015, p=0.05). Stratified gender models indicate that the decreased smoking probabilities following labor market department in the absence of a job loss are only significant for women, though coefficient values are similar to those in the non-stratified models.

*6.4 Associations of smoking with family income, psychological distress and recent job loss*

Our final sets of models add family income, psychological distress, or both, to the reduced form model of employment experience just described. The addition of income to the full sample model results in no differences in employment experience coefficients (Table 3, Model 3), and the addition of psychological distress (Table 3, Model 4) or distress and income (Table 3, Model 5) to the restricted sample produces no meaningful change in effect size or significance.

The protective effect of labor force departure without a job loss experience and the increased smoking risk associated with working in the context of recent job loss both remain in these alternate specifications. The use of the any job loss categorization in the place of the involuntary one produces the same significant decrease in smoking probability regardless of whether income or psychological distress variables are included (results not shown).

These models further indicate that changes in family income have no significant impact on smoking status when other factors are controlled, but that psychological distress did exert a significant independent impact on smoking. Specifically, a one point increase on the psychological distress scale was associated with a 0.2 percentage point increase in smoking probability, holding job loss experience, current employment status and other factors constant. Stratified models indicate this effect differs by gender. When women's psychological distress levels increase by one point, it is associated with a 0.3 percentage point increase in smoking likelihood (p=0.00), but distress is not significantly associated with smoking for men (b=0.001, p=0.64).

## 7. Conclusions

Our study suggests that the high levels of involuntary job loss associated with the Great Recession and its aftermath might be hampering progress toward national smoking goals, with possible ramifications for rates of smoking-related diseases. We found that individuals who experienced an involuntary job loss had a 1.2 percentage point increase in their probability of smoking, on average. Returning to work did not alleviate this effect; in fact the effect was strongest among those who were working within two years of losing work. The BLS estimates that 6.9 million people lost work involuntarily between 2007 and 2009, and another 6.1 million

were displaced between 2009-2011 (2012a). Taken together, this suggests that 165,000 people may have initiated or resumed smoking due to job loss in this four year window alone.

A recent study of smoking rates in the Behavioral Risk Factor Surveillance System before and after the recent recession estimates that the economic crisis altogether resulted in 0.6 million more smokers in the U.S. than would have been predicted based on previous trends and demographic shifts alone (Gallus, Ghislandi, Muttarak, & Bosetti, 2013). Our results are consistent with this finding, and suggest that involuntary job loss may be a key part of why this occurred.

To best target prevention dollars in poor economies, it may be important to understand why involuntary job loss influences smoking status. Unfortunately, our results do not provide clear support for either of the mechanisms we hypothesized. Although involuntary job loss experience was associated with changes in family income levels, it was not associated with smoking in adjusted models. The PSID measure of annual family income includes all sources of money brought into the house from all household members. We chose to use this broad measure, assuming that consumers make purchasing decisions with the household budget, rather than their individual income, in mind. If short-term changes in income derive primarily from family members, however, they may not be considered available for cigarette purchases. Alternatively, changes in income when people are not working could be associated with other changes we were not able to capture, including modifications to social networks or exposure to workplace smoking rules. Future work that examines relationships between different types of income and smoking, changes in smoking following longer term shifts in household income, and associations of income with other smoking risk and protective factors would be a useful addition to the findings we report here.

Although involuntary job loss was initially a significant predictor of psychological distress, further investigation indicates these effects are driven by current employment status, not the job loss experience itself. These findings are not necessarily contradictory to other research and theories which suggest that losing work is a stress-inducing event (Catalano et al., 2011; Paul & Moser, 2009). The job losses measured in our sample occurred up to two years before the assessment of distress. It is possible that involuntary displacement produces an immediate hike in distress levels that tapers over time, especially if new employment is found. In addition, the distress measure we used captures general levels of anxiety, worry and other emotions. A more specific measure of work-related or financial distress could illuminate additional relationships that remain obscured here, but such a measure was not available in these data.

Limitations in our data prevented us from assessing two alternative mechanisms that might connect job loss and smoking behaviors, and therefore deserve attention in future research. Many workplaces have implemented smokefree policies or provide employees with access to smoking cessation programs (Shopland, Gerlach, Burns, Hartman, & Gibson, 2001). Job loss and non-employment could result in the loss of smoking prevention resources, or less time spent in smoking restrictive environments, potentially increasing smoking risks. Additionally, smoking requires some amount of time commitment in a setting where smoking is permitted. Long work hours have been tied to higher smoking relapse rates, and fewer successful quit attempts (Angrave, Charlwood, & Wooden, 2014). Information about the smoking-related policies and programs of former employers, as well as detailed time-use information, however, was not available in the PSID data.

Although we were not able to elucidate clear pathways connecting job loss and smoking behavior, our study provides several important contributions to the field of employment and

health. First, by estimating within-person changes in all variables over time, we both place job loss experience between observations of smoking, alleviating concerns about reverse causation, and control for some unmeasured characteristics of individuals that might otherwise confound associations. In our bivariate comparisons of people who experienced any involuntary job loss during the analysis window with those people who reported no such loss, we found that these two groups differed substantially on nearly every demographic, employment, financial and emotional indicator we examined. It seems likely, therefore, that the groups differed in other ways, such as risk-taking proclivity or frequency of break-taking, which could be associated with higher propensities to both lose work and smoke.

Second, our results provide insight into potential differences between employment status and displacement experience that are not always considered in the literature. Contrary to some, but not all, previous research, we find no impact of being unemployed on smoking status, regardless of recent job loss exposure. A smaller proportion of the sample experienced variation in unemployment (19%) than experienced job loss (27%), so it is possible that our data did not have the power to uncover a smoking-unemployment relationship. Alternatively, it may be that the job loss shock is meaningfully distinct from the status of searching for work. Many previous studies of employment, job loss and health use unemployment status as a proxy or alternative measure for job loss (Arcaya et al., 2014; Jusot et al., 2008). If these concepts differ in consequential ways, failing to distinguish them could conflate results, and possibly obscure an opportunity to efficiently target smoking prevention resources immediately following displacement.

Similarly, our results underscore the importance of distinguishing individuals who are not working, but remain in the labor market, and those who have left the labor market altogether.

Although we find no differences in smoking when people are working or actively looking for work, we do find that when people retire, go to school, or otherwise exit the labor market outside the context of a recent job loss, they are less likely to smoke. Very few previous smoking studies compare individuals in and out of the labor force, but two that have found positive, rather than negative associations between being out of the labor force and smoking. One of these studies examined odds of cessation among smokers, so may not incorporate smoking uptake that could occur during labor market entry (Weden et al., 2006). The other study is a cross-sectional examination, and therefore does not examine changes within individuals (Prochaska et al., 2013). If poor working conditions, long hours and little job autonomy trigger smoking coping responses, departure from employment may alleviate these pressures, especially if the employee chose to leave and was not trying to return to work.

Finally, our findings highlight the potential of several programs or policies that could help reduce smoking, even during recessionary periods. Layoff and discharge rates have recently returned to pre-recession levels, but they remain a risk for many people. In January 2014, 2.8 million workers were involuntarily displaced (BLS, 2014). Smoking prevention efforts may therefore be particularly critical in places where economic growth remains slow. Since the impact of job loss is particularly strong among people who have returned to work, it may be important to provide prevention and cessation outreach to all displaced workers, even if they have been re-employed.

A recent study found that displaced workers are not well served by general community- or healthcare-based smoking cessation efforts (Neumann, Rasmussen, Ghith, Heitmann, & Tønnesen, 2013). Smoking prevention initiatives designed specifically for displaced workers could be integrated with unemployment or job seeking services, and perhaps be more successful.

Workplace smoking prevention and cessation programs and policies are considered effective tobacco control strategies (Cahill & Lancaster, 2014). Workplace-based opportunities that target new workers, especially those who previously experienced displacement, could augment other smoking prevention initiatives. Finally, although not implicated as a mediator, higher levels of psychological distress were directly associated with higher smoking probabilities in our study, especially among women. This finding is consistent with other studies (Dube et al., 2009; Lawrence, Mitrou, & Zubrick, 2011), underscoring the relevance of recent recommendations to pair mental health treatment with smoking prevention or cessation assistance (Prochaska, 2011).

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**Table 1: Smoking, Demographic Characteristics, and Resources of Sample Participants**

| | Full Sample (n=13,571) | | At least one job loss between 2001-2011 (n=3,408) | | No job loss experience (n=10,163) | | |
|---|---|---|---|---|---|---|---|
| | n | % /Mean | n | % /Mean | n | % /Mean | |
| **Smoking Experience (2001-2011)** | | | | | | | |
| Continuous non-smoker | 9479 | 69.8% | 2032 | 59.6% | 7447 | 73.3% | ** |
| Continuous smoker | 1919 | 14.1% | 678 | 19.9% | 1241 | 12.2% | ** |
| Periodic smoker | 2173 | 16.0% | 698 | 20.5% | 1475 | 14.5% | ** |
| **Employment history (2001-2011)** | | | | | | | |
| Employed at all observations | 7620 | 56.1% | 1172 | 34.4% | 6448 | 63.4% | ** |
| Unemployed at least once | 2633 | 19.4% | 1631 | 47.9% | 1002 | 9.9% | ** |
| Not in the labor force at least once | 4141 | 30.5% | 1051 | 30.8% | 3090 | 30.4% | |
| **Gender** | | | | | | | |
| Male | 6639 | 48.9% | 1791 | 52.6% | 4848 | 47.7% | ** |
| Female | 6932 | 51.1% | 1617 | 47.4% | 5315 | 52.3% | ** |
| **Age** | 13571 | 42.1 | 3408 | 39.6 | 10163 | 43.1 | ** |
| **Partnership Status (2001-2011)** | | | | | | | |
| Cohabitating at least once | 10956 | 80.7% | 2572 | 75.5% | 8384 | 82.5% | ** |
| No cohabitation | 2615 | 19.3% | 836 | 24.5% | 1779 | 17.5% | ** |
| **Race** | | | | | | | |
| White | 7935 | 58.5% | 1718 | 50.4% | 6217 | 61.2% | ** |
| Black | 4034 | 29.7% | 1269 | 37.2% | 2765 | 27.2% | ** |
| Hispanic | 1195 | 8.8% | 335 | 9.8% | 860 | 8.5% | * |
| Other | 392 | 2.9% | 82 | 2.4% | 310 | 3.1% | |
| Missing | 15 | 0.1% | 4 | 0.1% | 11 | 0.1% | |
| **Completed education** | | | | | | | |
| Less than HS | 1240 | 9.1% | 390 | 11.4% | 850 | 8.4% | ** |
| HS graduate | 4661 | 34.3% | 1335 | 39.2% | 3326 | 32.7% | ** |
| Some college | 3617 | 26.7% | 1001 | 29.4% | 2616 | 25.7% | ** |
| College graduate | 3922 | 28.9% | 656 | 19.2% | 3266 | 32.1% | ** |
| Missing | 131 | 1.0% | 26 | 0.8% | 105 | 1.0% | |
| **Total family income (in tens of thousands)** | 13,571 | 9.26 | 3408 | 7.06 | 10163 | 10.03 | ** |
| **Psychological distress** | 7,769 | 3.24 | 2205 | 3.72 | 5564 | 2.67 | ** |

Notes: Asterisks indicate statistically significant mean differences between sample members who did or did not experience involuntary job loss at some point during the observation timeframe. Means of time-varying variables are weighted averages across waves; wave-specific t-tests for these variables confirmed that people who experienced job loss were consistently younger, had lower family incomes and experienced higher levels of emotional distress at all waves, compared to who did not experience job loss during the observation period.
* p<0.05, ** p<0.01

**Table 2. Linear regression models of total family income and psychological distress (2001-2011)**

| | 1. Total family income | | | | 2. Psychological distress | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Model 1a: Job loss | | Model 1b: Employment exp. | | Model 2a: Job loss | | Model 2b: Employment exp. | |
| | b | CI | b | CI | b | CI | b | CI |
| **Employment experience** | | | | | | | | |
| No job loss past 2 yrs (ref) | --- | --- --- | | | --- | --- --- | | |
| x Working (ref) | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- |
| x Unemployed | --- | --- --- | -0.884 ** | (-1.072 , -0.699) | --- | --- --- | 0.809 ** | (0.543 , 1.075) |
| x Out of the labor force | --- | --- --- | -0.352 ** | (-0.417 , -0.287) | --- | --- --- | 0.613 ** | (0.446 , 0.780) |
| Job loss past 2 yrs | 0.129 ** | (0.083 , 0.175) | | | 0.286 ** | (0.126 , 0.446) | | |
| x Working | --- | --- --- | -0.015 | (-0.070 , 0.042) | --- | --- --- | 0.158 | (-0.047 , 0.363) |
| x Unemployed | --- | --- --- | 0.094 * | (0.018 , 0.170) | --- | --- --- | 0.734 ** | (0.469 , 1.000) |
| x Out of the labor force | --- | --- --- | 0.039 | (-0.050 , 0.128) | --- | --- --- | 0.614 ** | (0.153 , 1.074) |
| **Additional Variables** | | | | | | | | |
| Partnership status | | | | | | | | |
| Not cohabitating (ref) | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- |
| Cohabitating | 0.663 ** | (0.605 , 0.722) | 0.639 ** | (0.580 , 0.695) | -0.435 | (-0.486 , -0.285) | -0.432 ** | (-0.582 , -0.282) |
| Age | 0.071 ** | (0.021 , 0.121) | 0.057 * | (0.007 , 0.108) | 0.128 | (-0.019 , 0.275) | 0.159 * | (0.013 , 0.306) |
| Age (Square) | -0.001 ** | (-0.001 , -0.001) | -0.001 ** | (-0.001 , -0.001) | 0.001 * | (0.000 , 0.001) | 0.000 | (-0.000 , 0.001) |
| Respondent indicator | 0.025 | (-0.055 , 0.105) | 0.009 | (-0.070 , 0.088) | -0.666 ** | (-1.052 , -0.280) | -0.634 ** | (-1.019 , -0.249) |
| State unemployment rate | -0.004 | (-0.016 , 0.009) | -0.004 | (-0.016 , 0.009) | -0.944 | (-2.053 , 0.164) | -0.037 | (-0.073 , 0.000) |
| Survey year indicators included? | Yes | | Yes | | Yes | | Yes | |
| Fixed effects included? | Yes | | Yes | | Yes | | Yes | |
| Full or restricted sample? | Full | | Full | | Restricted | | Restricted | |
| Number of participants | 13571 | | 13571 | | 7769 | | 7769 | |
| Number of observations | 65034 | | 65034 | | 31279 | | 31279 | |

Notes: b=beta coefficient; CI=95% confidence interval. * p<0.05, ** p<0.01

**Table 3. Linear probability models of smoking status**

| | Model 1: Job Loss | | Model 2: Employment exp. | | Model 3: with income | | Model 4: with psych. distress | | Model 5: with income & distress | |
|---|---|---|---|---|---|---|---|---|---|---|
| | b | CI | b | CI | b | CI | b | CI | b | CI |
| **Employment experience** | | | | | | | | | | |
| No job loss past 2 yrs (ref) | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- |
| x Working (ref) | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- | --- | --- --- |
| x Unemployed | --- | --- --- | 0.001 | (-0.012 , 0.015) | 0.001 | (-0.012 , 0.015) | -0.012 | (-0.029 , 0.005) | -0.013 | (-0.031 , 0.004) |
| x Out of the labor force | --- | --- --- | -0.019 ** | (-0.027 , -0.010) | -0.019 ** | (-0.027 , -0.010) | -0.021 ** | (-0.033 , -0.008) | -0.021 ** | (-0.033 , -0.009) |
| Job loss past 2 yrs | 0.012 * | (0.003 , 0.02) | | | | | | | | |
| x Working | --- | --- --- | 0.014 * | (0.002 , 0.025) | 0.014 * | (0.002 , 0.025) | 0.019 * | (0.003 , 0.036) | 0.019 * | (0.003 , 0.036) |
| x Unemployed | --- | --- --- | 0.011 | (-0.003 , 0.026) | 0.011 | (-0.003 , 0.026) | 0.005 | (-0.015 , 0.025) | 0.006 | (-0.014 , 0.026) |
| x Out of the labor force | --- | --- --- | -0.015 | (-0.040 , 0.011) | -0.015 | (-0.040 , 0.011) | -0.010 | (-0.047 , 0.027) | -0.010 | (-0.047 , 0.027) |
| **Mechanisms** | | | | | | | | | | |
| Total family income (log) | --- | --- --- | --- | --- --- | 0.000 | (-0.002 , 0.002) | --- | --- --- | -0.001 | (-0.004 , 0.001) |
| Psychological distress | --- | --- --- | --- | --- --- | --- | --- --- | 0.002 ** | (0.001 , 0.003) | 0.002 ** | (0.001 , 0.003) |
| **Additional variables** | | | | | | | | | | |
| Partnership status | | | | | | | | | | |
| Not cohabiting (ref) | --- | --- --- | | | | | | | | |
| Cohabitating | -0.020 ** | (-0.031 , -0.010) | -0.020 ** | (-0.030 , -0.009) | -0.019 ** | -(0.023 , -0.009) | -0.039 ** | (-0.051 , -0.026) | -0.038 ** | (-0.050 , -0.025) |
| Age | 0.011 ** | (0.003 , 0.019) | 0.010 * | (0.002 , 0.018) | 0.010 * | (0.002 , 0.018) | 0.006 | (-0.006 , 0.019) | 0.007 | (-0.006 , 0.019) |
| Age (Square) | 0.000 | (-0.000 , 0.000) | 0.000 | (0.000 , 0.000) | 0.000 | (-0.000 , 0.000) | 0.000 | (-0.000 , 0.000) | 0.000 | (-0.000 , 0.000) |
| Respondent indicator | -0.002 | (-0.015 , 0.011) | -0.002 | (-0.015 , 0.011) | -0.002 | (-0.015 , 0.011) | -0.006 | (-0.040 , 0.028) | -0.006 | (-0.040 , 0.028) |
| State unemployment rate | -0.015 * | (-0.196 , 0.167) | 0.002 * | (0.000 , 0.004) | 0.002 * | (0.000 , 0.004) | 0.002 | (-0.001 , 0.005) | 0.002 | (-0.001 , 0.005) |
| Survey year indicators incl.? | Yes | | Yes | | Yes | | Yes | | Yes | |
| Fixed effects incl.? | Yes | | Yes | | Yes | | Yes | | Yes | |
| Full or restricted sample | Full | | Full | | Full | | Restricted | | Restricted | |
| Number of participants | 13571 | | 13571 | | 13571 | | 7769 | | 7769 | |
| Number of observations | 64518 | | 64518 | | 64518 | | 31223 | | 31223 | |

Notes: b=beta coefficient; CI=95% confidence interval. * p<0.05, ** p<0.01

**Figure 1: Smoking prevalence by recent job loss experience in the analytic sample, 2001-2011**