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Tobacco control policy and smoking among older Americans: An analysis of a nationally-representative longitudinal sample (1992–2014)

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ABSTRACT

Smoking has decreased less rapidly among older adults than among the working age population in the United States. This study examines whether tobacco control policy, specifically smoke-free laws and increased cigarette prices, are associated with smoking cessation and lower smoking intensity among older adults. In addition, it considers whether the effect of smoke-free laws varied by labor force participation. Using geocoded longitudinal data from the Health and Retirement study collected from 1992 to 2014, I estimate survival models to evaluate the association between the implementation of city, county, and state smoke-free laws, changes in average state cigarette pack price, and smoking cessation among smokers. I then interact labor force status with smoke-free laws to assess whether the associations differ for retired versus employed respondents. Second, I estimate within-person fixed effects models to evaluate the association between the implementation of smoke-free laws, changes in average state cigarette pack price, and smoking intensity among smokers. Models were stratified by labor force status to assess whether the associations varied by labor force participation. All analyses were also stratified by age into younger (51–64) and older (65+) respondents. Neither the implementation of smoke-free laws nor increases in cigarette prices were associated with greater smoking cessation or lower smoking intensity. There was no evidence that labor force participation was associated with greater responsiveness to smoke-free laws. The results suggest that two of the most popular tobacco control policy tools in the US, smoke-free laws and cigarette prices, may be less effective among older adults.

1. Introduction

Between 2005 and 2015, smoking decreased by 28% among American adults (Center for Disease Control and Protection, 2016). Active tobacco control, especially increased cigarette prices and comprehensive smoke-free laws, have been lauded as the key drivers of this decline. On average, every 10% increase in the cost of a pack of cigarettes has led to a three to 5% reduction in smoking (USHHS, 2014). Comprehensive smoking bans have been associated with a two to 3% reduction in smoking (Carton et al., 2016). Yet, the encouraging patterns have not manifested in all groups of Americans. Older adults have been left behind. Among women 65 years of age and older, smoking dropped by only 12% over the same time period. More alarmingly, among men 65 and older, we saw a 9% increase in smoking (Center for Disease Control and Protection, 2016). Using a nationally representative geocoded longitudinal sample of older adults, I hypothesize that weaker responsiveness to comprehensive smoke free laws and cigarette taxation may have contributed to the more limited progress in smoking reduction among older Americans.

Older adults have lower smoking rates than adults in other age groups. Only about 8% of people aged 65 and older smoke, compared to approximately 16% of the general adult population (Center for Disease Control and Protection, 2016). Lower smoking rates in later life arise from the combination of cessation that has accumulated over the life course and older smokers' premature mortality. Older smokers make fewer quit attempts on average and also quit at lower rates than younger smokers (Messer et al., 2008; Center for Disease Control and Protection, 2017). Part of the disparity may be related to the previously documented lesser encouragement from medical care providers that older adults receive for cessation (Doolan and Froelicher, 2008) and older smokers' lower likelihood of receiving pharmacological cessation interventions (Steinberg et al., 2006). As a population with an overall low smoking rate, but also a low average number of quit attempts and quit rates, today's older adult smokers may have become resistant to tobacco control efforts. The group may no longer contain people who find it easy to quit or desire to quit (Hughes, 2011), and may meet the definition of “hardened.” However, previous studies have found mixed evidence in support the hardened smoker hypothesis (Warner and Burns, 2003). While some have argued that smokers become less sensitive to cigarette taxation as they age (Center for Disease Control and

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Protection, 1998; Lewit and Coate, 1982), work by Tauras (Tauras, 2006), DeCicca and McLeod (DeCicca and McLeod, 2008), and MacLean and colleagues (MacLean et al., 2016) has shown small, but appreciable, effects of cigarette prices on current smoking prevalence among older adults.

There are two paths through which tobacco control lowers smoking prevalence in the working age and younger population: by discouraging initiation and encouraging cessation. Among older adults, among whom new smoking initiation is extremely uncommon (Johnston et al., 2016), the only path toward lower smoking is through encouraging cessation. But studies focusing on cessation outcomes of older adults in relation to tobacco control policy have been rare, and their conclusions contradictory. The results from the 1997 to 2013 Cancer Prevention Study cohort found that a one dollar increase in the price of a pack of cigarettes was associated with a 9% increase in the odds of cessation among smokers 65 years of age and older (Stevens et al., 2017). In contrast, a small local area study conducted in Colorado found older adults to be less likely to quit following smoke-free laws implementation than the general population (Prochaska et al., 2009), potentially due to their lower labor force participation. Nonetheless, older adults are more likely than any other age group to believe that smoking should not be allowed in indoor workplaces, restaurants, bars, or clubs and casinos (King et al., 2013)..

The US Census projects that, by 2030, one in five Americans will be 65 years of age or older (Colby and Ortman, 2015). The anticipated increase in the mean age of a US resident will translate to an increased share of older adults among smokers. If older smokers are less likely to be influenced by the previously successful tobacco control strategies, their greater share in the smoking population will result in an overall decrease in the effectiveness of tobacco control. It is therefore imperative that we develop an understanding how the effectiveness of tobacco control policies varies over the life course. This study aims to contribute to this literature. I use a large longitudinal nationally-representative dataset of older adults, the Health and Retirement Study (HRS), and complement it with unique place-specific smoke-free data and state-specific tobacco prices collected over a 22-year period to address two research questions. First, have smoke-free laws and increased cigarette prices been associated with smoking cessation in older adults? For smoke-free laws, I consider how the association varies by labor force participation. Second, have smoke-free laws and increased cigarette prices been associated with changes in smoking intensity among older adult smokers? I again consider variation by labor force participation for smoke-free laws. Because smokers have a large risk of premature mortality and smokers who survive into advance years likely differ from both the general population and other smokers (Wain et al., 2015), the analysis is stratified into middle aged (51–64) and older age (65 +).

2. Data and methods

2.1. Data

The HRS is a longitudinal biennial survey that was first administered in 1992 to a nationally representative sample of older adults born between 1931 and 1941. In its first wave, the HRS interviewed 12,652 people. The HRS merged with a separate longitudinal study of adults born before 1923, Asset and Health Dynamics among the Oldest Old, and sampled two additional cohorts, the first born between 1924 and 1930, and the second between 1942 and 1947. After these sample expansions, the HRS became nationally representative of Americans 51 years of age and older. The sample is periodically replenished to maintain a steady state representative sample. I merged publicly available data with restricted access geographic markers indicating respondents' zip code, county, and state of residence to identify which laws and taxes respondents were exposed to. Approval for the study was obtained from the Institutional Review Board at the University of Michigan (HUM00109983).

2.1.1. Analytic sample

The analytic sample included all respondents 51 years of age and older who were smokers during their first interview, who participated in at least two waves of data collection, ($N = 4452$), and provided valid responses to all questions that were used to construct any variables used in the analysis ($N = 4011$). Once smokers quit, they were no longer part of the analytic sample, even if they later relapsed.

2.2. Measures

2.2.1. Smoking cessation

If a respondent identified as a current smoker when they entered the survey but said they do not smoke “now” in the next wave, they were coded as a quitter (34%).

2.2.2. Smoking intensity

All smokers were asked about the number of individual cigarettes or packs of cigarettes they “usually smoke in a day.” Responses, given in packs, were converted to numbers of cigarettes.

2.2.3. Smoke-free laws

Data from the Americans for Non-smokers' Rights Foundation (ANRF) were used to identify smoke-free laws in a respondent's locality in each study year. This study focuses on three types of comprehensive smoke-free laws: the non-hospitality workplace (defined as all workplaces excluding restaurants and bars), restaurant, and bar laws. I constructed a categorical variable that designated whether a respondent lived in an area with: none of these smoke-free laws, smoke-free laws in one or two of the three domains, or laws that prohibit smoking in all workplaces, restaurants, and bars.

2.2.4. Cigarette prices

The price of a pack of cigarettes was measured at the state level. I used the Tax Burden of Tobacco data, compiled by Orzechowski and Walker (Orzechowski and Walker, 2018), and assigned each respondent the average price for a pack of cigarettes that applied to the year and state in which they lived at the time of their interview. The price of cigarettes was adjusted to the 2000 consumer price index.

2.2.5. Labor force status

Respondents were asked several questions in each interview to ascertain whether they were working full-time, working part-time, unemployed, partly retired, retired, disabled, or not in the labor force for other reasons. Those who were working full-time, working part-time, unemployed or only partly retired were classified as labor force active.

2.2.6. Other variables

I constructed several additional variables to control for changes in other relevant respondent characteristics that may influence smoking cessation and smoking intensity. These included: age, marital status, health status, household income, gender, race, and education. Age was calculated based on the respondent's birth date and the date of the interview. Because prior research has shown that smokers who are partnered with another smoker are less likely to quit (Margolis and Wright, 2016), respondents were classified as married or cohabiting with a non-smoker, married or cohabiting with a smoker, and widowed, divorced, or separated. Health status was measured by a commonly used question that asked: “Would you say your health is excellent, very good, good, fair, or poor?” Respondents were divided into two groups: 1) excellent, very good, or good health, and 2) fair or poor health. The total household income was calculated by combining reported earnings, social security, pensions, and financial assistance from other family members. Gender (man or woman) and race (white or nonwhite) were self-identified, and coded as time-invariant along with education, which

was based on a combination of responses to questions about the number of years a respondent spent in schooling and their highest reported educational attainment (less than high school, high school graduate, college graduate or more).

2.3. Analytic strategy

The first part of the study, examining smoking cessation as an outcome, relies on discrete time event history analysis (also known as survival analysis), a regression technique that captures the relationship between time-invariant and time-variant characteristics of person-year observations and the hazard of cessation. (Similar models have been used more commonly to study smoking initiation with younger cohorts (DeCicca et al., 2002; Vuolo et al., 2015)). I specify time as linear. The discrete-time hazard rate is defined as:

$$P(t) = \Pr[T = t \mid T \geq t, x(t)]$$

where T is a discrete random variable indicating the time of event occurrence. The hazard rate $P(t)$ is the conditional probability that event (cessation) took place at time t, given that it has not already occurred. I specify the hazard rate with the logistic regression function. The model written in logit form is as follows:

$$\log\left(\frac{P(t)}{1 - P(t)}\right) = a(t) + \beta_1 X_1 + \beta_2 X_2(t)$$

where $a(t)$ is a linear function, β_1 is a vector of estimated coefficients for time-invariant variables X_1, β_2 is a vector of estimated coefficients for time-varying variables X_2. To evaluate how the associations between smoke-free laws and smoking cessation vary by labor force status, I interact the two indicators. Because model specification checks showed that the relationship between cessation and price varied over time, the price variable was entered into the model as time-dependent.

In the second part of the study, where I examined the relationship between smoking intensity and tobacco control policies, I estimated ordinary least squares regression models with fixed effects. (Similar models have been used by other studies examining smoking intensity in younger cohorts (Tauras and Chaloupka, 1999)) These models rely on within-person variation to estimate the effect of a change in observed independent variables on the change in an observed dependent variable. The model is as follows:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it}$$

where Y_{it} is the number of cigarettes smoked daily at time t for person i, β_1 is a vector of estimated coefficients for independent variables, X_{it} is a vector of independent variables measured at a time t for person i, α_i represents person-specific intercepts, u_{it} is the time and person-specific error term. All analyses were weighted using population weights provided by the HRS, stratified into 51 to 64 and 65+ age groups, and conducted using Stata MP 15 (Stata Statistical Software, 2017) in the HRS secure virtual enclave.

3. Results

Table 1 shows the descriptive characteristics of the analytic sample at baseline. Over the course of the study, 34% of the sample quit. The mean number of cigarettes smoked daily by current smokers was 17.5.

Table 2 shows results from two survival models predicting the hazard of smoking cessation by changes in smoke-free laws, cigarette prices, and sociodemographic characteristics. The models are stratified by age. In both age groups, I find no statistically significant association between the hazard of smoking cessation and smoke-free laws or cessation and the price of a pack of cigarettes.

Table 3 shows results from the survival models predicting cessation with an interaction for labor force status. In both age groups, we find no evidence that labor force participation modifies the associations

Table 1
Population-weighted descriptive characteristics of the Health and Retirement Study analytic sample (1992–2014).

	Mean/%	CI
Time variant (across all interviews)		
Quit (over the course of study)	34%	–
Number of cigarettes daily	17.48	[17.02–17.95]
Age	57.36	[57.11–57.60]
Partnership		
Married or cohabiting with a non-smoker	34%	–
Married or cohabiting with a smoker	26%	–
Widowed/divorced/separated	41%	–
Poor/fair health	31%	–
HH income	$50,241	[$46,273 - 54,208]
Labor force active	69%	–
Time invariant (at baseline interview)		
Male	51%	–
White	80%	–
Education		
Less than HS	25%	–
HS grad	63%	–
College grad	12%	–
Tobacco control exposure (from 1992 to 2014)		
Smoke-free Laws coverage exposure		
No comprehensive 100% smoke-free Laws	79%	–
Some comprehensive 100% smoke-free Laws	10%	–
All 100% smoke-free Workplaces, restaurants, bars	11%	–
Average state retail price (CPI-2000 adjusted)	3.40	[3.30–3.50]
N	4011	

Table 2
Hazard of smoking cessation by changes in smoke-free laws, cigarette prices, and sociodemographic characteristics: results from the population-weighted discrete survival model stratified by age.

	Smoking cessation	
	51–64	65+
Smoke-free law coverage (reference no laws)		
One or two 100% smoke-free Laws	1.12	1.07
	[0.87, 1.37]	[0.83, 1.31]
Workplace, restaurant, Bar 100% smoke-free Laws	0.86	0.96
	[0.62, 1.1]	[0.71, 1.21]
Price of cigarette pack	1.00	1.00
	[1.00, 1.00]	[1.00, 1.00]
Age	1.34	0.78
	[0.46, 2.22]	[0.56, 1.00]
Age-squared	1.00	1.00
	[1.00, 1.00]	[1.00, 1.00]
Male	0.99	1.04
	[0.85, 1.13]	[0.86, 1.22]
Partnership status (reference partner non-smoker)		
Partner smoker	0.49	0.54
	[0.39, 0.59]	[0.38, 0.70]
Widowed/divorced/separated	0.68	0.83
	[0.56, 0.8]	[0.67, 0.99]
Non-white	1.20	1.20
	[1.00, 1.40]	[0.95, 1.45]
Education (reference less than high school)		
High school graduate	1.30	1.24
	[1.08, 1.52]	[1, 1.48]
College graduate	1.51	1.19
	[1.16, 1.86]	[0.8, 1.58]
Poor/fair health	1.31	1.41
	[1.11, 1.51]	[1.17, 1.65]
LN HH income	1.04	0.97
	[0.98, 1.10]	[0.91, 1.03]
Labor force active	0.90	1.04
	[0.78, 1.02]	[0.8, 1.28]
N	3773	1701

In addition to variables listed, models control for year.
Model coefficients transformed to hazard ratios.

Table 3
Hazard of smoking cessation by changes in smoke-free laws, cigarette prices, with an interaction for labor force status, and sociodemographic characteristics: results from the population-weighted discrete survival model stratified by age.

	Smoking cessation	
	51–64	65+
Smoke-free law coverage (reference no laws)		
One or two 100% smoke-free Laws	1.00	1.00
	[0.65, 1.35]	[0.76, 1.24]
Workplace, restaurant, Bar 100% smoke-free Laws	0.56	0.95
	[0.31, 0.81]	[0.66, 1.24]
Labor force active	0.84	0.95
	[0.70, 0.98]	[0.70, 1.20]
Labor force active*one or two 100% smoke-free Laws	1.17	1.40
	[0.68, 1.66]	[0.75, 2.05]
Labor force active*workplace, restaurant, Bar 100% smoke-free Laws	1.45	1.13
	[0.76, 2.14]	[0.44, 1.82]
Price of cigarette pack	1.08	1.17
	[0.98, 1.18]	[0.46, 1.88]
N	3773	1701

In addition to variables listed, models control for age, age-squared, gender, partnership status, race, education, self-rated health, natural log of household income, and year.
Model coefficients transformed to hazard ratios.

between smoke-free laws and cessation.

Table 4 shows results of ordinary least squares fixed effects regression models predicting changes in smoking intensity by changes in smoke-free laws and cigarette prices. In both age groups, I find no evidence of associations between changes in the two policies and smoking intensity.

Table 5 shows the same ordinary least squares regression models, but stratifies respondents by their current labor force status in addition to age. I find no evidence that changes in smoke-free coverage or in price of cigarette pack are associated with changes in smoking intensity among labor force active or inactive older adults.

Table 4
Change in number of cigarettes smoked daily by changes in smoke-free laws, cigarette prices and sociodemographic characteristics: results from the population-weighted ordinary least squares regression model stratified by age.

	Smoking intensity	
	51–64	65+
Smoke-free law coverage (reference no laws)		
One or two 100% smoke-free laws	1.06	−0.14
	[−1.14, 3.26]	[−1.88, 1.60]
Workplace, restaurant, bar 100% smoke-free laws	−1.25	−0.10
	[−2.58, 0.08]	[−1.53, 1.33]
Price of cigarette pack	−0.47	0.18
	[−1.12, 0.18]	[−0.58, 0.94]
Age	−0.98	−1.25
	[−2.9, 0.94]	[−3.62, 1.12]
Age-squared	0.01	0.01
	[−0.01, 0.03]	[−0.01, 0.03]
Partnership status (reference partner non-smoker)		
Partner smoker	1.66	2.71
	[0.07, 3.25]	[0.89, 4.53]
Widowed/divorced/separated	0.53	2.24
	[−2.16, 3.22]	[0.5, 3.98]
Poor/fair health	−0.33	−1.46
	[−1.19, 0.53]	[−2.38, −0.54]
LN HH income	−0.11	−0.16
	[−0.29, 0.07]	[−0.49, 0.17]
Labor force inactive	−0.25	0.61
	[−1.07, 0.57]	[−0.82, 2.04]
N	3830	1713

In addition to variables listed, models control for year. Robust standard errors.

3.1. Sensitivity analysis

Smoke-free laws may appear in many combinations. For example, some areas ban smoking in restaurants but not in bars, others implement a smoke-free workplace law but exempt restaurants and bars. I constructed a more granular categorical variable that designated whether a respondent lived in an area with: none of these smoke-free laws, non-hospitality workplace smoking bans only, restaurant smoking bans only, restaurant and bar bans, non-hospitality workplace and restaurant smoking bans, smoking bans in both restaurants and bars, or laws that prohibit smoking in all three domains. Upon inspection, I found insufficient sample size to estimate associations at this more granular level.

The effect of smoke-free laws on smoking in the population may be tempered by pre-existing private restrictions. I used data collected by the Current Population Survey Tobacco Use Supplement to measure the percentage of the population in each state that reported that smoking is prohibited by their private employer at the workplace. Private workplace coverage data were not available for the years when the CPS-TUS was not administered: 1994, 1997, 2000, 2004, 2005, 2008, and 2012. I used a linear interpolation to impute the likely level of private coverage in a state for the years during which data were absent. I re-estimated all models with a control for the percentage of CPS-TUS respondents who reported being covered by employer non-smoking rules. The results were substantively unchanged. The variable was excluded from final models because of the collinearity between self-reported employer restrictions and state and local smoke-free laws.

4. Discussion

Smoking cessation at the age of 50 leads to a six-year increase in life expectancy. At age 60, the increase is three years (Doll et al., 2004). In addition to the enhanced life expectancy, older adults who quit smoking lower their odds of adverse cardiovascular events, stroke, and smoking-related pulmonary conditions (Gellert et al., 2013; Higgins et al., 1993). Unfortunately, over the last ten years, declines in smoking have stalled among older Americans. Among older men, the share of smokers has even increased (Center for Disease Control and Protection, 2016).

A potential explanation for the lesser smoking reduction in this population could be the lower effectiveness of the core tobacco control strategies among older adults. This study investigated whether smoke-free laws and tobacco taxes are associated with quitting or decreasing

Table 5
Change in number of cigarettes smoked daily by changes in smoke-free laws, cigarette prices, with an interaction for labor force status, and sociodemographic characteristics: results from the population-weighted ordinary least squares regression model stratified by age.

	Smoking intensity			
	51–64		65+	
	In the labor force	Not in the labor force	In the labor force	Not in the labor force
Smoke-free law coverage (reference no laws)				
One or two 100% smoke-free Laws	0.82	2.67	3.21	−0.49
	[−0.79, 2.43]	[−3.27, 8.61]	[−0.47, 6.89]	[−2.59, 1.61]
Workplace, restaurant, Bar 100% smoke-free Laws	−0.70	−1.18	0.93	−0.33
	[−2.39, 0.99]	[−4.32, 1.96]	[−3.54, 5.4]	[−2.00, 1.34]
Price of cigarette pack	−0.71	−0.80	−0.01	−0.04
	[−1.65, 0.23]	[−1.96, 0.36]	[−1.46, 1.44]	[−0.06, −0.02]
N	3065	1814	512	1464

In addition to variables listed, models control age, age-squared, partnership status, self-rated health, natural log of household income, and year. Robust standard errors.

the intensity of cigarette smoking by older adults. The results suggest that neither smoke-free laws nor greater cigarette prices were associated with a higher probability of cessation or lower smoking intensity.

There are several reasons why older adults may be less sensitive to traditional tobacco control strategies. In their early days, the implementation of smoke-free laws centered on workplaces. Unless they were in the labor force, as only 69% of this sample was at baseline, or frequently visiting the workplaces of others, older adults were not directly affected. However, the results of models that analyzed how the effect of laws varied by labor force status did not support the hypothesis that lesser workplace exposure explains the lesser effectiveness of smoke-free laws among older adults. Older Americans may also be influenced less by the laws that regulate smoking in restaurants and bars because they spend less time in hospitality settings (The Food Institute, 2015). Those older adults who do frequent restaurants and bars, will nevertheless still benefit from the decreased exposure to second-hand smoke which has been associated with a decrease in the risk of a heart attack (Institute of Medicine, 2010).

Older smokers also appear to be less affected by increases in prices than what has been typically measured in younger groups (Chaloupka et al., 2012). Their lower price sensitivity could suggest that some older adults may view smoking as an integral part of their lives, for which they are more willing to make the required financial sacrifice than younger people. Considering that many older adults live on a fixed income, such a financial sacrifice may not be negligible. It is possible that some who have continued smoking into their older adulthood could be classified as “hardened”, though there is an ongoing scientific debate on whether “hardening” is occurring in any population (Smith et al., 2014). This study cannot directly speak to the question of “hardening” because it did not include measures of addiction.

Older adult smokers who were partnered with a smoker or who were divorced, widowed, or separated had lower odds of quitting than those partnered with a non-smoker. More educated smokers had a higher probability of cessation, as did smokers in poor or fair health. Future research may wish to consider how the effect of tobacco control among older adults varies by these and other individual-level characteristics, such as the presence and role of any mental health conditions, genetic propensity to nicotine addiction, and any chronic conditions smokers are navigating.

5. Limitations

The results need to be considered in the context of several analytic limitations. Most importantly, the study would benefit from a larger sample size of older adult smokers. Because the within-person estimator retains only observations from smokers who changed their smoking status over the course of the study, and because cessation is a rare occurrence among older adult smokers, the estimated coefficients may be imprecise.

Smokers are usually not successful when they attempt to quit smoking. In 2015, 55% made a quit attempt but only 7% successfully quit (Center for Disease Control and Protection, 2017). This study cannot differentiate between an attempt to quit and a successful cessation. However, in sensitivity analyses that only considered smokers as having quit when they had two consecutive reports of not being smokers (i.e., four years without smoking), the estimated coefficients were not substantively changed.

The HRS dataset does not include information on whether smokers were subject to smoking restrictions in their home. Prior research has shown that in-home restrictions are associated with improved odds of cessation and strengthened tobacco control could contribute to such restrictions in private spaces (Farkas et al., 1999).

The study would have been strengthened if it used local level price data to complement local level smoke-free law data. Localities can levy their own tobacco taxes, and thus, the average tobacco price may vary widely within a state (Chaloupka et al., 2015). Tobacco companies and retailers can adjust the cigarette price or product mix based on local cigarette market conditions; that too can lead to in state variation. The average cost of a cigarette pack in a state may not always correspond to the typical cost paid by a given respondent. While some local price data and are available, none of them meet the period and spatial coverage criteria of this study. Similarly, smoke-free laws may not be enforced with equal vigor in all local areas and some respondents may have been able to avoid them. But prior research shows that smoke-free laws' have generally been well enforced in the United States and smoke-free laws non-enforcement does not pose a large threat to the study (Weber et al., 2003; Farrelly et al., 2005).

The study did not consider the consequences of other policy changes that may have improved some but not all respondents' odds of cessation. One example of such policy change is Medicaid expansion, which led to greater access to cessation treatment for low-income adults in some states. However, in states where implemented, Medicaid expansions took place at the very end of the observational period, the earliest in 2014. Moreover, evidence of whether Medicaid expansion improved smokers' chances of cessation is mixed (Donahoe et al., 2019; Bailey et al., 2019).

Finally, the results, especially for the older group of smokers, are subject to survivor bias. Only living smokers can change their behavior in relation to new laws and taxes. Because smokers have approximately ten years shorter life expectancy than non-smokers (Jha et al., 2013), those who smoke into their old age are likely to be distinct in multiple ways from those who died prematurely due to smoking.

6. Conclusions

Smoking cessation by older smokers leads to substantial health gains and an overall improvement in health. Examining whether, and to what extent, core population-level tobacco control strategies effectively aid in achieving this goal is essential in projecting future smoking levels and achieving smoke-free world. This study suggests that smoke-free laws and increased tobacco prices may be less effective among older adults than they have been among younger smokers. As the mean age of the remaining American smoker grows, we may anticipate that increases in cigarette prices and smoke-free law coverage could translate to fewer successful cessation attempts and less steeply decreasing the smoking intensity than in the past. The results highlight the need for a life course approach to tobacco control (Lillard and Christopoulou, 2015). Further studies in this vein should pay attention to the age-specific factors that lead to successful cessation attempts in this population, which may be experiencing larger than usual contextual, social, and physiological barriers to cessation.

Author contribution

I, Lucie Kalousova, am the sole author of the manuscript. I have conceptualized and designed the study, conducted data analyses, written and prepared the manuscript for publication alone.

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