# Population Support Before and After the Implementation of Smoke-Free Laws in the United States: Trends From 1992-2007

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# Population Support Before and After the Implementation of Smoke-Free Laws in the United States: Trends From 1992–2007

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## Abstract

**Introduction:** Several states implemented comprehensive smoke-free laws in workplaces (14 states), restaurants (17 states), and bars (13 states) between 2002 and 2007. We tested the hypothesis that public support for smoke-free laws increases at a higher rate in states that implemented smoke-free laws between 2002 and 2007 (group A) than in states that implemented smoke-free laws after that time or not at all (group B). The period before the implementation (1992–2001) was also considered.

**Methods:** Data was used from the Current Population Survey (CPS) Tobacco Use Supplements (TUS), which is representative for the U.S. adult population. Respondents were asked whether they thought smoking should not be allowed in indoor work areas, restaurants, and bars and cocktail lounges. Differences in trends were analyzed with binomial mixed effects models.

**Results:** Population support for smoke-free restaurants and bars was higher among group A than among group B before 2002. After 2002, support for smoke-free restaurants and bars increased at a higher rate among group A than among group B. Population support for smoke-free workplaces did not differ between group A and B, and the increase in support for smoke-free workplaces also did not differ between these groups.

**Conclusions:** The positive association between the implementation of smoke-free restaurant and bar laws and the rate of increase in support for these laws partly supported the hypothesis. The implementation of the laws may have caused support to increase, but also states that have higher support may have been more likely to implement smoke-free laws.

## Introduction

Smoke-free workplace laws are implemented to protect the population from the harms of second-hand smoke.[1] Currently, almost half of the U.S. population is protected from exposure to second-hand smoke by comprehensive smoke-free laws in workplaces, restaurants, and bars.[2] *Comprehensive* smoke-free laws are defined as laws not allowing smoking inside at all (including in attached bars or separately ventilated rooms) and do not have size, age, or hours exemptions.[2]

Support for smoke-free laws among the population is an important factor in adopting smoke-free laws and in compliance with the laws once they are in place.[3,4] Also, support for smoke-free laws may

facilitate the adoption of other tobacco control policies, as support for smoke-free laws is thought to be indicative of more general social norms towards smoking.[3,5,6] Monitoring population support for smoke-free laws is important to inform policy development, media advocacy and enforcement activities.[3]

Another important reason for monitoring population support for smoke-free laws is the tobacco industry's claims that smoke-free laws are not supported by the public, that getting the public to comply with the laws will be difficult, and that there will be negative economic consequences of smoke-free laws for the hospitality industry.[7] If that is true, then population support will be likely to decrease after the implementation of the laws.

Review studies have demonstrated that developed countries show a general trend of increasing population support for smoke-free laws.[3,8] Possible reasons for this increasing trend are a decreasing prevalence of smoking and a decreasing social acceptability of smoking.[5,9] Certain events can potentially trigger sudden increases in support for smoke-free laws. For example, a review of Australian studies showed that population support for smoke-free laws increased significantly after extensive media attention about a court case on disease due to second-hand smoke.[8] The adoption and implementation of smoke-free laws can also be a potential cause for the support for smoke-free laws to increase at a higher rate. Possible reasons are that smoke-free laws are known to decrease the social acceptability of smoking[10,11] and that they are often accompanied by media attention about second-hand smoke.[12] It is also possible that the public may realize that smoke-free laws are feasible and desirable once they are in place.

A review on the impact of smoke-free laws concluded that support increases after the implementation of smoke-free laws,[13] but did not report whether this increase around the implementation of smoke-free laws is greater than when laws are not implemented. Another review suggests that, in places where smoke-free laws are accompanied by public education campaigns, there is a higher increase in population support than in places without campaigns.[3] Findings from a more recent European study suggest that a larger increase in support for smoke-free laws among smokers can be expected in the case of the implementation of comprehensive smoke-free laws, but not in the case of the implementation of partial smoke-free laws.[14] In sum, there are indications that support for smoke-free laws may increase when smoke-free laws are adopted and implemented, but it is unclear whether this increase is greater than in other places.

In the current study, data was used from the Current Population Survey (CPS) Tobacco Use Supplements (TUS) from 1992 to 2007 to examine trends in population support for smoke-free laws in the United States. This data is representative of the adult population in the United States and can also be used to provide representative state specific estimates. The data has been used before to examine state differences in trends in population support for smoke-free laws for the period 1992 to 1999.[6] In that period, only the state of California implemented a smoke-free law in all workplaces, including restaurants and bars. As expected, the study showed that population support for smoke-free laws increased at a higher rate in California compared to the other states.[6] That increase was even larger among smokers.

Other U.S. states have followed California's example by also implementing smoke-free laws in workplaces, restaurants, and bars. Most of these state laws were implemented since 2002 (see Table 1). The current study, therefore, focuses on trends in support among states that implemented comprehensive smoke-free laws between

**Table 1.** Implementation Dates and Groupings of Comprehensive Smoke-Free Laws in Workplaces, Restaurants, and Bars by State[a]

| | Smoke-free workplace law | | Smoke-free restaurant law | | Smoke-free bar law | |
|---|---|---|---|---|---|---|
| | Date | Group | Date | Group | Date | Group |
| Alabama | - | B | - | B | - | B |
| Alaska | - | B | - | B | - | B |
| Arizona | 5/2007 | B | 5/2007 | B | 5/2007 | B |
| Arkansas | - | B | - | B | - | B |
| Colorado | - | B | 7/2006 | A | 7/2006 | A |
| Connecticut | - | B | 10/2003 | A | 4/2004 | A |
| Delaware | 11/2002 | A | 11/2002 | A | 11/2002 | A |
| District of Columbia | - | B | - | B | - | B |
| Florida | 7/2003 | A | 7/2003 | A | 7/2003 | A |
| Georgia | - | B | - | B | - | B |
| Hawaii | 11/2006 | A | 11/2006 | A | 11/2006 | A |
| Idaho | - | B | 7/2004 | A | - | B |
| Illinois | 1/2008 | B | 1/2008 | B | 1/2008 | B |
| Indiana | 7/2012 | B | 7/2012 | B | - | B |
| Iowa | 7/2008 | B | 7/2008 | B | 7/2008 | B |
| Kansas | 7/2010 | B | 7/2010 | B | 7/2010 | B |
| Kentucky | - | B | - | B | - | B |
| Louisiana | 1/2007 | A | 1/2007 | A | - | B |
| Maine | 9/2009 | B | 1/2004 | A | 1/2004 | A |
| Maryland | 2/2008 | B | 2/2008 | B | 2/2008 | B |
| Massachusetts | 7/2004 | A | 7/2004 | A | 7/2004 | A |
| Michigan | 5/2010 | B | 5/2010 | B | 5/2010 | B |
| Minnesota | 10/2007 | B | 10/2007 | B | 10/2007 | B |
| Mississippi | - | B | - | B | - | B |
| Missouri | - | B | - | B | - | B |
| Montana | 10/2005 | A | 10/2005 | A | 10/2009 | B |
| Nebraska | 6/2009 | B | 6/2009 | B | 6/2009 | B |
| Nevada | 12/2006 | A | 12/2006 | A | - | B |
| New Hampshire | - | B | 9/2007 | B | 9/2007 | B |
| New Jersey | 4/2006 | A | 4/2006 | A | 4/2006 | A |
| New Mexico | - | B | 6/2007 | B | 6/2007 | B |
| New York | 7/2003 | A | 7/2003 | A | 7/2003 | A |
| North Carolina | - | B | 1/2010 | B | 1/2010 | B |
| North Dakota | 8/2005 | A | 12/2012 | B | 12/2012 | B |
| Ohio | 12/2006 | A | 12/2006 | A | 12/2006 | A |
| Oklahoma | - | B | - | B | - | B |
| Oregon | 1/2009 | B | 1/2009 | B | 1/2009 | B |
| Pennsylvania | 9/2008 | B | - | B | - | B |
| Rhode Island | 3/2005 | A | 3/2005 | A | 3/2005 | A |
| South Carolina | - | B | - | B | - | B |
| South Dakota | 7/2002 | A | 11/2010 | B | 11/2010 | B |
| Tennessee | - | B | - | B | - | B |
| Texas | - | B | - | B | - | B |
| Vermont | 7/2009 | B | 9/2005 | A | 9/2005 | A |
| Virginia | - | B | - | B | - | B |
| Washington | 12/2005 | A | 12/2005 | A | 12/2005 | A |
| West Virginia | - | B | - | B | - | B |
| Wisconsin | 7/2010 | B | 7/2010 | B | 7/2010 | B |
| Wyoming | - | B | - | B | - | B |

A = states that implemented comprehensive smoke-free laws in the period between 2002 and January 2007, inclusive. B = states that did not have comprehensive smoke-free laws until after January 2007.

[a]California and Utah are excluded from the analyses in this paper because these states implemented comprehensive laws before 2002.

2002 and 2007 and states that did not have comprehensive smoke-free laws until 2007. As a consequence, the two states that implemented comprehensive smoke-free laws before 2002, California and Utah, were excluded from the analyses in this paper. The hypothesis was tested that, after 2002, support increases at a higher rate in states that implemented smoke-free laws than in states that did not. Also tested was whether this same difference is present in the period before 2002 in order to determine whether the secular trends were already different in the two state groups.

## Methods

### Sample

The TUS-CPS is a large national household survey among U.S. citizens aged 15 years and older and is administered by the Census Bureau for the National Cancer Institute. The CPS includes a multistage probability sample from over 50,000 households per month. The TUS is conducted periodically as part of the CPS with eight panel rotations in three waves, each covering all 50 U.S. states and Washington DC.

In the current study, data was used from the five survey waves of the TUS-CPS study that were available and that included questions about smoke-free laws in workplaces, restaurants, and bars. Data were collected between September 1992 and May 1993, September 1995 and May 1996, September 1998 and May 1999, June 2001 and February 2002, and between May 2006 and January 2007. Additional details about the methodology of the TUS-CPS can be found in technical reports on the TUS-CPS website of the National Cancer Institute. For the analyses in this paper, proxies (those who answered on behalf of others) were excluded and respondents aged 15 to 17. Data were aggregated to the state level.

### Outcome Measures

The three outcome measures for this study were support for smoke-free laws in indoor work areas, in restaurants, and in bars and cocktail lounges. For each of these venues, respondents were asked whether they thought that smoking should be allowed in all areas, allowed in some areas, or not allowed at all. Variables were dichotomized as 1 = "should not be allowed at all" and 0 = "should be allowed in all areas" or "should be allowed in some areas."

### State Groupings

States were grouped based on whether they implemented comprehensive smoke-free laws in the period between the last two TUS-CPS survey waves, as this is the period in which most statewide smoke-free laws were implemented. Data from Americans for Nonsmokers' Rights[2] were used for this grouping. Group A consisted of states that implemented comprehensive smoke-free laws in the period between 2002 and January 2007, inclusive, in workplaces (14 states), restaurants (17 states), and bars (13 states). Group B consisted of states that did not have comprehensive smoke-free laws until after January 2007 in workplaces (35 states), restaurants (32 states), and bars (36 states). States that implemented smoke-free laws for the three venues in different years could be in different groups for different venues. All boundary cases (states which adopted smoke-free laws within one or two months of the time boundaries separating groups A and B) were included in the analyses. Table 1 provides details of the implementation dates of all states and groupings per venue.

### Analyses

The primary analysis used binomial mixed effects models. State proportions of the population supporting smoke-free environments were modeled as a function of state group (A or B), time, and group-by-time interaction, with random (state-specific) intercepts and rates of support estimated. Separate models were fitted for each of the three outcomes (workplaces, restaurants, and bars), and for time periods between 1992–2001 and 2001–2007. When modeling the 1992–2001 time period, centered time was used (to reduce dependence between slopes (rates) and intercepts). When modeling the 2001 to 2007 time period, the two time points were coded as 0 for 2001–2002 and 1 for 2006–2007. To adjust for multiple comparisons (six models), estimates were considered to be significant when the $p$ value was below .008 (0.05/6).[15] All statistical analyses were performed in R version 2.15.1.

Additional sensitivity analyses were performed. Separate analyses examined younger (18–34 years), middle aged (35–44 years), and older respondents (45 years and older); males and females; respondents with lower socio-economic status (less than 13 years education) and higher socio-economic status (13 years or more education); non-Hispanic White respondents and Hispanic non-White respondents; smokers and non-smokers. For the analyses of respondents with lower and higher socio-economic status, only respondents aged 25 years or older were included as they will have had sufficient time to accomplish higher education. Because the results from the sensitivity analyses were very similar to the results for all respondents, only the results for all respondents were reported in detail.

## Results

### Sample Characteristics

The mean age of respondents ranged from 44.0 ($SD$ = 4.9) to 45.7 ($SD$ = 5.3) for the five survey waves. There were somewhat more females than males in the surveys (ranging from 51.8% to 52.3% females). About half of the sample of 25 years and older followed less than 13 years of education (ranging from 43.7% to 53.5%). Most respondents were non-Hispanic White (ranging from 69.4% to 76.4%). Smoking prevalence decreased from 24.5% in the 1992/1993 survey to 18.5% in the 2006/2007 survey.

### Support for Total Smoke-Free Indoor Work Areas

As shown in Figure 1A, trends in support for total smoke-free indoor work areas did not differ much between states that implemented comprehensive smoke-free workplace laws in the period between 2002 and January 2007, inclusive, (group A) and states that did not have comprehensive smoke-free workplace laws until after January 2007 (group B). Even after 2002, the increases and levels of support were similar in both state groups. Support began at almost 60% in 1992–1993 and the level of support increased to almost 80% in 2006–2007.

Table 2 reports the results of the mixed effects models. It shows that in both time periods the state groups did not differ significantly from each other in terms of support for total smoke-free indoor work areas and that in both time periods there was a significant increase in support across time. The group by time interaction was not significant in both periods, indicating that trends in support did not differ by state group. Similar results in terms of significance patterns were seen in all additional analyses (stratified by age, sex, socio-economic status, smoking and ethnicity).

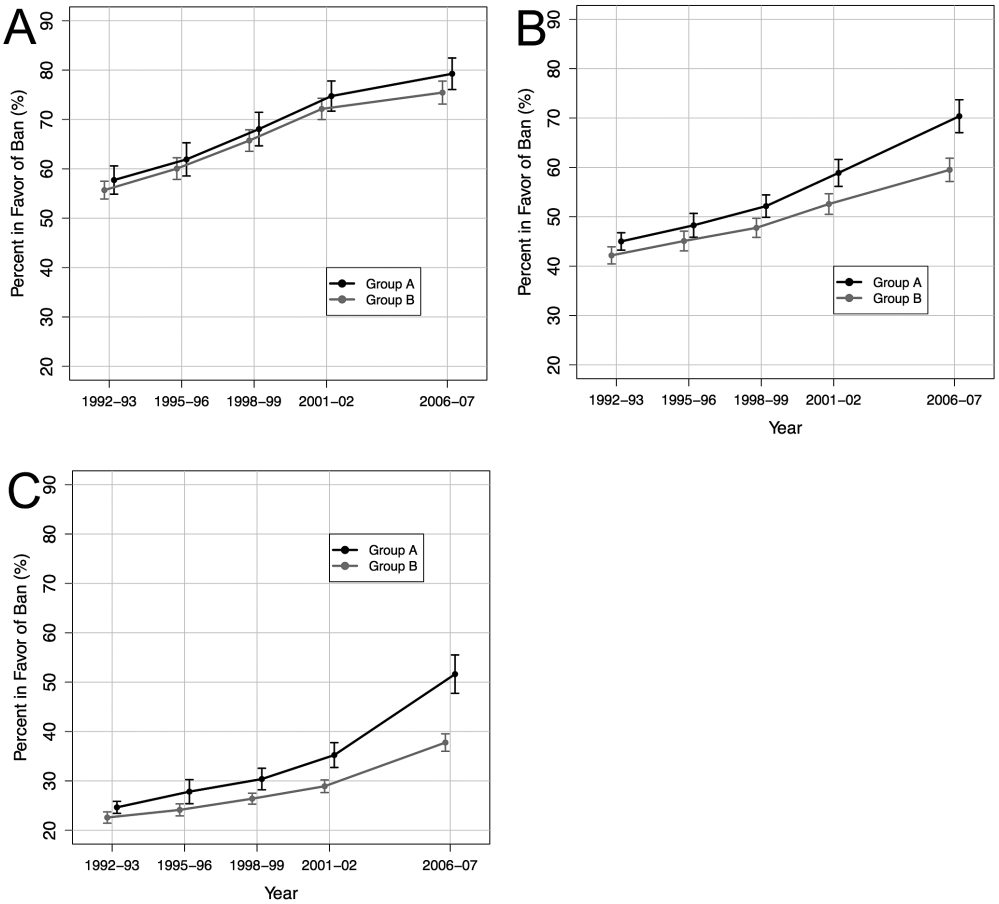


**Figure 1.** Support for total smoke-free indoor (A) work areas, (B) restaurants, and (C) bars and cocktail lounges among states that implemented comprehensive smoke-free laws in the period between 2002 and January 2007, inclusive, (group A) and among states that did not have comprehensive smoke-free laws until after January 2007 (group B).[a]

[a] Confidence intervals computed by normal approximation are shown for each survey wave. Group A and B trends are shifted slightly to either side of the survey year for better visibility.

**Table 2.** Associations Between State Groups, Time, and Groups*Time With Support for Smoke-Free Laws During 2 Periods

| | Support for total smoke-free indoor work areas | | Support for total smoke-free restaurants | | Support for total smoke-free bars and cocktail lounges | |
|---|---|---|---|---|---|---|
| | *z*[a] | *p* | *z* | *p* | *z* | *p* |
| **Time period 1992–2001** | | | | | | |
| Group | 1.198 | .231 | 3.046* | .002 | 3.637* | < .001 |
| Time | 25.545* | < .001 | 19.044* | < .001 | 14.669* | < .001 |
| Group*time | 0.771 | .441 | 2.491 | .013 | 2.864* | .004 |
| **Time period 2001–2007** | | | | | | |
| Group | 1.437 | .151 | 3.672* | < .001 | 4.720* | < .001 |
| Time | 6.592* | < .001 | 10.399* | < .001 | 12.744* | < .001 |
| Group*time | 1.527 | .127 | 4.081* | < .001 | 4.744* | < .001 |

[a]The table presents standardized regression coefficients (i.e., their *z* values) and *p* values from the models.
*To adjust for multiple comparisons, estimates are considered significant when the *p* value is below .008.

## Support for Total Smoke-Free Restaurants

Figure 1B shows the trends in support for total smoke-free restaurants among the two state groups. In the 1990s the level of support was significantly higher among states that implemented smoke-free restaurant laws (group A) than in states that did not have smoke-free restaurant laws (group B) in the later surveys. Support began at below 50% in 1992–1993 and increased to almost 60% in 2006–2007 in group B and to more than 70% in 2006–2007 in group A.

As shown in Table 2, the state groups differed significantly from each other on support for total smoke-free restaurants in both periods. There was a significant increase in support across time in both periods.

There was a significant group by time interaction in the second time period but not in the first period. This indicates that support increased at a higher rate in group A than in group B after 2002. Similar results were seen in additional analyses of respondent strata (with occasionally significant group by time interaction terms in the first time period).

### Support for Total Smoke-Free Bars and Cocktail Lounges

Figure 1C shows the trends in support for total smoke-free bars and cocktail lounges among the two state groups. The level of support appeared to be similar between the two state groups in 1992–1993, but this changed later on. The most striking difference between the trends in group A and B is seen between 2001–2002 and 2006–2007, when the states in group A implemented smoke-free bar laws. Support began below 30% in 1992–1993 and increased to almost 40% in 2006–2007 among group B and to more than 50% in 2006–2007 among group A.

The two state groups differed significantly from each other in terms of support for total smoke-free bars and cocktail lounges in both time periods (Table 2). There was a significant increase in support across time in both periods. There was a significant group by time interaction in both time periods. This indicates that support increased at a higher rate in group A than in group B after 2002 (but it was also increasing at a higher rate before 2002). Similar results were seen in additional analyses of respondent strata (with occasionally not significant interaction terms in the first time period).

## Discussion

The findings of the current study showed that support for smoke-free workplaces, restaurants and bars increased in the United States between 1992 and 2007. A considerable number of states implemented smoke-free laws in these venues after 2002. Population support for smoke-free restaurants and bars was already higher in those states between 1992 and 2001. After 2002, support for smoke-free restaurants and bars increased at a higher rate in the states that implemented smoke-free laws in these venues than in states that did not. Support for smoke-free bars was increasing at a higher rate in the states that implemented smoke-free bar laws before 2002 as well. Population support for smoke-free workplaces did not differ between states that implemented smoke-free workplace laws and states that did not. Also, the increase in support for smoke-free workplaces after 2002 did not differ between the two state groups. Therefore, the hypothesis that, after 2002, support increased at a higher rate in states that implemented smoke-free laws than in states that did not, was supported for smoke-free restaurants and bars, but not for smoke-free workplaces. It seems that the tobacco industry is not correct in claiming that smoke-free laws are unworkable and that the public will not support them.[7] If that were the case, support for the laws would be more likely to go down than up after the implementation.

A possible explanation for the different findings for workplaces is that public support for smoke-free workplaces was already quite high in 2001 (almost 75% in favor) and that a ceiling effect prevented the increase in support to be higher in states that implemented smoke-free workplace laws. Another possibility is that a minimum threshold of support is needed[16] to successfully adopt and implement smoke-free workplace laws, because so many people in the population (all employed people) are personally affected by this policy. A minimum threshold of support may be less needed for the adoption and implementation of smoke-free restaurant and workplace laws, because the people who do not frequently visit those venues may not vote against these laws. For these venues, larger increases in support may not occur until after the implementation.

There are multiple explanations possible for the positive association between the implementation of smoke-free restaurant and bar laws and the rate of increase in support for these laws. One of them is that the implementation of smoke-free laws causes support for smoke-free laws to increase at a higher rate.[14,17] Not only might the implementation have caused increases in support, but also the adoption and enforcement of the laws, media publicity and campaigns, and various health promotion activities that accompanied the adoption, implementation and enforcement[18]. However, the states that implemented smoke-free laws already differed from the states that did not implement these laws in terms of support for smoke-free restaurants and bars in the period before the laws were implemented. Therefore, a likely explanation is that states that already have higher support are more likely to implement smoke-free laws.[19] Also, increases in support for smoke-free laws and the implementation of smoke-free laws may both be the reflection of a process of denormalization of smoking[3,5,6,20] that may be more present in some states than in others. It seems reasonable to think that there is not a single explanation for the larger increase in support in states that implemented a smoke-free law than in states that did not, but that a combination of the above described explanations is true.[16,19]

Studies have shown that higher levels of support are helpful in ensuring compliance with the laws once they are in place.[3,4] Therefore, we recommend building public support for smoke-free laws. Americans for Nonsmokers' Rights also talks about greater public support being one of the key ingredients in the "recipe" for a smoke-free society.[21] The World Health Organization recommends increasing public support by running campaigns about the harms of second-hand smoke and by consulting and involving civil society in the adoption process.[22]

The current study used data from five survey waves of a large U.S. population survey that can provide representative state specific estimates. An important strength of this dataset is that there was data available from 10 years before a number of states started implementing smoke-free laws. This study adds to the literature because it can determine whether the secular trends in support were already different before the implementation of smoke-free laws. However, there are also some limitations to this data that need to be acknowledged. First, the data cannot be used to make causal conclusions about the impact of implementing smoke-free laws on population support for these laws. Since the period of increasing support coincides with the period when the smoke-free laws were implemented, the data cannot be used to determine the causal direction. Second, the fact that support in groups A and B was in some cases significantly different prior to 2002 makes interpretation more difficult. Third, the time between survey waves was quite long. Events other than the implementation of smoke-free laws took place during this period, including educational campaigns, which could not be controlled for in the analyses. Finally, states were grouped based on whether they implemented comprehensive smoke-free laws between the last two survey waves. We could not take into account whether states implemented non-comprehensive smoke-free laws. Within the state group that implemented comprehensive smoke-free laws there is considerable variability in terms of support for smoke-free laws. Therefore, the overall level of support for the state group is not necessarily a reflection of what happened in each individual state. This is especially true for boundary case states that implemented smoke-free laws at the end of 2006 or the beginning of 2007. States which implemented laws in December 2006 or

in January 2007 were assigned to group A. States which implemented laws in February or March 2007 would have been assigned to group B. Including these boundary cases may have introduced some conservative bias to our results. However, we only had four states which fit the first boundary condition (and none which fit the second): Louisiana, Nevada, Ohio, and (to a lesser extent) Hawaii. Excluding them could have potentially inflated our results, which is a more serious problem.

Future research into the association between implementing smoke-free laws and trends in support for smoke-free laws could benefit from using data that is collected at more regular time intervals. Also, additional data about the public and media debate on smoke-free laws and exposure to possible accompanying campaigns collected at the same regular time intervals could be very informative. With these more specific data, researchers could attempt to disentangle whether support increases at a higher rate before, during or after states discuss, debate, vote for, adopt, and implement smoke-free laws.

In conclusion, this study demonstrated that support for smoke-free restaurants and bars increased at a higher rate in states that implemented smoke-free laws in these venues than in states that did not. However, the states that implemented smoke-free laws in restaurants and bars already had higher levels and different rates of public support before they implemented the laws. Therefore, it cannot be determined whether the adoption and implementation of the laws caused the support to increase at a higher rate or whether states that already have higher support are more likely to implement smoke-free laws. Assuming that both of these explanations are partly true, we recommend building public support for smoke-free laws. This may not only make the adoption and implementation of smoke-free laws more likely, but may also facilitate enforcement of the laws.

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## Declaration of Interests

*None declared.*

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GN conceived the study and drafted the manuscript. TW conducted the statistical analyses with assistance from AG. S-HZ is the guarantor of the paper. All authors contributed to the data interpretation and to the writing of the manuscript. All authors revised the manuscript for intellectual content.

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