Projected Smoking-Related Deaths Among U.S. Youth: A 2000 Update

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Abstract:
This paper projects the long term consequences of the rise in youth smoking in the 1990s by updating the state estimates for projected smoking-related deaths among youth in the U.S. using information from the Behavioral Risk Factor Surveillance System (BRFSS) 2000 and the U.S. Census 2000. This analysis is similar to that from an earlier study published by the Centers for Disease Control and Prevention (CDC), Office on Smoking and Health (MMWR, 45[44], November 8, 1996). The 1996 analysis used young adult smoking prevalence data from 1994 and 1995; whereas, the analysis presented here represents smoking prevalence data from 2000. The overall number of potential future smoking-attributable deaths among persons aged 0-17 years in 2000 was 6,407,119 for the U.S., up from an estimated 5 million in 1995.

Compared with the 1995 estimates, every state except Arizona shows increases in projected smoking-related deaths among youth for 2000. This upsurge is attributable to both increases in smoking prevalence among young adults and population aged 0-17 years from 1995 to 2000. The increase in smoking prevalence among young adults was statistically significant in nine states including Alabama, District of Columbia, Iowa, Kentucky, Nevada, North Dakota, South Carolina, South Dakota, and Vermont.

With increasing attention and funding for comprehensive, research-based tobacco control programs in the U.S., one would expect smoking rates to decline over time, resulting in a reduction in projected smoking-related deaths among youth. The analysis reported here does not yet reflect this trend. This study clearly demonstrates that based on recent smoking patterns, there will continue to be a huge public health toll from tobacco. The results from this new analysis will be useful to states as they determine the overall public health benefits from increasing the state excise tax and consider funding for comprehensive tobacco control programs.
I. Introduction

Cigarette smoking among adolescents increased during the 1990s, peaked during the mid-1990s, and then began a gradual decline (Johnston, O’Malley, & Bachman, 2002). It was estimated that 5 million persons who were aged 0-17 years in 1995 would die prematurely from a smoking-related illness (CDC, 1996). Since this estimate was based on 1994 and 1995 smoking prevalence data, it does not adequately reflect the increase in youth smoking in the mid-1990s. The purpose of this paper is to project the long term consequences of the rise in youth smoking in the 1990s by updating the state estimates for projected smoking-related deaths among youth in the U.S. using information from the Behavioral Risk Factor Surveillance System (BRFSS) 2000 and the U.S. Census 2000. This analysis is similar to that from an earlier study published by the Centers for Disease Control and Prevention (CDC), Office on Smoking and Health (MMWR, 45[44], November 8, 1996).

II. Methods

State estimates for projected smoking-related deaths among youth in the U.S. were calculated using (a) the state prevalence of current smoking among adults aged 18-30 years in 2000; (b) the number of persons aged 0-17 years in each state in 2000; and (c) the probability of smoking-attributable mortality. State-specific data on the prevalence of current smoking among adults aged 18-30 years in all 50 states and the District of Columbia were obtained from the BRFSS for 2000 (http://www.cdc.gov/nccdphp/brfss/). Current smoking among adults age 18-30 years was defined as those who reported having smoked 100 cigarettes during their lifetimes and who reported smoking during the past 30 days. In the earlier analysis (CDC, 1996), the prevalence of smoking among adults
aged 18-30 years for each state was averaged for 1994 and 1995 (with a few exceptions) to estimate the future prevalence of smoking during early adulthood for the birth cohorts aged 0-17 years. In this analysis, the prevalence of smoking among 18 to 30 year olds in 2000 was employed. One year of smoking prevalence data vs. pooling 1999 and 2000 data was used since the state estimates are based on representative samples each year. The prevalence of cigarette use among young adults was compared between 1994-1995 and 2000 for each state by considering the 95% confidence intervals for these parameters. States whose confidence intervals for prevalence did not overlap were determined to be significantly different at an alpha level of 0.05. The number of persons aged 0-17 years in 2000 was obtained from the U.S. Census reports (www.census.gov), and was multiplied by the estimated prevalence of future smoking to determine the estimated number of youth who will become regular smokers in each state.

The projected number of smoking-attributable deaths was calculated by using the probability of smoking-attributable mortality (PSAM) from the earlier analysis (CDC, 1996). The PSAM is comprised of (a) the percent of persons who had ever smoked at least 100 cigarettes during their lifetime and continued to smoke until one year before their death (55%; CDC, 1996) multiplied by the estimated percent of deaths among continuing smokers (50%; Peto et al, 1994); plus (b) the percent of persons who had ever smoked at least 100 cigarettes during their lifetime and quit smoking prior to one year before their death (45%; CDC, 1996) multiplied by a conservative estimate of smoking-attributable deaths among former smokers (10%; CDC unpublished data, 1996). Thus, the probability of smoking-attributable mortality used in this analysis was .32 (PSAM = [(0.55 x 0.5) + (0.45 x 0.1)]).
III. Results

Overall, the estimated number of future smokers among the cohort of persons who were aged 0-17 years in 2000 was 20,022,241 for the U.S. (range: 25,781 [District of Columbia] to 1,874,940 [California]; see Table). The overall number of potential future smoking-attributable deaths among persons aged 0-17 years in 2000 was 6,407,119 for the U.S. (range: 8,250 [District of Columbia] to 599,981 [California]; see Table). The projected deaths presented here are slightly different than those contained in the recent Tobacco Control State Highlights 2002: Impact and Opportunity (CDC, 2002) which are based on average state-level smoking prevalence data for 1999 and 2000, rather than 2000 alone. The difference between the 2002 CDC estimates and those presented here represents an average difference of 464 projected deaths per state (r = .998, p = .70).

The updated analysis shows an increase in projected smoking-related deaths among youth in nearly every state. Change in smoking prevalence among persons 18-30 years was one factor that contributed to the increase in projected smoking-related deaths among youth. Smoking prevalence among young adults increased from 1994-1995 to 2000 in all states except Arizona and Virginia. The increase in smoking prevalence was statistically significant in nine states including Alabama, District of Columbia, Iowa, Kentucky, Nevada, North Dakota, South Carolina, South Dakota, and Vermont.

The change in population of persons 0-17 years also impacted the change in projected smoking-related deaths from 1995 to 2000. The population of persons 0-17 years increased in all states except Hawaii, Louisiana, Maine, Montana, North Dakota, South Dakota, West Virginia, and Wyoming.
Compared with the 1994-1995 estimates, every state except Arizona shows increases in projected smoking-related deaths for 2000. This upsurge is attributable to both increases in smoking prevalence among young adults and population aged 0-17 years from 1995 to 2000. If current tobacco use patterns persist, it is estimated that 6,407,119 persons in the U.S. who were aged 0-17 years in 2000 will die prematurely from a smoking-related illness.

IV. Discussion

The upsurge in projected smoking-related deaths among youth is due, in part, to increases in the number of persons aged 0-17 years from 1995 to 2000. However, this increase also is due to the increase in smoking prevalence among young adults in every state over the same time period. In nine states, this increase was statistically significant. With increasing attention and funding for comprehensive, research-based tobacco control programs in the U.S., one would expect smoking rates to decline over time, resulting in a reduction in projected smoking-related deaths among youth. The analysis reported here does not yet reflect this trend. Since youth smoking rates have recently declined (Johnston et al., 2002), it may be a few more years before this trend affects smoking prevalence among young adults (18-30 years). It should be noted, however, that this anticipated decline in young adult smoking may be offset, at least in part, by the tobacco industry’s changed marketing practices focused on young adults (Sepe, Ling, & Glantz, 2002). In addition, recent policy changes at state and local levels may simply delay initiation of tobacco use among youth, resulting in an increase in young adult smoking prevalence.
The tobacco industry has increased advertising and promotions expenditures since the 1998 Master Settlement Agreement (Federal Trade Commission, 2001). There has been a dramatic increase in tobacco industry sponsorship of bars and nightclubs during the 1990s, indicating that the industry is targeting young adults (Sepe et al., 2002). Not only do the bar and nightclub sponsorships reach beginning smokers through peer influence, they also promote smoke-friendly promotional environments and are used for marketing research (Sepe et al., 2002). These targeted marketing efforts are likely to contribute to the greater prevalence of smoking among young adults observed in recent years.

The population figures used for the analysis reported here were obtained from the 2000 U.S. Census, while the 1995 analysis was based on population estimates. Compared to the 1995 analysis, the projected death estimates reported here are more accurate since the population data used are more current and based on actual Census data.

**V. Policy Implications**

This analysis clearly demonstrates that based on recent smoking patterns, there will continue to be a huge public health toll from tobacco. In 1998, the estimated economic toll from smoking in the U.S. was over $75.5 billion per year in direct medical expenditures (CDC, 2002). In addition, from 1995 to 1999, smoking-attributable productivity losses from premature deaths was estimated at $81.9 billion per year (CDC, 2002). Sustained, well-funded comprehensive tobacco control programs and policies that are effective in reducing youth and young adult smoking will have long-term public health, as well as economic benefits.
Effective policy interventions are available that have been shown to reduce youth and young adult smoking including significant tobacco tax increases and funding for comprehensive programs. Tobacco control advocates in many states are increasing their efforts to raise the cigarette excise tax in an attempt to reduce cigarette consumption and promote cessation. A record number of state governments are considering raising the cigarette excise tax as a way to generate revenue. Not only do tax hikes prevent initiation of tobacco use, but increases in the real price of cigarettes also have been shown to prevent young smokers from moving beyond experimentation into regular, addicted smoking (Emery et al., 1999; Emery et al., 2001; Tauras, O’Malley, & Johnston, 2001). Increases in price also promote cessation among older smokers, resulting in further reductions in the public health toll from tobacco.

There are significant differences across states in the level of tobacco taxes. The average state excise tax on cigarettes in the U.S. in 2001 was $0.42/pack. The tobacco-growing states tend to have the lowest excise taxes: North Carolina at $0.05/pack; Kentucky at $0.03/pack; and Virginia at $0.025/pack of cigarettes. In contrast, state excise taxes in New York are $1.11 per pack, and those in Alaska, Hawaii, Rhode Island, and Maine are as high as $1.00/pack, followed by California at $0.87/pack. Tax increases in late 2001 and early 2002 have taken taxes even higher in some states. Voters in Washington State recently overwhelmingly approved an increase of 60 cents per pack, to $1.425, in the state cigarette excise tax. New York’s tax rose to $1.50 per pack in April 2002; Connecticut recently passed a $0.61 increase raising the cigarette tax to $1.11, also in April 2002; and Utah’s tax is scheduled to increase from 51.5 to 69.5 cents per pack in July 2002.
In recent years, several state governments have adopted comprehensive programs to reduce tobacco use, often funded by earmarked tobacco tax revenues. These programs generally have consistent goals for reducing tobacco use including: preventing initiation among youth and young adults; promoting cessation among all smokers; reducing exposure to secondhand smoke; and identifying and eliminating disparities among population subgroups (USDHHS, 2000). In general, these programs have one or more four key components: national and community interventions, counter marketing campaigns, policy and regulation, and surveillance and evaluation. Programs have placed differing emphasis on these four components, with substantial diversity among the types of activities supported within each component. Recent analyses from the U.S. and UK clearly indicate that these comprehensive efforts have been successful in reducing tobacco use and in improving public health (Farrelly, Pechacek, Chaloupka, 2001; Townsend, 1998; USDHHS, 2000; Wakefield & Chaloupka, 2000). In California, for example, the state’s comprehensive tobacco control program has doubled the rate of decline in tobacco use seen in the rest of the U.S. (Pierce et al., 1998). California lung cancer incidence has fallen by 14% from 1988 to 1997. In contrast, declines of 2.7% have been seen in other areas of the country (CDC, 2000).

Despite strong evidence that comprehensive approaches to tobacco control can effectively reduce smoking, and therefore diminish the social and economic burdens of tobacco use, even the best-funded comprehensive tobacco control programs in the U.S. fall short of optimal funding guidelines for tobacco control. Current estimates of the costs of implementing a comprehensive tobacco control program in the U.S. range from $7 to $20 per capita in smaller states (<$3 million population); $6 to $17 per capita in
medium-sized states (3-7 million population); and $5 to $16 per capita in larger states (>7 million population; CDC, 2001). At the highest recommended spending level for the U.S., annual funding for a comprehensive tobacco program would equal only 0.9% of U.S. public spending per capita on health.

In summary, it is estimated that nearly 6.5 million deaths from smoking will occur in the current 0-17 year-old cohort in the U.S. The results from this new analysis will be useful to states as they determine the overall public health benefits from increasing the state excise tax and consider funding for comprehensive tobacco control programs.
Table. Prevalence of current smoking among adults aged 18-30 years and projected number of persons aged 0-17 who will become smokers and die prematurely as adults because of smoking-related illness, by state—United States, 1995\(^1\) and 2000

<table>
<thead>
<tr>
<th>State</th>
<th>Prevalence of current smoking among person aged 18-30 years</th>
<th>Persons aged 0-17 years</th>
<th>Projected deaths from smoking</th>
</tr>
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<tbody>
<tr>
<td>Alabama*</td>
<td>24.1 (+3.4%)</td>
<td>32.3 (+4.6%)</td>
<td>1,080,145</td>
</tr>
<tr>
<td>Alaska</td>
<td>29.7 (+4.8%)</td>
<td>31.1 (+4.4%)</td>
<td>189,253</td>
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<td>Arizona</td>
<td>25.8 (+4.6%)</td>
<td>19.3 (+3.4%)</td>
<td>1,193,270</td>
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<td>Arkansas</td>
<td>24.0 (+3.5%)</td>
<td>27.3 (+3.7%)</td>
<td>649,521</td>
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<td>California</td>
<td>16.5 (+2.0%)</td>
<td>20.3 (+2.7%)</td>
<td>8,793,616</td>
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<td>Colorado</td>
<td>27.7 (+3.6%)</td>
<td>26.1 (+3.6%)</td>
<td>981,200</td>
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<td>Connecticut</td>
<td>22.0 (+3.5%)</td>
<td>28.4 (+3.3%)</td>
<td>797,733</td>
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<td>Delaware</td>
<td>29.0 (+3.3%)</td>
<td>30.1 (+3.9%)</td>
<td>178,826</td>
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<td>DC*</td>
<td>13.4 (+4.3%)</td>
<td>22.4 (+3.8%)</td>
<td>114,652</td>
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<td>Florida</td>
<td>27.5 (+2.8%)</td>
<td>28.7 (+2.9%)</td>
<td>3,371,328</td>
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<td>Georgia</td>
<td>21.3 (+3.0%)</td>
<td>25.8 (+3.0%)</td>
<td>1,923,594</td>
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<td>Hawaii</td>
<td>20.9 (+3.0%)</td>
<td>25.1 (+2.7%)</td>
<td>309,264</td>
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<tr>
<td>Idaho</td>
<td>21.9 (+3.0%)</td>
<td>25.9 (+2.5%)</td>
<td>347,924</td>
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<td>Illinois</td>
<td>26.0 (+3.2%)</td>
<td>28.4 (+3.2%)</td>
<td>3,125,894</td>
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<td>Indiana</td>
<td>30.0 (+3.1%)</td>
<td>35.0 (+3.9%)</td>
<td>1,487,359</td>
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<td>Iowa*</td>
<td>23.1 (+2.7%)</td>
<td>34.3 (+3.7%)</td>
<td>724,511</td>
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<td>Kansas</td>
<td>22.2 (+3.5%)</td>
<td>24.5 (+2.8%)</td>
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<td>Kentucky*</td>
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<td>37.8 (+2.8%)</td>
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<td>1,239,214</td>
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<td>Maine</td>
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<td>36.0 (+3.6%)</td>
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<td>25.0 (+2.9%)</td>
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<td>28.6 (+3.1%)</td>
<td>31.4 (+4.0%)</td>
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<td>Minnesota</td>
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<td>27.7 (+3.6%)</td>
<td>1,245,492</td>
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<td>Mississippi</td>
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<td>26.0 (+4.1%)</td>
<td>761,904</td>
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<td>Missouri</td>
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<td>31.9 (+3.2%)</td>
<td>1,381,552</td>
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<td>Montana</td>
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<td>22.9 (+3.8%)</td>
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<td>Nebraska</td>
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<td>30.1 (+3.7%)</td>
<td>443,297</td>
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<td>Nevada*</td>
<td>24.8 (+3.4%)</td>
<td>35.3 (+4.4%)</td>
<td>398,586</td>
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<td>34.1 (+5.6%)</td>
<td>294,969</td>
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<td>New Jersey</td>
<td>21.6 (+3.8%)</td>
<td>24.4 (+3.3%)</td>
<td>1,963,523</td>
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<td>New Mexico</td>
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<td>28.7 (+3.7%)</td>
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<td>New York</td>
<td>26.0 (+3.1%)</td>
<td>30.1 (+3.4%)</td>
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<td>North Carolina</td>
<td>28.8 (+3.0%)</td>
<td>34.3 (+3.8%)</td>
<td>1,799,119</td>
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<td>North Dakota*</td>
<td>22.5 (+3.2%)</td>
<td>31.6 (+4.5%)</td>
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<td>Ohio</td>
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<td>33.3 (+3.6%)</td>
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<td>Oklahoma</td>
<td>22.7 (+5.2%)</td>
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<td>878,039</td>
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<td>Oregon</td>
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<td>797,040</td>
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<td>Pennsylvania</td>
<td>29.5 (+2.9%)</td>
<td>32.9 (+3.8%)</td>
<td>2,909,302</td>
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<td>Rhode Island</td>
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<td>32.0 (+3.7%)</td>
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<td>South Carolina*</td>
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<td>30.1 (+3.4%)</td>
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<td>South Dakota*</td>
<td>22.1 (+3.3%)</td>
<td>29.1 (+3.0%)</td>
<td>206,436</td>
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<td>Tennessee</td>
<td>25.1 (+2.9%)</td>
<td>29.1 (+3.7%)</td>
<td>1,310,297</td>
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<td>Texas</td>
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<td>24.9 (+2.4%)</td>
<td>5,400,417</td>
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<td>Utah</td>
<td>16.1 (+2.5%)</td>
<td>16.7 (+2.6%)</td>
<td>674,618</td>
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<td>Vermont*</td>
<td>26.3 (+3.4%)</td>
<td>34.0 (+3.7%)</td>
<td>146,760</td>
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<td>Virginia</td>
<td>26.3 (+3.5%)</td>
<td>25.5 (+4.4%)</td>
<td>1,612,527</td>
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<td>Washington</td>
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<td>26.7 (+3.2%)</td>
<td>1,418,404</td>
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<td>West Virginia</td>
<td>28.6 (+3.3%)</td>
<td>30.2 (+4.3%)</td>
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<td>Wisconsin</td>
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<td>32.8 (+4.2%)</td>
<td>1,353,205</td>
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<td>Wyoming</td>
<td>23.2 (+4.3%)</td>
<td>30.0 (+4.2%)</td>
<td>136,268</td>
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<tr>
<td>United States</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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</tbody>
</table>

*Statistically significant increase in smoking prevalence among young adults from 1995 to 2000 at an alpha level of 0.05.

1995 figures from *MMWR*, 45(44), November 8, 1996.

2Smoking prevalence data for persons aged 18-30 years were pooled for 1994 and 1995, except for Rhode Island (1995 only) and the District of Columbia (1994 only).


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