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

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impacTEEN

A Policy Research Partnership to Reduce Youth Substance Use

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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[a]) 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[b]). In addition, from 1995 to 1999, smoking-attributable productivity losses from premature deaths was estimated at $81.9 billion per year (CDC, 2002 [b]). 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

State	Prevalence of current smoking among person aged 18-30 years				Persons aged 0-17 years					
	1995[2]		2000		Number		Projected smokers		Projected deaths from smoking	
	%	95% CI	%	95% CI	1995	2000	1995	2000	1995	2000
Alabama*	24.1	(±3.4%)	32.3	(±4.6%)	1,080,145	1,123,422	260,639	363,315	83,404	116,261
Alaska	29.7	(±4.8%)	31.1	(±4.4%)	189,253	190,717	56,246	59,294	17,999	18,974
Arizona	25.8	(±4.6%)	19.3	(±3.4%)	1,193,270	1,366,947	307,864	263,274	98,516	84,248
Arkansas	24.0	(±3.5%)	27.3	(±3.7%)	649,521	680,369	155,690	186,013	49,821	59,524
California	16.5	(±2.0%)	20.3	(±2.7%)	8,793,616	9,249,829	1,446,550	1,874,940	462,896	599,981
Colorado	27.7	(±3.6%)	26.1	(±3.6%)	981,200	1,100,795	271,694	286,977	86,942	91,833
Connecticut	22.0	(±3.5%)	28.4	(±3.3%)	797,733	841,688	175,501	239,208	56,160	76,547
Delaware	29.0	(±3.3%)	30.1	(±3.9%)	178,826	194,587	51,806	58,649	16,578	18,768
DC*	13.4	(±4.3%)	22.4	(±3.8%)	114,652	114,992	15,398	25,781	4,927	8,250
Florida	27.5	(±2.8%)	28.7	(±2.9%)	3,371,328	3,646,340	928,464	1,045,406	297,108	334,530
Georgia	21.3	(±3.0%)	25.8	(±3.0%)	1,923,594	2,169,234	409,726	559,879	131,112	179,161
Hawaii	20.9	(±3.0%)	25.1	(±2.7%)	309,262	295,767	64,574	74,267	20,664	23,765
Idaho	21.9	(±3.0%)	25.9	(±2.5%)	347,924	369,030	76,230	95,431	24,394	30,538
Illinois	26.0	(±3.2%)	28.4	(±3.2%)	3,125,894	3,245,451	813,670	920,734	260,374	294,635
Indiana	30.0	(±3.1%)	35.0	(±3.9%)	1,487,359	1,574,396	439,515	550,409	140,645	176,131
Iowa*	23.1	(±2.7%)	34.3	(±3.7%)	724,511	733,638	167,507	251,491	53,602	80,477
Kansas	22.2	(±3.5%)	24.5	(±2.8%)	692,761	712,993	153,862	174,755	49,236	55,922
Kentucky*	28.2	(±3.3%)	37.8	(±2.8%)	972,708	994,818	274,693	376,041	87,902	120,333
Louisiana	26.7	(±3.5%)	28.6	(±2.7%)	1,239,214	1,219,799	331,366	349,106	106,037	111,714
Maine	32.0	(±4.9%)	36.0	(±3.6%)	304,895	301,238	97,536	108,566	31,211	34,741
Maryland	21.1	(±2.0%)	25.0	(±2.9%)	1,271,966	1,356,172	267,876	338,365	85,720	108,277
Massachusetts	23.1	(±3.4%)	26.7	(±2.1%)	1,431,854	1,500,064	330,186	399,767	105,659	127,925
Michigan	28.6	(±3.1%)	31.4	(±4.0%)	2,519,455	2,595,767	721,572	816,109	230,903	261,155
Minnesota	24.3	(±2.2%)	27.7	(±3.6%)	1,245,492	1,286,894	303,153	355,955	97,009	113,906
Mississippi	20.0	(±3.5%)	26.0	(±4.1%)	761,909	775,187	152,610	201,316	48,835	64,421
Missouri	26.9	(±4.3%)	31.9	(±3.2%)	1,381,552	1,427,692	372,052	454,863	119,057	145,556
Montana	19.9	(±4.3%)	22.9	(±3.8%)	236,134	230,062	47,014	52,569	15,045	16,822
Nebraska	25.0	(±3.6%)	30.1	(±3.7%)	443,297	450,242	110,913	135,433	35,492	43,339
Nevada*	24.8	(±3.4%)	35.3	(±4.4%)	398,586	511,799	98,770	180,716	31,606	57,829
New Hampshire	25.2	(±4.0%)	34.1	(±5.6%)	294,969	309,562	74,303	105,684	23,777	33,819
New Jersey	21.6	(±3.8%)	24.4	(±3.3%)	1,963,523	2,087,558	423,728	508,320	135,593	162,662
New Mexico	20.9	(±4.1%)	28.7	(±3.7%)	500,099	508,574	104,271	146,062	33,367	46,740
New York	26.0	(±3.1%)	30.1	(±3.4%)	4,536,862	4,690,107	1,179,584	1,411,253	377,467	451,601
North Carolina	28.8	(±3.0%)	34.3	(±3.8%)	1,799,119	1,964,047	517,786	672,883	165,692	215,323

North Dakota*	22.5	(±3.2%)	31.6	(±4.5%)	170,445	160,849	38,350	50,748	12,272	16,239
Ohio	31.2	(±4.6%)	33.3	(±3.6%)	2,859,848	2,888,339	891,129	962,972	285,161	308,151
Oklahoma	22.7	(±5.2%)	26.6	(±3.2%)	878,039	892,360	199,490	237,457	63,837	75,986
Oregon	24.1	(±2.9%)	26.7	(±3.1%)	797,040	846,526	191,688	225,768	61,340	72,246
Pennsylvania	29.5	(±2.9%)	32.9	(±3.8%)	2,909,302	2,922,221	857,371	961,411	274,359	307,652
Rhode Island	30.9	(±5.9%)	32.0	(±3.7%)	237,611	247,822	73,446	79,303	23,503	25,377
South Carolina*	22.0	(±3.0%)	30.1	(±3.4%)	944,384	1,009,641	208,142	304,205	66,606	97,346
South Dakota*	22.1	(±3.3%)	29.1	(±3.0%)	206,436	202,649	45,705	58,971	14,626	18,871
Tennessee	25.1	(±2.9%)	29.1	(±3.7%)	1,310,297	1,398,521	329,147	406,830	105,327	130,186
Texas	21.5	(±3.6%)	24.9	(±2.4%)	5,400,417	5,886,759	1,158,389	1,465,214	370,685	468,868
Utah	16.1	(±2.5%)	16.7	(±2.6%)	674,618	718,698	108,883	120,166	34,843	38,453
Vermont*	26.3	(±3.4%)	34.0	(±3.7%)	146,760	147,523	38,613	50,173	12,356	16,055
Virginia	26.3	(±3.5%)	25.5	(±4.4%)	1,612,527	1,738,262	423,288	443,257	135,452	141,842
Washington	23.8	(±2.5%)	26.7	(±3.2%)	1,418,404	1,513,843	336,871	403,591	107,799	129,149
West Virginia	28.6	(±3.3%)	30.2	(±4.3%)	421,868	402,393	120,443	121,482	38,542	38,874
Wisconsin	27.0	(±3.8%)	32.8	(±4.2%)	1,353,205	1,368,756	365,907	449,226	117,090	143,752
Wyoming	23.2	(±4.3%)	30.0	(±4.2%)	136,268	128,873	31,669	38,636	10,134	12,364
United States	**NA**	**NA**	**NA**	**NA**	**68,739,952**	**72,293,812**	**16,620,880**	**20,022,241**	**5,318,682**	**6,407,119**

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

[1]1995 figures from *MMWR*, 45(44), November 8, 1996.

[2]Smoking 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).

Note. The number of projected smoking-related deaths for 2000 are slightly different than those presented in *Tobacco Control State Highlights 2002: Impact and Opportunity* (CDC, 2002). The 2002 CDC analysis pooled young adult smoking prevalence for 1999 and 2000.

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