

## RESEARCH PAPER

## Youth smoking prevention and tobacco industry revenue

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**Objectives:** Epidemiological surveys make it clear that youth smoking contributes to both current and future tobacco industry revenue: over 80% of adult smokers reportedly began smoking before age 18. This paper estimates annual and lifetime revenue from youth smoking, and highlights the association between declines in youth smoking and declines in tobacco industry revenue.

**Main outcome measures:** This paper reports the amount of tobacco industry revenue generated by youth smoking at two points in time (1997 and 2002), and describes the distribution of youth generated tobacco income among the major tobacco companies. The authors project the amount of tobacco industry revenue that will be generated by members of two cohorts (the high school senior classes of 1997 and 2002) over the course of their lifetimes.

**Results:** In 1997, youth consumed 890 million cigarette packs, generating \$737 million in annual industry revenue. By 2002, consumption dropped to 541 million packs and revenue increased to nearly \$1.2 billion. Fifty eight per cent of youth generated revenue goes to Philip Morris USA, 18% to Lorillard, and 12% to RJ Reynolds. The authors project that, over the course of their lives, the 1997 high school senior class will smoke 12.4 billion packs of cigarettes, generating \$27.3 billion in revenue. The 2002 high school senior class is projected to smoke 10.4 billion packs, generating \$22.9 billion in revenue over the course of their lives.

**Conclusions:** Cigarette price increases from 1997 to 2002 have resulted in greater revenue for the tobacco industry, despite declines in youth smoking prevalence. However, in the absence of further cigarette price increases, declines in youth smoking are projected to lead ultimately to a loss of approximately \$4 billion in future tobacco industry revenue from a single high school cohort.

More than 80% of adults who had ever smoked daily tried their first cigarette by age 18.<sup>1</sup> Smoking rates among high school seniors peaked in 1997 and have since dropped steadily due to a number of factors, including increases in cigarette prices, state tobacco control programmes,<sup>2</sup> and national and state tobacco countermarketing campaigns.<sup>3</sup> Business logic and internal industry documents illustrate the importance of youth smoking to future revenue streams (RJ Reynolds internal memo, 29 February 1984; Philip Morris internal report 1981).<sup>4,5</sup> Two studies have quantified annual cigarette company revenue attributable to youth smoking.<sup>6,7</sup> A 1990 study by DiFranza and Tye estimated that American youth under age 18 years smoke 947 million packs of cigarettes annually and that this translated into \$221 million in tobacco industry profits in 1988.<sup>6</sup> A 1999 study by DiFranza and Librett<sup>7</sup> estimated that daily smokers aged 12–17 years consumed 924 million packs of cigarettes in 1997. This translates to \$480 million in industry profits and a retail value of \$1.86 billion. No study to date has specified which tobacco companies benefit most from youth smoking, or projected the revenue associated with youth-initiated smoking over a lifetime.

The objectives of the current paper are threefold. First, we provide 2002 estimates of tobacco industry revenue associated with youth smoking based on a nationally representative survey; examine the share of total revenue for each of the major tobacco companies based on youth's reported brand preferences; and estimate total youth cigarette consumption in 2002 by race to determine the proportion of tobacco industry revenue generated by white and African American youth. Second, we project industry revenue based on lifetime smoking among two cohorts of high school seniors (the senior classes of 1997 and 2002). Third, we project the time at which the nation, at present rates of decline, will meet the Healthy People 2010 youth smoking prevalence objective of

16% and the associated loss of tobacco industry revenue over the lifetime of a single cohort of 12th grade youth, compared to the revenue they would have received if youth smoking did not decline. The contrasting levels of industry revenue from these scenarios illustrate the economic incentives tied to attracting young smokers to the habit and underscore the significant adverse fiscal impact on the industry of successful efforts to reduce youth initiation in the United States, which if fully successful would very notably reduce US consumption over time.

## METHODS

## Tobacco industry revenue from youth cigarette smoking

To calculate national estimates of total cigarette consumption and industry revenue associated with youth smoking, grade-specific smoking rates (based on smoking during the past 30 days) from the 1997 and 2002 Monitoring the Future (MTF) surveys of 8th, 10th, and 12th grade students were estimated. For 9th and 11th graders, smoking rates were estimated with linear projections based on smoking rates in 8th, 10th, and 12th grades. The number of smokers in each grade was estimated by using age-specific population data from the US Census Bureau.<sup>9</sup> Total cigarette consumption was derived by multiplying the average number of cigarettes smoked daily for each grade by the number of smokers in that grade. The MTF surveys ask youth to report how much they smoked in the past 30 days. Possible response categories include less than one cigarette per day, one to five cigarettes per day, about half a pack, about one pack, about one and a half packs, and two packs or more. A continuous measure of consumption was derived by assigning the number of cigarettes to be 0.5, 3, 10, 20, 30, and 40, respectively. Annual cigarette consumption in packs was estimated by multiplying monthly cigarette consumption by 12 months

and dividing by 20, the number of cigarettes in a pack. Past evidence suggests that adolescent and adult smokers under-report cigarette consumption by 28% on average; as a result, we multiplied the total number of packs smoked by 1.39 (1/0.72).<sup>10</sup> Cigarette consumption was capped at 40 cigarettes, thus conservatively estimating total consumption and hence industry revenue.

Total industry revenue for 1997 and 2002 levels of smoking was estimated by multiplying the number of packs smoked by youth by the average wholesale price (that is, the price that cigarette manufacturers charge wholesalers) per pack for premium brands in 1997 and 2002, or \$1.00 and \$2.37, respectively.<sup>11</sup> All dollar figures are adjusted for inflation and are expressed in 2005 dollars. Data from the 2002 MTF survey indicate that 82% of youth smokers considered Marlboro, Newport, or Camel cigarettes their “usual brand”, suggesting that most youth smoke what are known as premium rather than discount brands. The change in number of packs smoked and revenue earned between 1997 and 2002 smoking levels was then derived.

Finally, total industry revenue was disaggregated by tobacco company—Brown & Williamson (that is, GPC, Kool), Lorillard (that is, Newport), Philip Morris (that is, Marlboro, Parliament, Virginia Slims, Basic), and RJ Reynolds (that is, Camel, Winston, Doral)—and by the race of the youth smoker. The estimated tobacco company revenue based on youth’s brand preferences and cigarette consumption across all grades in the 2002 MTF survey was calculated. To estimate tobacco industry revenue by race, we calculated the proportion of cigarettes smoked by youth in 2002 by the race of the smoker.

**Cigarette revenue from a cohort of youth**

To estimate the number of packs of cigarettes smoked by a cohort of high school seniors (approximately 17 years old) over their lifetime, we rely on smoking prevalence from MTF surveys—36.5% in 1997 and 26.7% in 2002. The number of 17 year old smokers was estimated based on these rates and Census population statistics from 1999. Adjustments were made for each subsequent year of this cohort’s life by applying age-specific smoking initiation, cessation, relapse, and mortality rates using a software model developed to determine future smoking-attributable mortality (Mowery *et al*, 2003). The underlying population data for this model are from July 1999, so for consistency, these population statistics for our cohorts of 17 year olds were used. Age- and smoking status-specific mortality rates are based on the Cancer Prevention Study-II (Mowery *et al*, 2003). Finally, to capture disparate levels of smoking intensity between age groups and possible future trends in smoking intensity within age groups, 1992–1999 Current Population Survey (CPS) data were used to establish a trajectory for future smoking intensity among four targeted age groups (18–24, 25–39, 40–59, and 60–90 years). As a starting point, the 1999 CPS estimates of the average number of cigarettes smoked daily among current smokers for each age group were relied upon. The age group-specific trends to predict the average number

of cigarettes smoked daily for each year throughout the life of our cohort were created, adjusting for underreporting.

Lifetime smoking patterns for these hypothetical cohorts were then estimated and compared to calculate the difference in lifetime packs of cigarettes consumed and corresponding industry revenue. The value of the total packs of cigarettes consumed by this cohort of smokers was estimated by multiplying the total number of packs consumed by \$2.37, the average wholesale price per pack for premium brands in 2002.<sup>11</sup> We estimated a linear time trend to extrapolate future smoking rates based on changes from 1997 to 2002 to determine the date by which youth smoking rates would reach the *Healthy People 2010* goal of 16%. This was done to calculate the annual and long term decline in tobacco industry revenue associated with meeting this public health goal.

**RESULTS**

Based on our prevalence estimates, in 1997 there were 5.7 million smokers in grades 8 through 12. In one year, these youth smoked about 890 million packs of cigarettes and generated approximately \$737 million in annual domestic tobacco industry revenue (table 1). By 2002, the number of youth smokers dropped by 2 million to 3.7 million who smoked approximately 540 million packs of cigarettes with a wholesale value to the tobacco industry of about \$1.2 billion—a 62% increase. If cigarette prices had not increased between 1997 and 2002, industry revenue for 2002 would have been \$503 million, 42% less than the actual revenue, assuming no change in the decline in youth consumption. Table 2 shows that 58% (\$691 million) of the youth generated revenue goes to Philip Morris, followed by Lorillard with 18% (\$213 million) and RJ Reynolds with 12% (\$138 million). Because youth brand preferences are not available for 1997, we cannot compare these figures to 1997 values. Table 2 also illustrates that 90% of the 2002 \$1.2 billion in revenue comes from cigarettes smoked by white youth, compared with 6% from African American youth. The remaining 4% in revenue is generated by the combined smoking of other teens from a variety of racial backgrounds.

Although these annual youth smoking statistics represent a significant amount of revenue for the tobacco industry, they represent a very small fraction of the lifetime revenue generated by a cohort of youth smokers (table 3). Members of the 1997 high school senior class are projected to smoke 12.4 billion packs of cigarettes over the course of their lives. This translates into \$27.3 billion in revenue for the tobacco companies. These figures are adjusted to account for those who would have quit smoking or died. In contrast, members of the 2002 senior class, which smoked at a rate of 27.6%, are projected to smoke 10.4 billion cigarettes over the course of their lives, generating \$22.9 billion in industry revenue, a difference of \$4.3 billion.

The 27% decline in smoking rates from 1997 to 2002 among high school seniors (36.5% to 26.7%) represented a loss of more than \$4 billion in future revenue, for a single graduating cohort. Based on this decline, for each and every

**Table 1** Tobacco industry revenue from youth smoking, grades 8–12, 1997 versus 2002

	1997	2002	Difference
Number of smokers	5742429	3691092	-2051338
Annual cigarette consumption per smoker	155 packs	147 packs	-8 packs
Total annual cigarette consumption	888647140 packs	541345291 packs	-347301848 packs
Total annual industry revenue, actual prices	\$737501232	\$1194666680	\$457165448
Total annual industry revenue at 1997 prices	\$737501232	\$503574689	-\$233926543

Average revenue per pack is \$1.07 in 1997 and \$2.37 in 2002, based on wholesale price per pack for premium brands from the USDA.

**Table 2** Revenue from youth smoking in 2002, grades 8–12, by race and manufacturer

	White	Black	Other	Total
Philip Morris (column %)	\$658865368 61%	\$9841865 13%	\$22526908 51%	\$69123414 58%
Lorillard	\$152794670 14%	\$50605691 68%	\$9847641 22%	\$213248002 18%
RJ Reynolds	\$130727841 12%	\$2807430 4%	\$4156001 9%	\$137691271 12%
Brown & Williamson	\$20080592 2%	\$2177457 3%	\$1037952 2%	\$23296000 2%
Other	\$113876129 11%	\$8579057 12%	\$6449349 15%	\$128904535 11%
Total	\$1076344600 100%	\$74011500 100%	\$44017851 99%*	\$1194373949 101%*

\*Does not equal 100% because of rounding.

Revenue based on reported youth brand preferences as follows: Brown & Williamson (GPC, Kool), Lorillard (Newport), Philip Morris (Marlboro, Parliament, Virginia Slims, Basic), and RJ Reynolds (Camel, Winston, Doral). The period reported in this table is before the merger of RJR and B&W, thus the data are presented separately. Race is reported as "white", "black" and "other" in the MTF public use data files.

high school senior that did not smoke in 2002, this represents a loss of \$20 000 in future revenue for the tobacco industry. If youth smoking continues to decline at the present rate, it will exceed the *Healthy People 2010* objective of 16% two years early, in 2008, when the smoking rate among youth would reach 15.5%. If this occurs, there will be about 600 000 fewer high school seniors smoking in 2008 than there were in 2002. As a result of the lower rate of smoking in this single 2008 cohort, future revenue for the tobacco industry would fall by \$11 billion. Furthermore, for each subsequent senior class that smokes at or below that rate, future tobacco industry revenue would fall by \$11 billion. Eradication of youth smoking altogether would result in staggering future income reductions of about \$1.2 billion per year and more than \$20 billion over *each* senior class cohort's lifetime (tables 1 and 3). Combined cohorts would, over time, further reduce revenue as older smokers die and are not replaced.

## DISCUSSION

There are several limitations to this study. First and most important, the estimates of the tobacco industry revenue generated by a cohort over its lifetime are projections, and although they are based on what the authors consider to be the most appropriate models, it is difficult to know how the future will affect some of the variables in these models. For example, patterns of quitting may substantially change as a result of new pharmacotherapies, changes in the price of pharmacotherapies, state-level smoking bans, effective cessation campaigns, the emergence of "reduced harm" tobacco products and, of course, cigarette prices. These projections also assume that the price of a wholesale pack of cigarettes will remain constant at the 2002 price. Although it is unlikely that cigarette prices will remain unchanged, 2002 data were used in this analysis given the uncertainty of future cigarette prices. Any changes in the price of cigarettes will affect

smoking prevalence and consumption among continuing smokers of both cohorts.

The projection that the *Healthy People 2010* goal for adolescent smoking will be met in 2008 is dependent upon continued declines in youth smoking which may not occur given recent funding cuts to state and national anti-tobacco campaigns, and tobacco control efforts generally.

The analysis presented here demonstrates that recent declines in youth smoking have the potential to reduce tobacco industry revenue considerably. Although large increases in cigarette wholesale prices from 1997 to 2002 (from \$1.00 to \$2.37) prevented substantial decreases in revenue during this period, over the long term, declines in youth smoking are likely to reduce tobacco industry revenue. Indeed, if the nation's year 2010 objective for youth smoking is achieved, the net loss to the industry per graduating cohort's lifecycle is more than \$11 billion. Although the tobacco industry maintains that it takes no action to recruit youth smokers and indeed purports to actively dissuade youth smoking, the continued uptake of smoking by youth (presently an estimated 4400 youth try their first cigarette each day; data from 2000 NHSDA, analysed for American Legacy Foundation by Research Triangle Institute, May 2002) suggests otherwise. Spillover effects of marketing to "adult" smokers in the 18 to 24 year old range readily reach 12 to 17 year olds.<sup>12–13</sup> Furthermore, a substantial component of the tobacco industry's \$15 billion annual marketing and promotional effort is dedicated to cut-rate cigarette pricing (that is, promotional allowances)<sup>14</sup> which eases youth access to tobacco given that youth are the most price-sensitive consumers.<sup>15</sup>

The continued market entry of youth is essential to the successful domestic business model for tobacco companies. Without a robust youth market, industry revenue will continue to decline, resulting in broad societal benefits

**Table 3** Tobacco industry revenue from smoking among the 2002 grade 12 cohort, over their lifetime: a comparison of 1997 versus 2002 smoking rates

	1997 smoking rates	2002 smoking rates	Difference
Lifetime cigarette consumption in packs	12360246191 packs	10390290442 packs	–1969955748 packs
Total lifetime industry revenue	\$27279723218	\$22931919556	\$–4347803662
Industry revenue per high school senior who smokes	\$18968	\$20004	

Lifetime cigarette consumption is based on historical lifetime patterns of smoking cessation and relapse and census population projections. Cigarette revenue is based on 2002 revenue per pack of \$2.37. Industry revenue per smoker differs by year as a result of the difference in the proportion of never smokers who begin smoking after age 18 in 2002 as compared with 1997.

### What this paper adds

A 1990 study by DiFranza and Tye estimated that American youth under age 18 years smoke 947 million packs of cigarettes annually and that this translated into \$221 million in tobacco industry profits in 1988. A 1999 study by DiFranza and Librett estimated that daily smokers aged 12–17 years consumed 924 million packs of cigarettes in 1997. This translates to \$480 million in industry profits and a retail value of \$1.86 billion. No study to date has specified which tobacco companies benefit most from youth smoking, or projected the revenue associated with youth initiated smoking over a lifetime.

This study provides new estimates for the amount of tobacco industry revenue generated by youth smokers; in 2002, youth consumed 541 million packs of cigarettes and tobacco industry revenue was nearly \$1.2 billion. This study shows that 58% of youth generated revenue goes to Philip Morris USA, 18% to Lorillard, and 12% to RJ Reynolds. The authors project that, over the course of their lives, the 2002 high school senior class will smoke 10.4 billion packs, generating \$22.9 billion in revenue.

including reduced morbidity and mortality from tobacco and the associated social and economic costs to the public. Continued declines in youth smoking are far from assured, however. A recent study from Minnesota illustrates the impact of reduced funding for a state tobacco control programme for youth. Within months after the end of the Minnesota youth prevention campaign, there was a statistically significant increase in youth susceptibility to smoking.<sup>16</sup> As more and more states make the decision to cut funding for tobacco control, the potential for further youth smoking reductions declines. Absent aggressive public policy intervention, progress toward reducing tobacco-related morbidity and mortality in the United States may well be diminished.

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