

Retail Impact of Raising Tobacco Sales Age to 21 Years

The majority of tobacco use emerges in individuals before they reach 21 years of age, and many adult distributors of tobacco to youths are young adults aged between 18 and 20 years. Raising the tobacco sales minimum age to 21 years across the United States would decrease tobacco retailer and industry sales by approximately 2% but could contribute to a substantial reduction in the prevalence of youths' tobacco use and dependency by limiting access. (*Am J Public Health*. Published online ahead of print September 11, 2014; e1–e4. doi:10.2105/AJPH.2014.302174)

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RECENT RESEARCH HAS HIGHLIGHTED

the susceptibility of the young adult brain to rapid nicotine addiction.^{1,2} While individuals are still experimenting with tobacco use and before they are aware of their own level of addiction, they first want, then crave, then need cigarettes, at which point they are unable to quit.¹ Individuals who begin smoking at a young age are more likely to become addicted, progress to daily smoking, become heavier tobacco users as adults, and have difficulty quitting.^{3,4} The US Surgeon General has expressed concern about the potential long-term cognitive effects of exposure to nicotine during brain development with the potential for lasting adverse consequences.⁵

For many years, public health strategies focused on preventing the onset of nicotine addiction by relying on the strict enforcement of laws that prevent the sale of tobacco to minors younger than 18 years. Indeed, successful efforts to limit tobacco access of minors by disrupting the sale of tobacco to minors have made an important contribution toward reductions in the prevalence of tobacco use among minors.⁶

A factor that might limit the impact of preventing the sale of tobacco to minors is the fact that, in most communities, 18- to 20-year-olds who can legally purchase cigarettes provide them to younger friends and family members.⁷ The majority (59%) of 18- and 19-year-olds have been asked by someone younger than 18 years to buy cigarettes for them.⁸ Also, high-school students are less likely to have 21-year-old

adults than 18- to 20-year-old adults in their social circles, suggesting reduced opportunities to access tobacco from older buyers.⁹ Inhibiting this well-established distribution cycle provides one rationale for increasing the legal age for tobacco sales to 21 years.

Another rationale stems from the 2012 Surgeon General's report finding that almost 90% of smokers in the United States began smoking before the age of 21 years.^{4,10} The report concludes that if young people can remain free of tobacco, most will never start to smoke. Currently, people who reach the age of 21 years as a nonsmoker have a minimal chance of ever becoming a smoker. For these reasons, there is interest in extending the benefits of restricting tobacco sales to individuals younger than 21 years.

RECENT CHANGES IN US TOBACCO SALES AGE LAWS

In consideration of the potential beneficial public health impact of raising the tobacco sales age to 21 years, some US cities and counties (New York City; Suffolk County, NY; Hawaii County, HI; and Needham, Arlington, Sharon, Canton, Ashland, Wellesley, Dedham, Dover, Norwood, Scituate, West Boylston, Hudson, Winchester, Wakefield, Reading, and Melrose counties, MA) have already approved legislation for raising the age to 21 years, and other cities, counties, and states are making legislative or regulatory efforts to approve similar proposals. With a single exception, all of these measures were adopted in either

2013 or 2014. Clearly, the idea of increasing the minimum tobacco sales age to 21 years has momentum.¹¹

The tobacco industry and retailers argue that raising the sales age to 21 years will significantly hurt businesses that depend on tobacco sales.^{12,13} We sought to determine the proportion of the current legal tobacco market (≥ 18 years) that is consumed by 18- to 20-year-old smokers to determine the potential impact to retailers if the tobacco sales age of 21 years was universally implemented and enforced.

We obtained self-reported data regarding cigarette consumption by age from the 2011 National Health Interview Survey (NHIS). The survey includes both citizen and noncitizen noninstitutionalized civilian American households. We analyzed data from 33 014 respondents who were asked questions about smoking in the NHIS Sample Core Adult Health Behavior Section (≥ 18 years) database. Current smokers were identified as having smoked at least 100 cigarettes in their lifetime and still smoking when surveyed. We sought to calculate the volume of cigarette products consumed by individuals, between the ages of 18 and 20 years. Because the data were derived from self-reported cigarettes smoked, it accounts for any tobacco used to "roll your own," as well as small cigars that are functionally identical to cigarettes. Tobacco consumed by 15- to 17-year-old smokers was not included as sales to this population are already illegal under federal law.

We used SAS version 9.3 (SAS Institute, Cary, NC) to conduct data analysis. We calculated mean average daily and annual cigarette consumption for current smokers aged 18 to 20 years and those aged 21 years or older to determine the proportion of total cigarette consumption that is attributable to 18- to 20-year-old smokers.

In our sample of 33 014 (Table 1), there were 6138 (18.6%) current smokers, 188 (15.2% smoking prevalence) in the 18- to 20-year-old group and 5950 (18.7% smoking prevalence) in the group aged 21 years and older. The 18- to 20-year-old group of current smokers were 49% female, 77% White, 18% Hispanic, and 16% Black, and the current smokers aged 21 years or older were 48% female, 77% White, 12% Hispanic, and 17% Black.

About 37% of 18- to 20-year-old respondents lived with 3 or more household members compared with 4% of those aged 21 years or older ($P < .001$).

Table 2 demonstrates the lower daily cigarette consumption of those aged 18 to 20 years versus those aged 21 years or older (8.6 per day vs 12.5 per day; $P < .001$). We also found out that 18- to 20-year-old smokers make up 3.06% of the total adult smoking population but account for just 2.12% of cigarette consumption.

EFFECTS ON TOBACCO INDUSTRY AND RETAILERS

If one assumes that the number of cigarettes smoked by 18- to 20-year-old smokers corresponds to the number of cigarettes sold to

them or to others on their behalf, the maximum immediate loss of sales would be just 2% of the total cigarette sales in the United States. If we assume that this intervention would have a long-term impact on the prevalence of smoking by adolescents and young adults, the gradual aging of this low-tobacco-use cohort would give plenty of time for small businesses to adjust to changing market conditions were the minimum legal tobacco sales age raised to 21 years.

Similar objections were raised decades ago when the national minimum drinking age was proposed to be raised to 21 years. After the law was passed and implemented by most states in the 1980s, a reduction in drinking, problematic drinking, drinking and driving, and alcohol-related crashes among youths was seen.¹⁴

The alcohol industry still survived by adapting to the changing market despite the loss of sales to those younger than 21 years. Furthermore, retailers are already required under federal rules to check the ID of anyone who appears to be younger than 27 years seeking to purchase tobacco,¹⁵ so an age-21 requirement would place no additional compliance burdens on their staff. The fact that more than one third of the 18- to 20-year-old young adults live with 3 or more individuals highlights the additional potential for blocking the transfer of tobacco use behavior to other household members.

OVERALL IMPLICATIONS

The evolving neuroscience of the young adult brain demonstrates

TABLE 1—Basic Characteristics of Respondents and Current Smokers: 2011 National Health Interview Survey, United States

Characteristics	Respondents Aged 18–20 Years (n = 1239), No. (%) or Mean ±SD	Current Smokers Aged 18–20 Years (n = 188), No. (%) or Mean ±SD	Respondents Aged ≥ 21 Years (n = 31 775), No. (%) or Mean ±SD	Current Smokers Aged ≥ 21 Years (n = 5950), No. (%) or Mean ±SD
Gender				
Male	610 (49.23)	96 (51.06)	14 201 (44.69)	3112 (52.30)
Female	629 (50.77)	92 (48.94)	17 574 (55.31)	2838 (47.70)
Race/ethnicity				
White	867 (69.98)	144 (76.6)	24 207 (76.18)	4570 (76.81)
Black	245 (19.77)	31 (16.49)	4948 (15.57)	1031 (17.33)
American Indian/Alaska Native	22 (1.78)	2 (1.06)	375 (1.18)	108 (1.82)
Asian Indian	9 (0.73)	0 (0)	394 (1.24)	28 (0.47)
Chinese	19 (1.53)	1 (0.53)	458 (1.44)	35 (0.59)
Filipino	18 (1.45)	3 (1.6)	450 (1.42)	49 (0.82)
Other Asian	43 (3.47)	6 (3.19)	775 (2.44)	100 (1.68)
Not released	4 (0.32)	0 (0)	74 (0.23)	8 (0.13)
Multiple race	12 (0.97)	1 (0.53)	94 (0.30)	21 (0.35)
Hispanic	318 (25.67)	33 (17.55)	5549 (17.46)	721 (12.12)
Household number per family				
1	524 (42.29)	87 (46.28)	22 369 (70.4)	4368 (73.41)
2	257 (20.74)	55 (29.26)	8159 (25.68)	1328 (22.32)
3	305 (24.62)	34 (18.09)	841 (2.65)	178 (2.99)
≥ 4	153 (12.35)	12 (6.38)	406 (1.28)	76 (1.28)
Mean ±SD	2.12 ±1.2	1.88 ±1.07	1.36 ±0.66	1.33 ±0.66
Current smoker	188 (15.2)		5950 (18.7)	

Note. The sample size was n = 33 014 participants.

TABLE 2—Average Cigarette Consumption by Age for Current Smokers and Percentage of 18- to 20-Year-Old Smokers as a Percentage of Total Adult Cigarette Consumption: 2011 National Health Interview Survey, United States

Variable	All Participants Aged ≥ 18 Years, Mean of No.	Participants Aged 18–20 Years	Participants Aged ≥ 21 Years	Participants Aged 18–20 Years, % of Total Sample
Average daily cigarette consumption per smoker	12.38	8.57	12.50	
Average annual cigarette consumption per smoker	4520.28	3131.62	4564.16	
No. of current smokers	6138	188		3.06
Total no. of cigarettes smoked in 2011	27 745 475	588 745		2.12

Note. Current smokers included both daily and nondaily users, and lifetime consumption of greater than 100 cigarettes. The same size was n = 33 014 participants, including n = 6138 current smokers; 18.6% of the population reported lifetime use of greater than 100 cigarettes and some level of current use.

a special susceptibility to even experimental tobacco use.¹ Low minimum sales age laws exploit that susceptibility to addict youths to cigarettes for life, with relatively few cigarettes. Meanwhile, raising the sales age would appear likely to have a significant effect on current tobacco use rates among youths, decreasing the chances of a person ever becoming tobacco dependent. By some estimates, raising the tobacco sales age to 21 years would reduce tobacco use prevalence by 55% for 15- to 17-year-old adolescents within 7 years.¹⁶

In 2005, Needham, Massachusetts, was the first town in the country to implement the law to raise the tobacco sales age to 21 years. Following the implementation of the law, the Youth Risk Behavior Surveillance System and Metro West Health Foundations' Adolescent Health survey data showed a 47% reduction in Needham high-school smoking rate in the 4 years (2006–2010) after the legislation was implemented.¹⁷ Of note, no tobacco retailers have gone out of business in Needham since implementation.

LIMITATIONS

Although we have not specifically accounted for other non-cigarette tobacco or smokeless

tobacco sales, we have accounted for any tobacco that is smoked and self-reported as a cigarette, the form that has the highest disease burden. According to the Centers for Disease Control and Prevention's *Morbidity and Mortality Weekly Report*, about 90% of all combustible tobacco consumption is cigarettes among adult smokers.¹⁸ In addition, 2012 National Youth Tobacco Survey data indicate that the majority of tobacco consumption remains cigarettes, and high-school students in the young adult age range (>17 years) are 3 times more likely to smoke cigarettes daily than use any other combination of cigars, bidis, and cigarillos on a daily basis.

Adult versus youth smokeless tobacco use rates and amount consumed are much harder to quantify and we intentionally excluded these to avoid reporting bias. In addition, the US retail cigarette market is more than 30 times greater than the smokeless tobacco market, making any adult versus youth consumption discrepancy unlikely to change our overall estimate of the tobacco sales impact.¹⁹

CONCLUSIONS

Overall, a small percentage of total tobacco sales (2%) is attributed to those younger than

21 years, yet most lifetime tobacco users start smoking before the age of 21 years. Early tobacco initiation during young adulthood comes with a high probability of addiction, progression to daily smoking, and heavier tobacco use in adulthood, and has long-term harmful health consequences. Action on this critical issue of raising the minimum tobacco sales age to 21 years across the United States has excellent public health and ethical rationales, and costs almost nothing to implement through existing regulatory frameworks. ■

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Contributors

J.P. Winickoff originated and designed this study, drafted the article and revised it, and takes full responsibility for the final submission. L. Hartman, M. Gottlieb, E. Nabi-Burza, and J.R. DiFranza made substantial intellectual contributions to the conceptualization and design of the study, and to editing the article. M.L. Chen advised on and conducted data analyses, and participated in the interpretation of results. All authors approved the final article as submitted.

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Human Participant Protection

This study was exempt from institutional review board approval because it is a secondary data analysis of a publicly available data set.

References

- DiFranza JR, Wellman R, Mermelstein R, et al. The natural history and diagnosis of nicotine addiction. *Curr Pediatr Rev*. 2011;7:88–96.
- Zhan W, Dierker LC, Rose JS, Selya A, Mermelstein RJ. The natural course of nicotine dependence symptoms among adolescent smokers. *Nicotine Tob Res*. 2012;14(12):1445–1452.
- Taioli E, Wynder EL. Effect of the age at which smoking begins on frequency of smoking in adulthood. *N Engl J Med*. 1991;325(13):968–969.
- US Department of Health and Human Services. Preventing tobacco use

- among youth and young adults: a report of the Surgeon General, 2012. Available at: <http://www.surgeongeneral.gov/library/reports/preventing-youth-tobacco-use/#Full%20Report>. Accessed November 26, 2013.
5. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General, 2014. Available at: <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/exec-summary.pdf>. Accessed June 1, 2014.
 6. DiFranza JR. Which interventions against the sale of tobacco to minors can be expected to reduce smoking? *Tob Control*. 2012;21(4):436–442.
 7. DiFranza JR, Coleman M. Sources of tobacco for youths in communities with strong enforcement of youth access laws. *Tob Control*. 2001;10(4):323–328.
 8. Ribisl KM, Norman GJ, Howard-Pitney B, Howard KA. Which adults do underaged youth ask for cigarettes? *Am J Public Health*. 1999;89(10):1561–1564.
 9. Ahmad S. Closing the youth access gap: the projected health benefits and cost savings of a national policy to raise the legal smoking age to 21 in the United States. *Health Policy*. 2005;75(1):74–84.
 10. Mowery PD, Brick PD, Farrelly MC. Legacy first look report 3. Pathways to established smoking: results from the 1999 National Youth Tobacco Survey. Washington DC: American Legacy Foundation; 2000.
 11. Winickoff JP, Gottlieb M, Mello MM. Tobacco 21—an idea whose time has come. *N Engl J Med*. 2014;370(4):295–297.
 12. Discussion draft sociopolitical strategy. Chart. January 21, 1986. Philip Morris. Bates no. 2043440040/0049. Available at: <http://legacy.library.ucsf.edu/tid/aba84e00>. Accessed January 10, 2014.
 13. Wade CM. Proposal on teen smoking decried. Available at: <http://www.bostonglobe.com/metro/regionals/north/2013/12/01/board-plan-increase-tobacco-buying-age-newburyport-riles-store-owners-mayor/9IcbV2ra3L5nCi06jILJK/story.html>. Accessed February 27, 2014.
 14. McCartt AT, Helling LA, Kirley BB. The effects of minimum legal drinking age 21 laws on alcohol-related driving in the United States. *J Safety Res*. 2010;41(2):173–181.
 15. Cigarettes and smokeless tobacco, 21 CFR § 1140.14(b).
 16. Ahmad S, Billimek J. Limiting youth access to tobacco: comparing the long-term health impacts of increasing cigarette excise taxes and raising the legal smoking age to 21 in the United States. *Health Policy*. 2007;80(3):378–391.
 17. MetroWest Health Foundation. 2006 and 2010 MetroWest Adolescent Health Surveys. Available at: <http://www.mwhealth.org/PublicationsampMedia/Reports/tabid/192/Default.aspx>. Accessed July 1, 2013.
 18. Centers for Disease Control and Prevention. Tobacco product use among middle and high school students—United States, 2011 and 2012. *MMWR Morb Mortal Wkly Rep*. 2013;62(45):893–897 [erratum in *MMWR Morb Mortal Wkly Rep*. 2013;62(46):940].
 19. National Institute on Drug Abuse. Topics in brief: smokeless tobacco. Available at: <http://www.drugabuse.gov/publications/topics-in-brief/smokeless-tobacco>. Accessed June 18, 2014.