

A Longitudinal Study of Exposure to Retail Cigarette Advertising and Smoking Initiation



WHAT'S KNOWN ON THIS SUBJECT: Point of sale is the dominant channel for advertising cigarettes, and adolescents are routinely exposed to these messages.



WHAT THIS STUDY ADDS: This is the first longitudinal study to provide evidence that adolescents' exposure to widespread cigarette advertising at the point of sale is a risk factor for smoking initiation.

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KEY WORDS

adolescence, advertising, cohort studies, smoking

ABBREVIATION

FDA—Food and Drug Administration

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abstract

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OBJECTIVES: Accumulating evidence suggests that widespread advertising for cigarettes at the point of sale encourages adolescents to smoke; however, no longitudinal study of exposure to retail tobacco advertising and smoking behavior has been reported.

METHODS: A school-based survey included 1681 adolescents (aged 11–14 years) who had never smoked. One measure of exposure assessed the frequency of visiting types of stores that contain the most cigarette advertising. A more detailed measure combined data about visiting stores near school with observations of cigarette advertisements and pack displays in those stores. Follow-up surveys 12 and 30 months after baseline (retention rate: 81%) documented the transition from never to ever smoking, even just a puff.

RESULTS: After 12 months, 18% of adolescents initiated smoking, but the incidence was 29% among students who visited convenience, liquor, or small grocery stores at least twice per week and 9% among those who reported the lowest visit frequency (less than twice per month). Adjusting for multiple risk factors, the odds of initiation remained significantly higher (odds ratio: 1.64 [95% confidence interval: 1.06–2.55]) for adolescents who reported moderate visit frequency (0.5–1.9 visits per week), and the odds of initiation more than doubled for those who visited ≥ 2 times per week (odds ratio: 2.58 [95% confidence interval: 1.68–3.97]). Similar associations were observed for the more detailed exposure measure and persisted at 30 months.

CONCLUSIONS: Exposure to retail cigarette advertising is a risk factor for smoking initiation. Policies and parenting practices that limit adolescents' exposure to retail cigarette advertising could improve smoking prevention efforts. *Pediatrics* 2010;126:232–238

Tobacco use among adolescents has declined since 2000, but 21% of eighth-graders and 45% of high school seniors still report experimenting with smoking.¹ Because this behavior increases the risk for adult smoking,^{2,3} it is important for pediatricians to be aware of environmental factors that promote smoking experimentation and initiation in childhood and adolescence.

Point of sale has become the dominant channel for tobacco advertising in the United States, representing 90% of the tobacco industry's \$12.5 billion marketing budget in 2006.⁴ The quantity of cigarette ads in stores has increased over time,^{5,6} and tobacco companies provide more ads and shelf space for cigarettes in stores where adolescents shop frequently.⁷ Not surprising, 63.7% of US adolescents reported seeing ads for cigarettes all or most of the time when they visit convenience stores, supermarkets, and gas stations.⁸

Two population-based surveys of adolescents examined the impact of retail tobacco marketing on smoking initiation. A US study correlated data from the Monitoring the Future school surveys with the prevalence of tobacco advertising in convenience stores near the surveyed schools.⁹ Higher scores on a measure of retail tobacco advertising were correlated with higher odds of "puffing" (only), but the study could not determine whether surveyed adolescents visited any of those stores. A national survey of students (aged 14–15) in New Zealand observed a graded, cross-sectional relationship between the frequency of visiting stores that sell cigarettes and the odds of experimenting with smoking¹⁰; however, in New Zealand, tobacco advertising is banned at the point of sale and pack displays are the only form of retail promotion. Thus, previous studies were cross-sectional, and neither measured exposure to retail tobacco

advertising per se. A longitudinal survey of California adolescents revealed that perceived exposure to cigarette advertising in stores and to actors who smoke on television were associated with greater susceptibility to smoking at follow-up,¹¹ but the study did not examine the unique influence of retail cigarette advertising on smoking behavior. To address these important gaps in the literature, this study examined whether exposure to retail cigarette advertising is a risk factor for smoking initiation, by using longitudinal data from a sample of adolescents for whom cross-sectional findings have been reported.^{12,13} A secondary objective was to examine which of 3 exposure measures that were correlated with trying smoking at baseline predict initiation at follow-up.

METHODS

The Survey of Teen Opinions about Retail Environments (STORE) combined data from a longitudinal, school-based survey with observations of retail tobacco marketing in Tracy, California (population 56 929), a Central Valley city with a similar ethnic/racial composition to the state of California and a higher median household income. Active parental consent and student assent were obtained by using a protocol that was approved by Stanford University's Administrative Panel on Human Subjects. The baseline survey was administered at all 3 middle schools in grades 6 to 8 (February through April 2003) by using a procedure described elsewhere (78% participation rate).¹² Follow-up surveys were administered ~12 months after baseline, when students were in grades 7 to 9, and ~30 months after baseline, when students were in grades 9 to 11.

Measures

Two items assessed adolescents' smoking status at baseline and follow-ups: ever smoking, even just a puff, and

number of days smoked in the past month. The primary outcome was smoking initiation, defined as the transition from never smoking to ever smoking at either follow-up. This study did not examine current smoking as a separate outcome because the incidence of smoking in the previous 30 days was quite low: 4.1% at 12 months and 7.9% at 30 months.

We compared 3 measures of exposure to retail cigarette advertising reported in a previous cross-sectional study.¹³ A 3-item measure of shopping frequency asked students to report how often they visited any convenience stores, small markets, and liquor stores, 3 types of stores that typically contain the most cigarette advertising.^{14–16} A more detailed measure combined information about where and how often students shopped in stores near school and assessed the quantity of advertising and shelf space (product facings) for cigarettes in those stores. Specifically, we multiplied the frequency of visits to each store near school by the number of cigarette-branded ads, functional items (eg, ash cans, clocks, counter mats), and product facings in each store and then summed scores for each student to compute cigarette brand impressions per week. A measure of perceived exposure, adapted from the National Youth Tobacco Survey, was a single item that asked students to estimate how often they see cigarette ads when they visit stores.⁸

Measurements of other baseline characteristics that could confound associations between exposure to retail cigarette advertising and smoking initiation are described in more detail elsewhere.¹² Briefly, exposure to social influences to smoke was measured by asking about current smoking by a parent or other household member, the number of 4 best friends who smoke, and perceived ex-

posure to people who smoke in movies or on television. Other covariates were risk-taking propensity,¹⁷ unsupervised time after school (days per week), self-reported grades in school, and demographics (gender, grade level, race, and ethnicity).

Analyses

Of the 2110 students who completed a baseline survey, 1681 reported never having tried smoking, and 1356 of these provided data about smoking behavior at either or both follow-ups (retention rate: 81%). Attrition analyses compared all covariates for this analysis sample with the 325 who were lost to follow-up, by using χ^2 and *t* tests.

Tests of the primary hypothesis about exposure to retail cigarette advertising and smoking initiation used multilevel modeling to account for clustering of students within schools. Although exposure to retail cigarette advertising varied significantly among schools, the relationships between exposure and smoking initiation did not vary. In the final models, all covariates were also treated as fixed effects, and the intercept randomly varied across schools. Separate multilevel models examined smoking

shopping frequency and cigarette brand impressions per week with smoking initiation at 12-month and 30-month follow-ups. Because these 2 exposure variables were quite skewed, we compared groups according to tertiles. All models included perceived exposure as a covariate because it was not highly correlated with other exposure measures at baseline,¹³ and a previous study observed independent associations of perceived exposure and shopping frequency with adolescent smoking.¹⁰ All models also adjusted for demographics, exposure to smoking by parents and peers, risk-taking behavior, exposure to smoking on television or in movies, self-reported grades in school, and unsupervised time after school. The last 2 variables were dichotomized at the median value because the distributions were quite skewed. Race and ethnicity were treated as separate variables. Race was coded to compare any minority with Hispanic and non-Hispanic white students because the last 2 groups have the highest smoking rates among California adolescents. Ethnicity was coded to compare any Hispanic with non-Hispanic students regardless of race.

RESULTS

Attrition was ~30% between each assessment and was consistent across grades. No greater attrition occurred during the transition to high school. The baseline never smokers who were lost to follow-up were more likely than the analysis sample to be boys (56.0% vs 44.2%; *P* < .001), to live with a smoker (47.2% vs 38.0%; *P* < .01), to earn mostly Bs or lower (58.3% vs 38.8%; *P* < .001), and to score higher on risk-taking behavior (2.6 vs 2.4; *P* < .001). Students who were lost to follow-up did not differ from the analysis sample on shopping frequency (*P* = .27); however, students who were lost to follow-up were more likely than the analysis sample to rank in the highest tertile of cigarette brand impressions per week (42.8% vs 31.1%; *P* < .001). No differences between the 2 groups were observed for other covariates, including exposure to peer smoking and unsupervised time after school.

The analysis sample (aged 11–14 at baseline) included slightly more girls than boys (Table 1). The sample was both racially and ethnically diverse: 5.3% black, 14.9% Asian/Pacific Islander, 23.0% multiracial, 53.4% white,

TABLE 1 Characteristics of Never Smokers at Baseline and Association With Exposure to Retail Tobacco Marketing

Characteristics at Baseline	<i>n</i>	Value	Shopping Frequency, visits/wk			<i>P</i>
			Low	Moderate	High	
Grade level, %	1356					.120
6	504	37.2	33.0	38.5	40.2	
7	410	30.2	32.5	27.7	30.5	
8	442	32.6	34.5	33.8	29.4	
Male gender, %	1354	44.2	42.2	43.4	46.8	.355
Hispanic ethnicity, %	1342	40.2	30.6	38.5	51.1	<.001
Racial minority	1351	46.0	46.4	48.2	43.2	.317
Self-reported grades (mostly Bs or below), %	1351	38.8	31.3	37.9	46.9	<.001
Unsupervised after school (>2 d/wk), %	1342	50.2	42.3	55.0	53.8	<.001
Risk-taking propensity (4 = max), mean ± SD	1355	2.4 ± 0.9	2.3 ± 0.9	2.5 ± 0.8	2.6 ± 1.0	<.001
At least 1 parent/household smoker, %	1353	38.0	27.3	39.7	47.1	<.001
At least 1 friend smokes, %	1354	9.7	8.2	9.2	11.7	.180
Perceived exposure, mean ± SD						
See smoking in movies/television (4 = often)	1352	2.8 ± 0.9	2.6 ± 0.9	2.9 ± 0.9	2.3 ± 1.0	<.001
See cigarette ads in stores (4 = often)	1354	3.2 ± 0.8	3.1 ± 0.8	3.3 ± 0.8	3.4 ± 0.8	<.001
Cigarette brand impressions/wk, mean ± SD	1354	324.7 ± 501.2	113.9 ± 266.8	226.9 ± 304.9	633.4 ± 663.6	<.001

P values derived from χ^2 or analysis of variance. All proportions are column percentages unless otherwise noted. For example, 33% of students who reported low shopping frequency were sixth-graders.

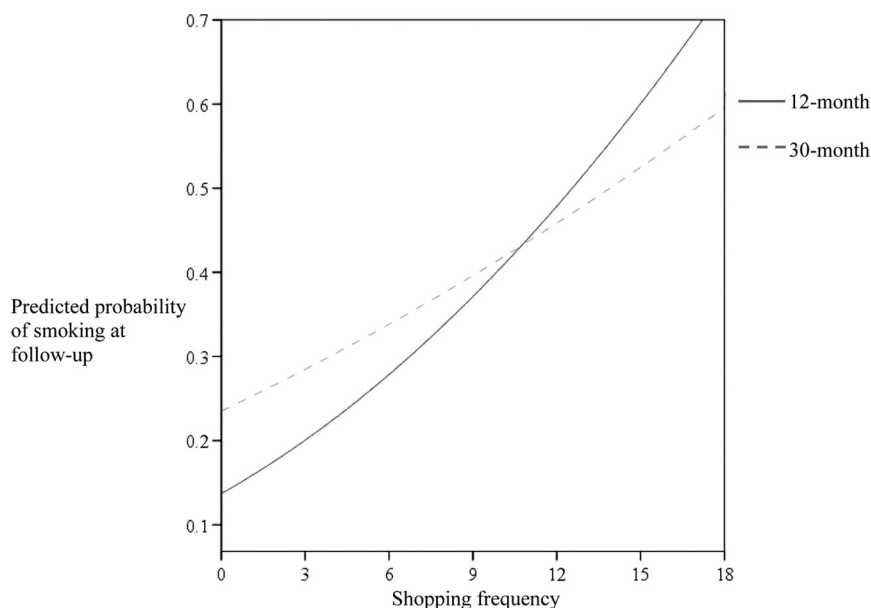


FIGURE 1

Predicted probability of smoking initiation at follow-up on the basis of shopping frequency (visits per week) measured at baseline.

and 3.5% other or unknown; 40.2% were Hispanic.

At baseline, adolescents who had never smoked reported visiting convenience stores, liquor stores, or small markets an average of 2.1 times per week (SD: 2.8; maximum: 18.0). Visits to stores near school yielded an average of 325 cigarette brand impressions per week (SD: 501; maximum: 5987). These cues were noticeable to never smokers: 82.1% of the sample reported seeing cigarette ads in stores sometimes or often. As shown in Table 1, shopping frequency was positively correlated with other measures of exposure to retail cigarette advertising and with several risk factors for smoking initiation. Shopping frequency was unrelated to gender, age (grade level), being a racial minority, and having at least 1 friend who smokes.

The incidence of smoking initiation was 18% after 12 months and 27% after 30 months. The unadjusted associations between store visits at baseline and the probability of smoking at 12- and 30-month follow-ups illustrate a graded relationship (Fig 1). A signifi-

cant quadratic term indicates an accelerated probability of smoking with more frequent store visits. Table 2 summarizes the odds ratios and confidence intervals from the multilevel model, adjusted for all covariates in the table. Compared with students who reported the lowest shopping fre-

quency (fewer than 0.5 visits per week), the odds of initiation after 12 months increased 64% for students who reported moderate visits (0.6–1.9 visits per week) and more than doubled for those who reported ≥ 2 visits per week (see Table 2). This association persisted at the 30-month follow-up: the odds of smoking increased 19% for moderate visits and 42% for the most frequent visits. Although Hispanic adolescents were more likely than others to report trying smoking at the 12-month follow-up, there was no significant interaction of ethnicity with shopping frequency on smoking initiation (data not shown).

Perceived exposure predicted a small but significant increase in the odds of initiating, but only at the 30-month follow-up (see Table 2). Tests of an interaction examined whether the impact of shopping frequency on smoking initiation was greater for students who perceived more exposure to cigarette ads in stores, but it was not significant (data not shown).

The most detailed measure of exposure, cigarette brand impressions per

TABLE 2 Predictors of Smoking Initiation After 12 and 30 Months

Baseline Characteristics	Smoking at 12 mo (<i>n</i> = 1182), OR (95% CI)	Smoking at 30 mo (<i>n</i> = 895), OR (95% CI)
Constant	0.02 (0.01–0.06)	0.03 (0.02–0.04)
Grade level		
6	1.00	1.00
7	0.88 (0.58–1.32)	1.41 (1.19–1.67)
8	1.44 (0.99–2.10)	1.26 (1.07–1.49)
Male gender	0.94 (0.68–1.30)	0.86 (0.75–0.99)
Ethnicity (Hispanic vs all others)	1.59 (1.15–2.22)	1.43 (1.25–1.65)
Racial minority (any vs all others)	1.01 (0.73–1.40)	0.88 (0.77–1.01)
Self-reported grades (mostly Bs or below)	1.51 (1.10–2.09)	1.61 (1.40–1.86)
Unsupervised after school (>2 d/wk)	1.36 (0.98–1.88)	0.83 (0.73–0.96)
Risk-taking propensity (1–4)	1.51 (1.25–1.81)	1.41 (1.30–1.53)
At least 1 parent/household smoker	1.54 (1.12–2.12)	1.25 (1.09–1.44)
At least 1 friend smokes	1.67 (1.06–2.64)	1.91 (1.56–2.36)
Perceived exposure		
See smoking in movies/television (4 = often)	1.10 (0.91–1.31)	1.26 (1.17–1.36)
See cigarette ads in stores (4 = often)	0.90 (0.74–1.10)	1.11 (1.02–1.22)
Shopping frequency (visits/wk)		
Low (<0.5)	1.00	1.00
Moderate (0.5–1.9)	1.64 (1.06–2.55)	1.19 (1.00–1.41)
High (2.0–18.0)	2.58 (1.68–3.97)	1.42 (1.19–1.69)

Odds ratios (ORs) are adjusted for all other variables in the table. CI indicates confidence interval.

TABLE 3 Cigarette Brand Impressions as Predictor of Smoking Initiation After 12 and 30 Months

Baseline Characteristics	Smoking at 12 mo (<i>n</i> = 1182), OR (95% CI)	Smoking at 30 mo (<i>n</i> = 895), OR (95% CI)
Constant	0.03 (0.01–0.07)	0.03 (0.01–0.09)
Grade level		
6	1.00	1.00
7	0.88 (0.58–1.32)	1.39 (0.94–2.07)
8	1.52 (1.04–2.22)	1.26 (0.85–1.86)
Male gender	0.94 (0.68–1.30)	0.87 (0.62–1.20)
Ethnicity (Hispanic vs all others)	1.56 (1.12–2.17)	1.38 (0.99–1.93)
Racial minority (any vs all others)	1.01 (0.73–1.39)	0.88 (0.63–1.22)
Self-reported grades (mostly Bs or below)	1.55 (1.13–2.14)	1.61 (1.15–2.25)
Unsupervised after school (>2 d/wk)	1.31 (0.95–1.82)	0.82 (0.59–1.13)
Risk-taking propensity (1–4)	1.50 (1.25–1.80)	1.40 (1.16–1.70)
At least 1 parent/household smoker	1.61 (1.17–2.21)	1.27 (0.91–1.76)
At least 1 friend smokes	1.61 (1.02–2.54)	1.88 (1.15–3.06)
Perceived exposure		
See smoking in movies/television (4 = often)	1.08 (0.90–1.30)	1.26 (1.05–1.51)
See cigarette ads in stores (4 = often)	0.90 (0.73–1.10)	1.10 (0.89–1.36)
Cigarette brand impressions per week		
Low (<60)	1.00	1.00
Moderate (60–259)	1.22 (0.79–1.89)	1.20 (0.81–1.79)
High (≥260)	2.36 (1.55–3.61)	1.58 (1.05–2.37)

Odds ratios (ORs) are adjusted for all other variables in the table. CI indicates confidence interval.

week, predicted similar increases in the odds of smoking initiation at both follow-ups. After 12 months, the odds of smoking were 2.36 times greater for students who ranked in the highest category of exposure (≥260 brand impressions per week) than for students who ranked in the lowest category of exposure (<60 brand impressions per week); after 30 months, the odds of smoking were 58% greater (Table 3). The difference between moderate and low tertiles of cigarette brand impressions was not significant at either time point.

DISCUSSION

This is the first longitudinal study to provide evidence that adolescents' exposure to widespread cigarette advertising at the point of sale is a risk factor for smoking initiation. Two measures of exposure were developed by (1) assessing self-reported frequency of visits to the types of stores that contain the most cigarette advertising and (2) eliciting information about where and how often adolescents shopped near school and observing the quantity of ads and pack

facings in those stores. Adjusting for multiple other risk factors, both measures predicted significant increases in the odds of initiating smoking among adolescents who had never smoked at baseline. A graded relationship was also observed: the more store visits adolescents reported at baseline, the greater their chances of initiating smoking at follow-up.

Contrary to expectation, the most detailed exposure measure, cigarette brand impressions per week, was not a substantially better predictor of smoking initiation than the 3-item measure of shopping frequency. Because the combination of in-store observations with student survey data are costly and impractical for population-based surveys, we recommend shopping frequency as an appropriate and useful indicator of exposure to retail tobacco advertising.¹⁵ An alternative is to infer exposure from geographic area measures, such as the density of stores that sell cigarettes in specified neighborhoods or the quantity of cigarette ads that those stores contain. Imputing environmental data to individuals

assumes that exposure is constant for individuals in the same area, but this study observed substantial individual differences in adolescents' exposure to retail cigarette advertising within school neighborhoods. This does not invalidate area measures of exposure but indicates that such predictors will have limited power.

Perceived exposure (noticing cigarette ads) was not as strong a predictor of smoking initiation as the other measures of exposure. This result is consistent with our cross-sectional report and our conclusion that perceived exposure measures a different underlying construct.¹³ Additional research is needed to examine whether perceived exposure measures a cognitive bias for cigarette advertising and whether it predicts other aspects of adolescent smoking. Such inquiry is important because perceived exposure is typically the only item about the retail environment that appears on state and national surveys about adolescent smoking.

Strengths of this study are its longitudinal design, the inclusion of multiple measures of exposure to retail cigarette advertising, and the assessment of behavioral outcomes at 2 follow-ups. Surveying students in a single California community is the primary weakness of this study and limits the ability to generalize findings to other adolescents and stores; however, it seems unlikely that adolescents' exposure to retail tobacco advertising and its relationship with smoking behavior would be different for adolescents who live in other areas where cigarette packs and advertising are displayed prominently at the point of sale. California has the longest running anti-tobacco media campaign in the United States but does not advertise anti-tobacco messages at the point of sale. Exposure to anti-tobacco ed-

ucation in the media and in school might make California adolescents more resistant than others to retail cigarette advertising, but that would make it more difficult to detect its effect on smoking behavior in this sample.

The response and retention rates in this study are comparable to other school-based surveys that use active parental consent^{18,19}; however, students who were lost to follow-up reported more frequent exposure to retail cigarette advertising at baseline. Consequently, this study may underestimate its impact on smoking behavior at follow-up. By focusing exclusively on exposure measured at baseline, this study cannot assess the impact of cumulative exposure to retail cigarette advertising on smoking.

Previous research has shown that adolescents' exposure to pack displays alone, in the absence of cigarette advertising at the point of sale, is associated with increased intentions to smoke.^{10,20} This study cannot disentangle the relative importance of advertising and pack displays in encouraging youth smoking.

Shopping frequency may be a proxy for access to cigarettes or for other unmeasured confounders; however, this study controlled for a large number of potential confounders, including unsupervised time and risk-taking propensity. It is highly plausible that retail cigarette advertising would influence smoking initiation because it is ubiquitous at the point of sale and salient to

adolescents. Thus, it seems unlikely that an unmeasured risk factor confounded our results. Moreover, because randomized trials of the influence of retail cigarette advertising are not possible, longitudinal studies such as this one provide the strongest guidance available to establish relevant policies.

In 2009, the Family Smoking Prevention and Tobacco Control Act granted the Food and Drug Administration (FDA) authority to regulate the manufacturing, marketing, and sale of tobacco products.²¹ Three provisions that could reduce the impact of pro-smoking cues at the point of sale are restricting tobacco advertising to black-and-white, text-only ("tombstone") format, eliminating misleading terms such as "light" and "mild," and mandating stronger warning labels on advertising and packaging. Even with expanded authority, the FDA's restrictions must be consistent with the first amendment, a requirement that tobacco companies are contesting in court.²² Indeed, a previous FDA ruling mandating tombstone advertisements did not survive judicial review.²³ Results of this study provide empirical evidence for the argument that restricting advertising at the point of sale could reduce adolescent smoking.

CONCLUSIONS

A growing body of evidence suggests that stores that are saturated with cigarette advertising and product displays constitute a significant public health concern, particularly for

youth.²⁴ Results from this longitudinal study complement and extend previous findings from cross-sectional surveys^{9,10} and experiments.^{20,25} Additional longitudinal studies are needed to assess the impact of retail cigarette advertising on other behavioral outcomes, such as established smoking and brand choice.²⁶

The steady decline in smoking rates among US adolescents that has been observed since 2000 is unlikely to continue without addressing the proliferation of cigarette advertising at the point of sale. Both US and international agencies identify regulations of retail advertising and promotions as a priority for tobacco control.^{27,28} Smoking initiation by children and adolescents remains significant, and health professionals need to maintain their vigilance. Until and unless public health efforts to curtail tobacco advertising and promotion further in retail settings succeed, those who care for adolescent patients should warn them and their parents about the potential effects of exposure to such advertising. Widespread adoption is needed for current clinical guidelines that call for medical care providers to assess smoking status and provide support for cessation. Pediatricians and other health care practitioners could also advocate for anti-tobacco education that addresses retail promotion.

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Helmets Are Not Just for Children: A recent article in The New York Times (Alderman L, May 22, 2010) noted that 90 percent of the 714 bicyclists killed in 2008 were not wearing helmets. This data compiled by the Insurance Institute for Highway Safety called for adults over 30 being strongly encouraged to wear helmets because their gray matter is not packed as tightly as it used to be. According to Dr Angela F. Gardner, president of the American College of Emergency Physicians, “As you age, your brain shrinks, but your skull does not. That extra space means that the brain can bounce around inside the skull and may be more easily damaged from a blow.” Despite this, while half of our states have laws requiring children and teens to wear helmets, no state requires people of all ages to do so. Perhaps we can encourage our parents to do what our kids do when they ride their bikes—wear a helmet!

Noted by JFL, MD

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