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Ruth A. Shults

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention

Tamara M. Haegerich

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention

Geeta Bhat

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention

Xinjian Zhang

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention

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Teens and seat belt use: What makes them click?☆



Ruth A. Shults,* Tamara M. Haegerich, Geeta Bhat, Xinjian Zhang

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Hwy, N.E., MS F62, Atlanta, GA 30341, USA

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ABSTRACT

Problem: Motor vehicle crashes kill more adolescents in the United States than any other cause, and often the teen is not wearing a seat belt. **Methods:** Using data from the 2011 Youth Risk Behavior Surveys from 38 states, we examined teens' self-reported seat belt use while riding as a passenger and identified individual characteristics and environmental factors associated with always wearing a seat belt. **Results:** Only 51% of high school students living in 38 states reported always wearing a seat belt when riding as a passenger; prevalence varied from 32% in South Dakota to 65% in Delaware. Seat belt use was 11 percentage points lower in states with secondary enforcement seat belt laws compared to states with primary enforcement laws. Racial/ethnic minorities, teens living in states with secondary enforcement seat belt laws, and those engaged in substance use were least likely to always wear their seat belts. The likelihood of always being belted declined steadily as the number of substance use behaviors increased. **Discussion:** Seat belt use among teens in the United States remains unacceptably low. Results suggest that environmental influences can compound individual risk factors, contributing to even lower seat belt use among some subgroups. **Practical applications:** This study provides the most comprehensive state-level estimates to date of seat belt use among U.S. teens. This information can be useful when considering policy options to increase seat belt use and for targeting injury prevention interventions to high-risk teens. States can best increase teen seat belt use by making evidence-informed decisions about state policy options and prevention strategies.

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1. Introduction

Learning to drive is an important milestone for most adolescents in the United States. While novice teen drivers gain experience, their crash risk is high. Motor vehicle crashes kill more adolescents in the United States than any other cause (CDC, 2015), and most of these deaths occur in crashes involving teens either driving or riding with a teen driver (Insurance Institute for Highway Safety [IIHS], 2015b). In 2013, 1725 teens aged 16–19 years died in passenger vehicle crashes; 567 of the fatally injured teens were drivers. Only 47% of fatally injured drivers and 34% of passengers were wearing a seat belt (IIHS, 2015b). Seat belts are the most effective means for reducing serious injuries and deaths in a crash (Dinh-Zarr et al., 2001). Although seat belt use has increased in the United States in recent years (Shults & Beck, 2012; National Highway Traffic Safety Administration [NHTSA], 2015a), use by teens and young adults continues to lag behind use by adults aged ≥25 years (NHTSA, 2015a,b).

Seat belt laws increase seat belt use and reduce traffic fatalities in the general population. (Dinh-Zarr et al., 2001). As of June 2015, 34 states

and the District of Columbia had primary enforcement seat belt laws (primary laws), which allow law enforcement to stop drivers and issue tickets solely because someone is not belted, and 15 states had secondary enforcement seat belt laws (secondary laws), which allow tickets to be issued only after a driver has been pulled over for another reason. Some states with secondary laws have a primary enforcement provision within the law for children and youth, typically up to age 17 or 18 years (Governors Highway Safety Association [GHSA], 2015a). New Hampshire, the only state without a seat belt law for adults, has a primary enforcement provision for drivers and passengers <18 years as part of their child passenger safety law (GHSA, 2015a).

To our knowledge, only two studies have estimated the effectiveness of enacting seat belt laws specifically on teen seat belt use in the United States (Carpenter & Stehr, 2008; O'Malley & Wagenaar, 2004). O'Malley and Wagenaar (2004) found a 14% post-law increase in self-reported belt use among high school seniors living in 20 states that passed secondary seat belt laws during 1986–2000. Carpenter and Stehr (2008) estimated the effects of changes in seat belt laws from 1991 to 2005. They found that, relative to states that did not pass a seat belt law, states that passed a primary law experienced a 14 percentage point reduction in students who rarely or never wore a seat belt. Similarly, cross-sectional studies that examined the association between the type of seat belt law and teen belt use have consistently reported higher use rates in states with primary seat belt laws (Durbin, Smith, Kallan, Elliott, & Winston, 2007; García-España, Winston, & Durbin, 2012; McCartt & Northrup, 2004).

☆ The findings and conclusions in this paper of those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

* Corresponding author at: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Hwy, N.E., MS F62, Atlanta, GA 30341, USA. Tel.: 770 488 4638; fax: +770 488 1317.

E-mail address: rshults@cdc.gov (R.A. Shults).

Community-level and regional differences in teen seat belt use are not well understood. However, observational seat belt surveys and fatal crash data indicate that persons of all ages living in rural areas have seat belt use rates slightly lower than their counterparts in urban areas (NHTSA, 2015a, 2014). One study of seat belt use among fatally injured teen drivers found lower use rates among drivers on rural roadways (McCartt & Northrup, 2004). Self-reported seat belt use among U.S. adults is substantially lower in rural areas compared with urban or suburban areas (Beck & West, 2011; Strine et al., 2010), with the lowest rates of use occurring among adults living in rural areas of states with a secondary seat belt law (Strine et al., 2010). Both observed and self-reported seat belt use varies by region, with higher rates recorded in the Western region of the United States (NHTSA, 2015a; Strine et al., 2010).

Risky driving behaviors among teens, including nonuse of seat belts, are known to co-occur with other “problem behaviors” such as alcohol and illicit drug use, cigarette smoking, and unprotected sex (Bingham, Shope, & Raghunathan, 2006; Begg & Langley, 2000; Jessor, 1987; Li, Simons-Morton, & Hingson, 2013; Pickett et al., 2002; Scott-Parker, Watson, King, & Hyde, 2013; Vassallo et al., 2008). Yet the health risk behaviors that co-occur most often with seat belt nonuse among the U.S. teen population are still unclear, as many previous studies have been conducted with small, non-representative samples, and sometimes in countries other than the United States.

Understanding how individual risk behaviors and environmental factors may interact to influence teen seat belt use can help inform prevention efforts. To that end, we analyzed data from 38 U.S. states using the 2011 state Youth Risk Behavior Surveys (YRBSs). Individual characteristics included age, sex, race/ethnicity, and five substance use behaviors. Substance use was of interest because it often occurs when teens are together, and it may occur while traveling in a vehicle (McCabe, West, Veliz, Frank, & Boyd, 2014), potentially increasing crash risk (Voas, Torres, Romano, & Lacey, 2012). We explored whether seat belt use declined as the number of substance use behaviors increased. Environmental factors included state seat belt law, state-level adult seat belt use, geographic location (rurality and U.S. census region), and strength of state Graduated Driver Licensing (GDL) programs. GDL programs reduce crashes by requiring novice teen drivers to gain independent driving experience under safer conditions such as restricting nighttime driving and limiting teen passengers (GHSA, 2015b). State-level adult seat belt use was included because teen driver seat belt use has been shown to correlate highly with belt use for all ages (McCartt & Northrup, 2004). Lastly, we expanded on previous studies of seat belt laws and teen belt use by including a separate category for states with a secondary law that included a primary seat belt provision for youth.

2. Materials and methods

2.1. Data sources

The national and state Youth Risk Behavior Surveys are conducted biennially to monitor priority health risk behaviors among youth. The Centers for Disease Control and Prevention (CDC) conducts the national YRBS and supports state education and health agencies that conduct the state YRBSs. In 2011, each participating state used a two-stage cluster sample design to obtain a representative sample of public school students in 9th–12th grades and public and private school students in 9th–12th grades in Ohio and South Dakota. Thirty-six of the state surveys included in the study were conducted during spring 2011, and the New Mexico and Virginia surveys were conducted during fall 2011 (personal communication, Shari Shanklin, CDC, October 19, 2015). Participation in the survey was anonymous and voluntary and local parental permission procedures were used. The student sample sizes ranged from 1147 to 13,201 (median: 2170) (Eaton et al., 2012). State health and education agencies followed local Institutional Review Board policies and procedures (Brener et al., 2013). Details of the

sample design and survey methodology are described elsewhere (Brener et al., 2013; Eaton et al., 2012).

We obtained the 2011 YRBSs data files from the CDC, with permission from each state's Youth Risk Behavior Surveillance System representative. We analyzed data from 38 states that included the seat belt and substance use questions and had an overall response rate of at least 60%, calculated as (number of participating schools/number of eligible sampled schools) \times (number of usable questionnaires/number of eligible students sampled) (Eaton et al., 2012). Because many high school students are not old enough to drive, students were asked about seat belt use only when riding as a passenger. Therefore, seat belt use while driving or among students who drive was not available. However, the 2005 national YRBS included a question about seat belt use while driving, and results revealed that “always” wearing a seat belt when driving correlated well with “always” wearing a seat belt when riding as a passenger (Briggs, Lambert, Goldzweig, Levine, & Warren, 2008).

We obtained the 2011 YRBS national estimate of seat belt use from the 2011 YRBS Data User's Guide (CDC, 2012).

2.2. Outcome measures

We assessed seat belt use using the question, “How often do you wear a seat belt when riding in a car driven by someone else?” Response options were “always,” “most of the time,” “sometimes,” “rarely,” and “never.” We dichotomized the response categories into “always” or “less than always” for bivariate and multivariate analyses.

2.3. Explanatory variables

Individual characteristics included age (≤ 14 , 15, 16, 17, ≥ 18 years), sex, race/ethnicity (categorized mutually exclusively as white, black, other, Hispanic), and five substance use behaviors: driving after drinking alcohol, riding with a driver who had been drinking alcohol, smoking cigarettes, using marijuana, and binge drinking. Binge drinking was defined as consuming five or more drinks of alcohol in a row within of couple of hours. Respondents were asked how many times during the past 30 days they had participated in each substance use behavior. We dichotomized the responses into “none” or “ ≥ 1 times.”

Environmental factors included type of seat belt law as of April 2011 (primary enforcement, secondary enforcement, secondary enforcement with a primary provision for youth) (GHSA, 2015a; IIHS, 2015a), the April 2011 Insurance Institute for Highway Safety (IIHS) GDL rating (good, fair, marginal) (personal communication, Michele Fields, IIHS, July 9, 2013), prevalence of state-level adult self-reported seat belt use (always wear) from the 2010 Behavioral Risk Factor Survey (BRFS) (Shults & Beck, 2012), categorized into tertiles of 60–79%, 80–85%, $\geq 86\%$), and rurality, measured as the proportion of students enrolled in public schools located in distant or remote areas (Keaton, 2012), categorized into tertiles of $< 10\%$, 10–19%, and $\geq 20\%$. Region was defined using the four U.S. Census regions (West, South, Northeast, and Midwest). Rhode Island enacted a primary seat belt law in June 2011, after the state's YRBS was conducted.

2.4. Statistical analysis

Approximately 10% of the observations had missing values for one or more of the explanatory variables. To reduce the likelihood of loss of precision and biased estimates, we imputed the missing values using fully conditional specification multiple imputation methods (Lee & Carlin, 2010; Liu & De, 2015; Van Buuren, Brand, Groothuis-Oudshoorn, & Rubin, 2006). As the descriptive and multivariate analyses were conducted, results from the imputed data set were compared to the corresponding results from the data set before the multiple imputation modeling (complete case analysis) to check that the results were similar (Lee & Carlin, 2010; Liu & De, 2015).

Table 1
Responses to question “How often do you wear a seat belt when riding in a car driven by someone else?” 38 states;^a 2011 Youth Risk Behavior Surveys.

Seat belt use	Unweighted	Weighted	Weighted	95% confidence interval	
	N	N	Percent	Lower limit	Upper limit
Always	50,418	4,772,742	51	50	52
Most of the time	26,300	2,523,749	27	27	28
Sometimes	11,801	1,099,377	12	11	12
Rarely	6280	575,946	6	6	7
Never	3751	340,721	4	3	4

^a AZ, AK, AL, AR, CT, DE, FL, GA, ID, IA, IL, IN, KS, KY, LA, MA, MD, MI, MS, MT, NH, NC, ND, NE, NJ, NM, OH, OK, RI, SD, TN, TX, UT, VT, VA, WI, WV, WY.

After producing a frequency distribution with 95% confidence intervals (CIs) of seat belt use using all five response categories, we dichotomized the variable into “always” and “less than always.” In the bivariate analyses, we calculated seat belt use percentages and corresponding 95% CIs for each of the explanatory variables. Differences were considered to be statistically significant if the 95% CIs did not overlap.

To explore whether seat belt use varied according to the number of substance use behaviors youth engaged in, we created a risk index variable using the five measured behaviors, summing the responses for each individual behavior measure (Pickett et al., 2002). Each behavior was given equal weight in the index, and the index was categorized into six levels, with “0” representing no substance use behavior and “5” representing participation in all five behaviors. The substance use index, rather than each of the separate substance use behaviors, was included in the multivariate modeling.

We modeled the multilevel associations between seat belt use, individual characteristics, and environmental factors using the generalized estimating equation approach with exchangeable correlation option to implement the loglink procedure (Hanley, Negassa, Edwardes, & Forrester, 2003). We calculated adjusted prevalence ratios (APRs) and 95% CIs for “always” wearing a seat belt for an overall model and by type of seat belt law, resulting in four separate models: all 38 states; 23 states with primary laws; 11 states with secondary laws; and four

states with a primary provision for youth, including New Hampshire, the only state without a seat belt law for adults. In the latter three models, we examined seat belt use by type of seat belt law to determine if students’ individual characteristics associated with seat belt use varied according to the type of state seat belt law. We did not include the other state-level variables and the region variable in these three models because data were lacking for some of the covariates (e.g., there is no state in the Western region with a primary enforcement provision for youth). Therefore, the prevalence ratios for the individual characteristics in the model with all 38 states are not directly comparable to those in the other three models. Analyses were conducted using SUDAAN software (Release 9) to account for the complex survey sampling design.

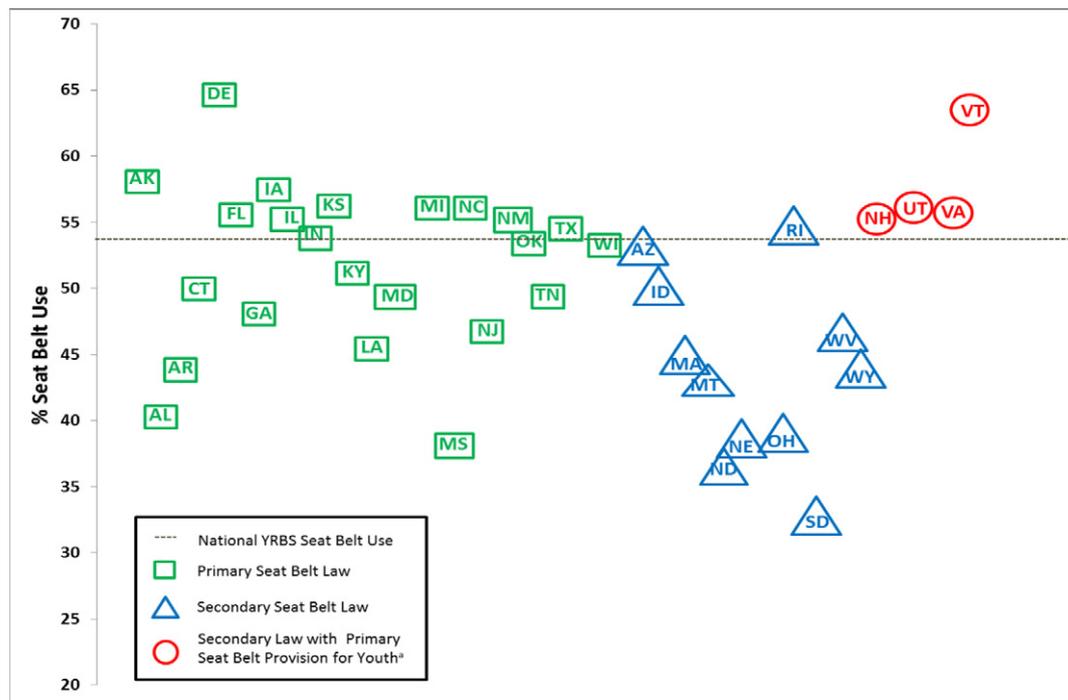
3. Results

Data available from students in grades 9–12 from 38 states produced a total sample size of 101,347. Observations lacking data for seat belt use (n = 2797, 2.8% of total) were excluded, resulting in a study sample size of 98,550. Table 1 presents the results from the seat belt question for respondents from all 38 states combined. Overall, 51% of students reported always wearing their seat belt while riding as a passenger, with another 27% buckling up “most of the time.”

Prevalence of always wearing a seat belt varied across the 38 states, from 32% in South Dakota to 65% in Delaware (Fig. 1).

3.1. Prevalence of seat belt use by individual characteristics

Seat belt use differed significantly across most measured variables (Table 2). The most pronounced differences existed according to students’ substance use behaviors. For each of the five measured risk taking behaviors, students who engaged in the behavior reported seat belt use of about 20 percentage points lower compared with their counterparts who did not engage in the behavior. Large differences in seat belt use also existed by race, with the more pronounced difference being between black and white students (43% vs. 55%, respectively).



^aNH does not have a seat belt law for adults, but their child passenger safety law has a primary enforcement seat belt provision for drivers and passengers <18 years.

Fig. 1. Prevalence of always wearing a seat belt among US high school students, by type of seat belt law, 38 States, 2011 Youth Risk Behavior Surveys.

Table 2
Prevalence of always wearing a seat belt when riding as a passenger among U.S. high school students, 38 states, 2011 Youth Risk Behavior Surveys.

Characteristic	Weighted N	Weighted percent	95% confidence interval	
			Lower limit	Upper limit
<i>Individual level</i>				
Age (years)				
≤14	458,777	48	47	50
15	1,151,081	49	48	51
16	1,223,087	51	50	53
17	1,184,585	54	52	55
≥18	755,213	53	51	54
Sex				
Female	2,421,074	53	52	54
Male	2,351,667	50	49	51
Race/ethnicity				
White	2,979,792	55	54	56
Black	760,495	43	42	45
Hispanic	746,491	48	46	49
Other	285,964	49	47	50
Rode in car with someone who had been drinking during past 30 days				
0 times	3,971,447	56	55	57
≥1 times	801,294	36	35	37
Driven car when drinking during past 30 days				
0 times	4,549,160	53	52	54
≥1 times	223,582	30	28	32
Smoked cigarette during past 30 days				
0 times	4,223,477	55	54	56
≥1 times	549,265	33	31	34
Binge drinking during past 30 days				
0 times	4,062,289	55	54	56
≥1 times	710,453	36	35	37
Used marijuana during past 30 days				
0 times	4,071,785	56	55	57
≥1 times	700,956	34	33	36
<i>State level</i>				
Type of seat belt law ^a				
Primary	3,822,400	53	52	53
Secondary	599,977	42	40	44
Secondary with youth provision ^b	350,364	56	54	58
GDL rating ^c				
Good	3,845,901	51	50	52
Fair	737,043	54	52	55
Marginal	189,798	44	42	46
Adult seat belt use, Behavioral Risk Factor Survey, 2010 (%)				
60–79	436,746	49	47	51
80–85	1,001,091	47	45	49
≥86	3,334,905	53	52	54
% of students attending public schools in distant or remote areas				
<10	2,878,513	51	50	52
10–19	1,281,008	53	52	55
≥20	613,221	47	46	48
<i>Region</i>				
Northeast	475,465	48	46	50
Midwest	1,363,277	51	49	52
South	2,634,290	52	51	53
West	299,709	52	50	54

^a April 2011 seat belt law type: primary enforcement states: AK, AL, AR, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MS, NC, NJ, NM, OK, TN, TX, WI; secondary enforcement states: AZ, ID, MA, MT, ND, NE, OH, RI, SD, WV, WY; secondary enforcement with a primary youth provision: UT, VT, VA.

^b NH does not have a seat belt law for adults, but their child passenger safety law has a primary enforcement seat belt provision for drivers and passengers <18 years.

^c April 2011 Insurance Institute for Highway Safety rating of Graduated Driver Licensing systems: good: AK, AL, AR, CT, DE, GA, IL, IN, KS, KY, MA, MD, MI, NC, NE, NJ, OH, OK, RI, TN, TX, UT, VA, WI, WV; fair: AZ, FL, IA, LA, NH, VT, WY; marginal: ID, MS, MT, NM, ND, SD.

3.2. Prevalence of seat belt use by environmental factors

Seat belt use among students living in states with a secondary enforcement seat belt law (secondary law states) was at least 10 percentage points below use among those living in primary law states or states with a primary provision for youth (42% vs. 53% and 56%, respectively). Seat belt use in nine of the ten secondary law states was below the national prevalence of 54% (Fig. 1). Students living in states with a “marginal” GDL rating reported significantly lower seat belt use (44%) that those living in states with ratings of “fair” (54%) or “good” (51%). Likewise, students living in states with adult seat belt use ≤85% reported significantly lower use rates than those living in states where adult seat belt use was ≥86% (Table 2). Seat belt use was similar across all four U.S. census regions.

3.3. Multivariate results

The multivariate analysis confirmed the descriptive findings, in that students who engaged in even one of the measured substance use risk taking behaviors were significantly less likely to always use seat belts than students who did not engage in any of the behaviors (Table 3). Furthermore, the likelihood of always being belted declined steadily as the number of risk taking behaviors increases. The pattern was consistent across all four multivariate models, with students who engaged in all five risk taking behaviors being 59% to 77% less likely to always buckle up compared with those who did not engage in any risk behaviors.

Important differences in seat belt use by race/ethnicity also persisted. In the analysis of all 38 states (Model 1), black students were significantly less likely than any other racial/ethnic groups to always be belted. In addition, compared with their white counterparts, black students, students of other races, and Hispanic students were significantly less likely to always be belted in each model. Seat belt use tended to increase with age, with students aged ≥18 years being at least 20% more likely to always be belted than those ≤14 years, with one exception (students aged ≥18 years [APR 1.15, 95% CI = 1.00–1.32] in states with a primary provision for youth).

Model 1 revealed that among the state-level variables, the type of seat belt law was most strongly associated with seat belt use. Students living in secondary law states were about 20% less likely to always be belted than students in primary law states (APR 0.79, 95% CI = 0.75–0.84). Seat belt use among students living in states with a primary provision for youth was equivalent to use among students living in primary law states (APR 1.00, 95% CI = 0.95–1.05). Seat belt use among students living in the states with ≥20% of students attending schools in distant or remote areas was about 10% lower compared to their counterparts living in states with <10% of schools located in such areas (APR 0.92, 95% CI = 0.87–0.97). The associations between teen seat belt use and a state's GDL rating and adult seat belt use were somewhat attenuated in the multivariate model.

As indicated by the prevalence ratios in Models 2 (states with primary law), 3 (states with secondary law and youth primary provision), and 4 (states with secondary law), the subgroups of students who were at greatest risk for not always being belted, racial/ethnic minorities and students engaged in substance use behaviors, were consistent across states with all three types of seat belt laws. These findings raise the greatest safety concerns for students living in secondary law states because seat belt use even among the reference groups in these states was substantially below that of their respective reference groups in primary law states (e.g., 51%, 95% CI = 49–53 for students without any substance use behaviors in secondary law states versus 60%, 95% CI = 59–61 for students without any substance use behaviors in primary law states, data not shown). Such findings point to the potential for environmental factors to compound risk taking behaviors, contributing to even lower seat belt use among some subgroups.

Table 3

Crude and adjusted prevalence ratios for always wearing a seat belt when riding as a passenger among U.S. high school students, 38 states, 2011 Youth Risk Behavior Surveys.

Characteristic	Crude prevalence ratios All 38 states		Model 1 All 38 states		Model 2 States with primary law (23 states)		Model 3 States with secondary law and youth primary provision (4 states)		Model 4 States with secondary law (11 states)	
	CPR	95% CI	APR	95% CI	APR	95% CI	APR	95% CI	APR	95% CI
<i>Individual level</i>										
Age (years)										
≤14	1		1		1		1		1	
15	1.02	0.99–1.06	1.04	1.01–1.08	1.03	0.99–1.07	1.10	0.96–1.25	1.11	0.99–1.26
16	1.07	1.03–1.12	1.12	1.08–1.16	1.12	1.08–1.16	1.11	0.95–1.30	1.16	1.01–1.33
17	1.12	1.08–1.17	1.21	1.16–1.26	1.21	1.16–1.26	1.22	1.04–1.42	1.20	1.05–1.38
≥18	1.13	1.08–1.17	1.25	1.20–1.30	1.24	1.19–1.30	1.15	1.00–1.32	1.38	1.21–1.57
Sex										
Female	1		1		1		1		1	
Male	0.94	0.92–0.96	0.95	0.94–0.97	0.96	0.94–0.98	0.93	0.87–0.99	0.92	0.87–0.97
Race/ethnicity										
White	1		1		1		1		1	
Black	0.81	0.78–0.84	0.76	0.73–0.79	0.77	0.75–0.80	0.76	0.64–0.90	0.66	0.55–0.78
Hispanic	0.84	0.81–0.87	0.83	0.81–0.86	0.85	0.82–0.88	0.89	0.80–0.98	0.77	0.71–0.84
Other	0.87	0.84–0.90	0.86	0.83–0.89	0.87	0.83–0.90	0.85	0.75–0.97	0.81	0.73–0.89
Substance use behavior index ^a										
0	1		1		1		1		1	
1	0.78	0.76–0.80	0.78	0.75–0.80	0.78	0.76–0.81	0.84	0.75–0.94	0.71	0.65–0.78
2	0.69	0.66–0.72	0.67	0.64–0.70	0.68	0.65–0.72	0.64	0.54–0.75	0.61	0.51–0.73
3	0.60	0.56–0.63	0.58	0.54–0.61	0.58	0.54–0.63	0.64	0.53–0.77	0.49	0.42–0.57
4	0.50	0.46–0.54	0.48	0.44–0.52	0.50	0.46–0.54	0.53	0.38–0.74	0.33	0.25–0.43
5	0.40	0.35–0.46	0.39	0.34–0.44	0.41	0.35–0.48	0.23	0.09–0.64	0.27	0.16–0.44
<i>State level</i>										
Type of seat belt law										
Primary	1		1		–	–	–	–	–	–
Secondary	0.80	0.76–0.85	0.79	0.75–0.84	–	–	–	–	–	–
Secondary with youth provision ^b	1.07	1.02–1.12	1.00	0.95–1.05	–	–	–	–	–	–
GDL rating										
Good	1		1		–	–	–	–	–	–
Fair	1.05	1.02–1.09	1.06	1.02–1.09	–	–	–	–	–	–
Marginal	0.86	0.83–0.90	0.98	0.94–1.03	–	–	–	–	–	–
Adult seat belt use, Behavioral Risk Factor Survey, 2010 (%)										
60–79	0.92	0.88–0.96	0.97	0.92–1.03	–	–	–	–	–	–
80–85	0.89	0.86–0.93	0.95	0.92–0.99	–	–	–	–	–	–
≥86	1		1		–	–	–	–	–	–
% of students attending public schools in distant or remote areas										
<10	1		1		–	–	–	–	–	–
10–19	1.04	1.01–1.08	0.99	0.95–1.03	–	–	–	–	–	–
≥20	0.92	0.88–0.95	0.92	0.87–0.97	–	–	–	–	–	–
<i>Region</i>										
Northeast	1		1		–	–	–	–	–	–
Midwest	1.06	1.00–1.11	1.04	0.98–1.10	–	–	–	–	–	–
South	1.08	1.04–1.13	1.04	0.99–1.09	–	–	–	–	–	–
West	1.08	1.01–1.14	1.10	1.04–1.17	–	–	–	–	–	–

CPR = crude prevalence ratio; APR = adjusted prevalence ratio; CI = confidence interval.

^a Number of substance use behaviors students engaged in during the past 30 days.^b NH does not have a seat belt law for adults, but their child passenger safety law has a primary enforcement seat belt provision for drivers and passengers <18 years.

4. Discussion

Seat belt use among U.S. teens remains unacceptably low. Among the 38 states included in this study, only 51% of high school students reported always wearing a seat belt when riding as a passenger. Fatality statistics lay bare the consequences; in 2013, only 34% of teen passengers aged 16–19 years and 47% of teen drivers killed in crashes were belted (IIHS, 2015a). Estimates of seat belt effectiveness suggest that nearly half of the deaths among unbelted teens might have been prevented had the teen been belted (Kahane, 2013).

Our finding that teens living in secondary enforcement seat belt law states are less likely to always be belted than teens living in primary law states confirms previous findings (Carpenter & Stehr, 2008; Durbin et al., 2007; García-España et al., 2012; McCartt & Northrup, 2004; O'Malley & Wagenaar, 2004). At 42%, seat belt use among teens in

secondary law states is strikingly low. Interestingly, seat belt use among teens living in states with a secondary law that included a primary enforcement provision for youth is similar to use among teens living in primary law states. This new finding provides suggestive evidence for secondary law states that might consider an age-specific primary provision to improve youth seatbelt use. States may also consider implementing model GDL guidelines requiring seat belt use by all occupants when a novice teen driver is behind the wheel (Mayhew, Williams, & Pashley, 2014; AAA, n.a.)

We found that teens who engaged in substance use behavior were among the least likely to buckle up, and as the number of substance use behaviors increased, the likelihood of always wearing a seat belt steadily declined. This finding is consistent with the "problem behavior" literature in that health risk behaviors tend to cluster and can reinforce each other (Catalano, Hawkins, Berglund, Pollard, & Arthur, 2002;

Jessor, 1987). In recognition of this reality, positive youth development interventions have shifted away from a focus on single problems, such as seat belt nonuse, to broader factors that affect any array of risk behaviors (Catalano et al., 2002; Griffin, Botvin, & Nichols, 2004; Haggerty, Fleming, Catalano, Harachi, & Abbott, 2006; Vassallo et al., 2008). For example, the Life Skills Training substance use prevention program develops skills related to resisting alcohol and drug use including communicating effectively and managing anxiety, and yet students who participated in the program were less likely to have violations and points on their driving records, even after controlling for alcohol use (Griffin et al., 2004). Such models could be adapted to more comprehensively include a focus on motor vehicle risk behaviors, including seat belt nonuse.

5. Limitations

YRBS data are self-reported and, therefore, may be subject to reporting bias. Because the study included high school students in 38 states, results may not be representative of all teens in the United States or of all teens in states with a particular type of seat belt law. Furthermore, data were not available for any of the three the west coast states of Washington, Oregon, and California, which have some of the highest population-based seat belt use rates in the United States (NHTSA, 2015b). Because of the cross-sectional nature of the study, associations between seat belt use and the measured covariates cannot be interpreted to be causal. Because the YRBS measures only individual characteristics and behaviors among students, important factors that influence risky driving/riding behaviors such as parenting practices (Ouimet et al., 2008; Prato et al., 2010; Scott-Parker, Watson, King, & Hyde, 2014), peer influence (Scott-Parker et al., 2014; Williams & Shabanova, 2002), and perception of consequences of risk behaviors (Ouimet et al., 2008; Scott-Parker, Watson, & King, 2009; Scott-Parker et al., 2014) could not be considered.

YRBS defines binge drinking as 5 or more drinks in a row for both sexes, whereas the more commonly accepted definition provided by the National Institute on Alcohol Abuse and Alcoholism defines binge drinking as 4 or more drinks for women and 5 or more drinks for men (NIAAA, n.a.). Therefore, binge drinking by females in this study is likely underestimated. Additionally, the seat belt use question was not asked of all respondents in Arizona and Nebraska (Brener et al., 2013). Of the 2797 observations in the study population with missing data for seat belt use, 1120 (40%) were from Arizona and 1113 (40%) were from Nebraska. Because these observations were excluded from analyses, the Arizona and Nebraska prevalence estimates for seat belt use and the measured covariates may not be representative of their respective state. Last, the IIHS GDL rating system used in the analysis is no longer in use, and the state ratings are no longer available on the IIHS website.

6. Conclusion

This study provides the most comprehensive state-level estimates to date of seat belt use among U.S. teens. Results suggest that environmental influences such as living in a state with a secondary enforcement seat belt law can compound individual-level risk factors for seat belt nonuse, contributing to even lower seat belt use. This information can be useful when considering policy options for increasing seat belt use and in targeting injury prevention interventions to high-risk teens. Given racial disparities in risk, interventions should be socio-culturally relevant and targeted to address disparities in risk (Nation et al., 2003).

Pairing policy interventions with youth development programs that enhance adult supervision and affect a broad array of health risk behaviors among high-risk youth may further improve safety behavior including seat belt use. States can best increase teen seat belt use and reduce deaths and injuries from motor vehicle crashes by making evidence-informed decisions about state policy options and prevention strategies.

Conflicts of interest

The authors declare they have no conflicts of interest.

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Ruth A. Shults is a senior epidemiologist on the Transportation Safety Team at the Centers for Disease Control and Prevention (CDC) where she leads CDC's research in the areas of teen drivers and alcohol-impaired driving. She holds a PhD in epidemiology from the University of North Carolina and an MPH in epidemiology for the University of Oklahoma. At the time that the study was completed, Geeta Bhat was a Research Fellow on the Transportation Safety Team at CDC. She holds an MPH from Emory University.

Tamara M. Haegerich is the Deputy Associate Director of Science for the Division of Unintentional Injury at CDC. She holds a PhD in social psychology from the University of Illinois at Chicago.

Xinjian Zhang is a statistician in the Division of Analysis Research and Practice Integration at CDC. He holds a master degree in statistics from Georgia State University and a PhD from Chinese Academy of Prevention Medicine.