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A comparison of self-reported seat belt usage among the Appalachian and Non-Appalachian United States

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Abstract

Purpose—Seat belts are known to effectively prevent death and serious injury among motorists involved in vehicular collisions. Limited research exists regarding seat belt usage in Appalachia. This study compares self-reported seat belt use in the Appalachian and non-Appalachian counties of the United States.

Methods—Data from 2012 Behavioral Risk Factor Surveillance System were used to calculate nationally representative estimates of consistent seat belt usage in each region. These estimates were stratified by age, sex, and rurality. Total and potential lives saved by seatbelts were calculated for each region using 2012 Fatality Analysis Reporting System data.

Results—Of the 345,513 respondents (unweighted), Appalachians were 6% less likely than non-Appalachians to always wear a seatbelt (relative risk=0.94, 95% CI 0.93, 0.95). Seatbelt usage was consistently lower among Appalachians regardless of sex, age, or rurality. Only 68.1% of rural, Appalachian youth reported always wearing a seatbelt. Seat belt usage was highest among non-Appalachian females residing in urban areas (92.5%). With 100% belt compliance, an additional 360 and 1,712 potential lives could have been saved in Appalachia and non-Appalachia, respectively.

Conclusions—Regional differences possibly influence seat belt usage. Therefore, public health interventions to increase seat belt usage in Appalachia are likely warranted.

Keywords

Appalachian region; seat belts; rural population; motor vehicles; traffic accidents

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INTRODUCTION

It is well-established in the literature that seat belts effectively prevent death and disability among motorists involved in traffic collisions. It is estimated that seat belts reduce the risk of fatal injuries sustained from motor vehicle collisions by ~45% and serious injuries by ~50% [1]. From 1975-2008, it is projected that seat belts saved ~255,000 lives in the United States (US) [2]. As of August 2015, 49 states and the District of Columbia (DC) have enacted mandatory seat belt use laws; New Hampshire is currently the only state without such legislation [3].

Despite the afforded protection and the existing legislation, many vehicle occupants still choose not to wear their seat belts. According to the 2012 National Occupant Protection Use Survey, 86% of vehicle occupants were observed wearing a seat belt at randomly sampled intersections throughout the US [4]. Previous research has shown that seat belt use rates can vary. For example, a study conducted in 2004 showed higher seat belt use rates among females compared to males [5] and that teenagers and young adults were less likely to wear seat belts relative to older individuals [6]. Another study found that African Americans were less likely to use seat belts compared to Caucasians [5]. There is also evidence that those residing in rural areas wear seat belts less than those living in suburban/urban areas [7]. Seat belt use rates are also higher in states with primary enforcement as opposed to secondary enforcement [8]. Molnar et al found that religiosity, political leaning and race were also important in explaining the regional differences in seat belt use [9].

The Appalachian region, home to more than 25 million people, encompasses all of West Virginia and parts of 12 other states and stretches from the southern tier of New York to northern Alabama, Mississippi and Georgia [10]. Because of its mountainous terrain and geographic isolation, the region possess a unique culture compared to the rest of the US [11-13]. While endowed with lavish natural resources, the region struggles with poverty, economic and health related problems [10]. Previous studies have suggested that disparities in traffic safety may be extant in this region [14]. A report produced by the West Virginia Department of Health and Human Resources (WVDHHR) in 1995 indicated that seat belt use was lower in Appalachian states compared to non-Appalachia [15]. Therefore, the purpose of this study was to compare whether seat belt use does vary in the Appalachian region compared to the non-Appalachian US and to quantify the impact of seat belt use on potential lives saved in each region.

MATERIALS AND METHODS

The primary data source for this analysis was the 2012 Behavioral Risk Factor Surveillance System (BRFSS) survey. BRFSS is a state-based, telephone survey intended to measure behavioral risk factors among adults 18 years of age living in US households [16]. The methodology of the BRFSS has been described in detail elsewhere [16]. To assess seat belt use, BRFSS respondents were asked, "How often do you use seatbelts when you drive or ride in a car?" Responses included always, nearly always, sometimes, seldom, never, or never ride or drive in a car. For this analysis, the outcome of interest was consistent seat belt

usage (i.e. those that reported always wearing a seat belt). The exposure of interest was Appalachian residence. Appalachian residence was classified using the Federal Information Processing Standard County Code according to the Appalachian Regional Commission's classification [10]. Those with missing county of residence information and respondents from US protectorates were excluded (n=61,139). Within each region (i.e. Appalachia or non-Appalachia), weighted frequencies and proportions of consistent seat belt use were calculated. Relative risks (RR) and 95% confidence intervals (CI) were estimated; non-Appalachian residence served as the referent group. Estimates were stratified by the respondents' age group (18-24, 25-34, 35-44, 45-54, 55-64, and 65), sex, and rurality. Rurality was dichotomized as urban or rural which was based on whether or not the respondent lived in a metropolitan statistical area as noted in BRFSS.

In order to translate the regional self-reported seat belt use rates into potential lives saved, the number of actual fatalities experienced by belted and unbelted occupants of passenger vehicles 18 years of age by region were obtained from the Fatality Analysis Reporting System (FARS) for 2012. FARS is database maintained by the National Highway Traffic Safety Administration (NHTSA) of all fatal crashes in the US where at least one person involved in the collision dies within 30 days of the incident; the methodology of FARS has been described in detail elsewhere [17]. The calculations for total lives saved [total lives saved=fatalities_(belted) × (effectiveness / (1-effectiveness))] and potential lives saved [potential lives saved= (fatalities_(total) + lives saved) × effectiveness] were based on equations and methodology used by NHTSA [18]. The effectiveness of seat belts have been estimated previously at 45-60%; because the average effectiveness of a seat belt preventing death among occupants of passenger cars and trucks is ~53%, 0.53 was used in the calculations [19]. The equation for potential lives saved calculates the number of lives that would be spared if 100% of drivers wore belts [18]. The resulting figure was then multiplied by the self-reported percentages obtained from BRFSS. The difference between these two estimates showed how many more lives would have theoretically been saved regionally in 2012 if belt use increased. All statistical analyses were conducted using SAS/STAT software version 9.3 [20].

RESULTS

There were a total of 401,467 responses (unweighted) to the seat belt use question from the 2012 BRFSS. Of the Appalachian respondents, 81.6% reported always wearing a seat belt compared to 86.9% of respondents in the non-Appalachian United States (Table 1). Regardless of region or rurality, women tended to wear seatbelts more than males. Age differences were also noted. Only 68.1% of rural, Appalachians 18-24 year olds reported always wearing seatbelts compared to 91.7% of urban-dwelling, non-Appalachian adults over 65 years. In both regions, the proportions of those always wearing seatbelts tended to increase with age. Regardless of region, the proportions of seatbelt use were typically higher in urban compared to rural areas.

As for relative risks, Appalachians were 6% less likely to always wear a seatbelt compared to non-Appalachian respondents (Table 1). When stratified by sex, age group, and rurality,

those who reported always wearing a seatbelt in Appalachia were significantly lower than those residing in non-Appalachia.

Theoretically, if 100% of vehicle occupants wore a seat belt in 2012, potentially 1,955 lives would have been saved in Appalachia, while 13,072 lives could have been potentially saved in the non-Appalachian regions (Table 2). Since self-reported seatbelt use among BRFSS participants was 81.6% in Appalachia, 360 more lives could have been saved if seat belt use was increased ($1,955 \times 0.816 = 1595$; $1955 - 1595 = 360$). In non-Appalachia, where self-reported seat belt use was 86.9%, 1,712 more potential lives could have been saved if belt use was increased ($13,072 \times 0.869 = 11,360$; $13072 - 11,360 = 1,712$).

DISCUSSION

The findings of this analysis show that regardless of sex, age, or rurality, respondents of the 2012 BRFSS who reside in Appalachia were less likely to consistently wear their seatbelts compared to those living in non-Appalachia. Therefore, regional differences may influence traffic safety behaviors such as seat belt use. These findings have significant public health and traffic safety implications as more lives could be saved if belt use was increased within this region.

The findings of this analysis are consistent with the extant literature. Previous research has shown that females typically wear seatbelts more than males [5] and that seat belt use is generally increases with age [6]. Prior studies have also shown that seat belt use is lower in rural areas compared to urban areas [7]. Additionally, seat belt use in Appalachia has remained consistent (i.e. 6 % lower) with the research conducted by the WVDHHR in the 1990's [15].

There may be several plausible explanations for the disparate seat belt use in Appalachia. First, many communities in Appalachia are geographically isolated and the presence of law enforcement may be virtually non-existent. Therefore, the perceived risk of being apprehended for seat belt non-use may be low. Previous research has shown that perception of legal enforcement greatly influences traffic safety behavior, particularly seat belt use [21]. Another possible explanation may be peer or family influence. Appalachia is largely a patriarchal society with strong family ties and values [11]. Therefore, if individuals see that their peers or family are not wearing seat belts, they may be less likely to wear them as well. Other studies have shown that peers can influence traffic safety behavior [22] and that youth, particularly teens, are greatly influenced by their parents' behavior [23]. A third explanation may be attributed to the lack of education and/or knowledge of actual risk. It is possible that some individuals may know that seatbelts can prevent injury, but they may not fully grasp or believe "how much" seatbelts prevent injuries. A study of seatbelt use in Turkey showed that belt use was lower among drivers who did not actually believe that a seatbelt would save their life [24]. A fourth explanation may be explained by cultural beliefs. A study by Shin et al found that fatalism, or belief that one's fate is predetermined, greatly influenced seatbelt use [25]. Fatalism is a known and documented belief commonly found in Appalachia [11]. It is possible that some individuals may choose to not wear their seatbelt simply because they feel their fate is predetermined.

Because seat belt use is lower but traffic fatalities are nearly 45% higher in Appalachia compared to non-Appalachia [14], the findings of this analysis pose several public health implications. First, public health interventions to increase seatbelt use in this region may be warranted. Second, the findings also elude that Appalachian culture may influence belt use. Therefore, interventions may need to be designed to help enforce the positive cultural variables that increase seat belt use as well as help combat the negative attitudes and practices of towards seat belt use.

Strengths and limitations

The strengths of this analysis are that data from a nationally representative survey were used to assess consistent seat belt usage. As to our knowledge, this study was the only study in the past ~20 years to demonstrate the differences in self-reported seat belt use among Appalachian and non-Appalachian residents. Despite these strengths, there are several distinct limitations. The results of this study were based on self-report; there is a possibility that survey respondents may have answered questions in a more favorable manner. Therefore, over-estimation of seat belt use may have been observed. Additionally, the results of this study were based on one survey question and may not have fully captured seatbelt use behaviors. Also, the equations for potential lives saved were theoretical and used actual belted an unbelted fatality counts as opposed to BRFSS, which was self-reported. Lastly, the counts obtained from FARS were based on the location of the fatal crash rather than the driver's location of residence. It is entirely possible that residents of Appalachian counties were involved in fatal collisions while travelling through a non-Appalachian county.

CONCLUSIONS

The Appalachian region, in addition to various negative health and lifestyle behaviors, has a lower practice of wearing seat belts compared to the non-Appalachian US. Subsequently, further studies that investigate as to why people do not use seat belts in this region will be beneficial in understanding the causes of the disparity. Educational programs or community interventions that can help bring about a behavioral change and encourage safe driving practices are likely warranted in this region which could potentially save more lives each year.

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LIST OF ABBREVIATIONS

BRFSS	Behavioral Risk Factor Surveillance System
CI	confidence interval
DC	District of Columbia

FARS	Fatality Analysis Reporting System
NHTSA	National Highway Traffic Safety Administration
RR	relative risk
US	United States
WVDHHR	West Virginia Department of Health and Human Resources

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HIGHLIGHTS

Regional differences possibly influence seat belt usage

Appalachians were 6% less likely than non-Appalachians to always wear a seatbelt

Seatbelt usage was lower among Appalachians regardless of sex, age, or rurality

Only 68.1% of rural, Appalachian youth reported always wearing a seatbelt in 2012

With 100% belt compliance, 360 more lives would have been saved in Appalachia in 2012

Table 1

Comparison of 2012 Behavioral Risk Factor Surveillance System participants living in Appalachia versus non-Appalachia who reported always wearing a seat belt^a

		Appalachia (N=43,068)		Non-Appalachian U.S. (N=371,480)		Relative Risk (95% CI)
		N	%	N	%	
Total		35,322	81.6	310,191	86.9	0.94 (0.93-0.95)
	Urban	17,212	85.2	186,461	89.8	0.95 (0.94, 0.96)
	Rural	12,639	79.7	65,583	84.2	0.95 (0.93, 0.96)
Gender						
Male						
	Total	12,538	76.0	116,987	83.2	0.91 (0.90-0.93)
	Urban	5,890	80.3	66,677	86.5	0.93 (0.91-0.95)
	Rural	4,182	72.7	22,498	78.4	0.93 (0.90-0.96)
Female						
	Total	22,784	86.8	193,204	90.3	0.96 (0.95-0.97)
	Urban	11,322	89.1	119,784	92.5	0.96 (0.95-0.97)
	Rural	8,457	85.6	43,085	89.0	0.96 (0.95-0.98)
Age (years)						
18-24						
	Total	1,299	72.2	13,376	78.7	0.92 (0.88-0.96)
	Urban	266	73.5	3,709	81.9	0.90 (0.82-0.98)
	Rural	257	68.1	1,138	77.1	0.88 (0.78-1.00)
25-34						
	Total	2,727	78.0	28,099	83.4	0.94 (0.91-0.96)
	Urban	822	81.8	10,687	86.2	0.95 (0.91-0.99)
	Rural	730	71.5	3,125	77.8	0.92 (0.85-0.99)
35-44						
	Total	4,065	80.7	39,231	87.1	0.93 (0.91-0.95)
	Urban	1,712	83.7	22,457	89.9	0.93 (0.90-0.96)
	Rural	1,256	79.2	5,876	83.6	0.95 (0.90-0.99)
45-54						
	Total	6,126	81.8	55,242	88.7	0.92 (0.91-0.94)
	Urban	2,852	84.2	33,692	90.5	0.93 (0.91-0.95)
	Rural	2,190	79.6	10,452	83.5	0.95 (0.92-0.99)
55-64						
	Total	8,267	85.2	68,994	89.8	0.95 (0.94-0.96)
	Urban	4,294	88.1	44,037	91.4	0.96 (0.95-0.98)
	Rural	3,124	81.2	16,411	85.8	0.95 (0.92-0.97)
>65						
	Total	12,576	86.8	102,606	90.6	0.96 (0.95-0.97)
	Urban	7,112	88.1	69,969	91.7	0.96 (0.95-0.97)

	Appalachia (N=43,068)		Non-Appalachian U.S. (N=371,480)		Relative Risk (95% CI)
	N	%	N	%	
Rural	4,990	85.1	28,131	87.3	0.97 (0.96-0.99)

^a : Presents number and weighted percentage of participants who reported that they always wore a seatbelt. Non-Appalachian United States served as the denominator in relative risk calculations.

Table 2

Overall lives saved by seatbelts among occupants of passenger vehicles 18 years of age and older in 2012 by region

Region	Fatalities ^a			Lives Saved ^b	Potential Lives Saved (100% Compliance) ^{c,d}	Potential Lives Saved (BRFSS Compliance) ^e	Difference ^f
	Belted	Unbelted	Total				
Appalachia	1,065	1,423	2,488	1,201	1,955	1,595	360
Non-Appalachia	7,808	8,051	15,859	8,805	13,072	11,360	1,712

^a: Numbers of fatalities were obtained from the Fatality Analysis Reporting System

^b: Lives saved=fatalities (belted) $\times$ [effectiveness/(1-effectiveness)]; effectiveness of seatbelts is 0.53

^c: Potential lives saved=[fatalities (total) + lives saved] $\times$ effectiveness; effectiveness of seatbelts is 0.53

^d: The calculation for overall potential lives saved was based on 100% compliance among vehicle occupants to always wear a seatbelt.

^e: The figure for potential lives saved was multiplied by the BRFSS self-reported compliance percentages which was 81.6% for Appalachia and 86.9% for non-Appalachia

^f: the difference between the potential lives saved at 100% compliance and BRFSS self-reported compliance is a theoretical estimate of how many more lives could have been saved if more individuals always wore a seatbelt in 2012