NOT WEARING SEAT BELTS IS ANOTHER DANGER ASSOCIATED WITH OBESITY

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ABSTRACT

Shoulder and lap belt use in automobiles reduces the risk of death by 45% and the risk of severe injury by 50% while their use in light trucks lowers the risk of death by 60% and severe injury by 65%. Discomfort is a leading reason cited for not wearing a seat belt. Seat belts may be uncomfortable for obese persons and discouraging their use. This study examined the relationship between weight status and self-reported seat belt use. Data from the 2002 Behavioral Risk Factor Surveillance System (BRFSS) were analyzed using logistic regression. After controlling for age, gender, state seat belt laws, income, education, ethnicity, and general health, obesity (30 ≤ BMI < 40) and extreme obesity (BMI ≥ 40) were significantly (p<0.0001) associated with lower rates of seat belt use. Relative risk for always wearing seat belts was .734 (95% CI 0.668 - 0.807) for obese and .491 (95% CI 0.440 - 0.547) for extreme obesity. With rates of obesity rising, poor compliance with seat belt laws and increased exposure to preventable death and injury due to motor vehicle crashes appears to be another health risk associated with obesity.

Seat Belts Save Lives

Wearing a shoulder and lap restraint can significantly reduce the risk of severe injury and death for drivers, front seat passengers, and rear seat passengers[1-5] as well as for children[6]. The National Highway and Traffic Safety Association (NHTSA) estimates that shoulder and lap belt use in automobiles reduces the risk of death by 45% and the risk of severe injury by 50% while their use in light trucks lowers the risk of death by 60% and severe injury by 65%[7]. In comparison, air bags reduce the risk of death by only 12%[7]. Seat belt use has also been shown to decrease medical costs associated with accident-related injuries[8].

Obesity & Belt Use

Discomfort is often cited as a reason for not wearing seat belts[9, 10]. Little is known about how body weight influences seat belt comfort, but there are data showing that obesity is associated with an increased risk of death or injury in a traffic accident[11-14]. Some of this effect may be due to a general tendency for obese individuals to be at higher risk for death when injured[15]. While some of these studies controlled for seat belt use[11, 12, 14], only one study could be identified that looked at the relationship between weight and seat belt use. Lichtenstein et al. analyzed data from 3,140 health-risk appraisals and found that seat belt use was lower among overweight individuals after controlling for potential confounding variables[16].

BRFSS

The Behavioral Risk Factor Surveillance System (BRFSS) is a yearly telephone survey sponsored by the Centers for Disease Control and Prevention. Random digit dialing is used to obtain a nationally representative sample of respondents. In the 2002 survey, a question about seat belt use was included in the base set of questions and therefore was asked in all 50 states, the District of Columbia, and Puerto Rico. The purpose of the present study is to examine the relationship between self-reported relative body weight and seat belt use using the 2002 BRFSS data.

Subject Sample

The BRFSS 2002 data base was downloaded from the CDC web site[17]. Details of the interview and the sampling methods have been documented elsewhere [18]. The file included interviews from 247,964 individuals from all 50 States, Guam (n=831), Virgin Islands (n=2,279), Puerto Rico (n=4,119), and the District of Columbia (n=2,408).

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Variable Coding

- State law: 1 = Primary (37%) , 0 = secondary (63%)
- Seat belt use: 1 = always (77%) , 0 = less than always (23%)
- Weight:
  - underweight: BMI < 18 (1.3%)
  - ideal weight: 18 ≤ BMI < 25 (41.5%)
  - Overweight: 25 ≤ BMI < 30 (35.8%)
  - Obese: 30 ≤ BMI < 40 (19.0%)
  - extreme obesity: BMI ≥ 40 (2.4%)
- Race: White (83.4%), African American (8.5%), other (8.1%)
- Hispanic: yes (7.3%) no (92.7%)
- Income:
  - not stated (14.3%),
  - less than $25,000 per year (26.6%),
  - between $25,000 and $50,000 per year (28.7%)
  - above $50,000 per year or upper (30.4%)
- Education:
  - Never attended school or only kindergarten (0.2%),
  - Grades 1 - 8 (3.9%),
  - Grades 9 - 11 (7.2%),
  - Grade 12 or GED (31.6), 26.7%
  - College 1 year to 3 years (26.7%)
  - College 4 years or more (30.5%)
- Smoking: some or everyday (21.9%), nonsmoker (87.1%)
- Alcohol users past 30 days: Yes (52.0%) No (48.0%)
- Drive after drinking: Yes (2.0%) No (98%)

Statistical Analysis

Binary logistic regression analysis was conducted using "Always uses a seat belt" (yes or no) as the dependent variable. The final model was built in four steps. In step one, the presence or absence of a primary seat belt law in the respondent's state was entered. In step two, demographic variables (age, gender, race, Hispanic ethnicity, income, and education) were entered into the model. In step 3, other behaviors (alcohol use, smoking, driving after drinking) were entered. In the final step, weight status (underweight, ideal weight, overweight, obese, and extreme obesity) was added to the model.

This hierarchical modeling approach allows the analysis of the relationship between weight status and seat belt use after controlling for state law, demographic variables, and other behaviors. Multi-category variables (e.g., income, education) were converted into a set of dummy coded variables comparing each category to the first or last category. The Analyses were conducted using SPSS version 11.5 (SPSS Inc., Chicago IL).

Literature Cited

1. Cummings, P., J.D. Wells, and F.P. Rivara, Estimating seat belt effectiveness using matched-pair cohort methods. Accid Anal Prev, 2003. 35(1): p. 143-9.
2. Houston, D.J., L.E. Richardson, Jr., and G.W. Neeley, Mandatory seat belt laws in the states. A study of fatal and severe occupant injuries. Eval Rev, 1996. 20(2): p. 146-59.
3. Knight, S., et al., Shoulder belts in motor vehicle crashes: a statewide analysis of restraint efficacy. Accid Anal Prev, 2001. 33(1): p. 65-71.
4. Robertson, L.S., Reduced fatalities related to rear seat shoulder belts. Inj Prev, 1999. 5(1): p. 62-4.
5. McGwin, G., Jr., et al., The association between occupant restraint systems and risk of injury in frontal motor vehicle collisions. J Trauma, 2003. 54(6): p. 1182-7.
6. Halman, S.I., et al., Are seat belt restraints as effective in school age children as in adults? A prospective crash study. Bmj, 2002. 324(7346): p. 1123.
7. National Center for Statistics and Analysis, Traffic Safety Facts for 2001: Occupant Protection. 2001, National Highway Traffic Safety Administration, US Department of Transportation: Washington, DC.
8. Gill, S.S., et al., The economic impact of motor vehicle crashes: the cost of restrained versus unrestrained occupants in South Carolina. Am Surg, 2002. 68(6): p. 569-74; discussion 574.
9. Chliaoutakis, J.E., et al., Modelling the factors related to the seatbelt use by the young drivers of Athens. Accid Anal Prev, 2000. 32(6): p. 815-25.
10. Block, A., 1998 Motor Vehicle Occupant Safety Survey: Volume 2 Seat Belt Report. 2000, National Highway Traffic Safety Administration: http://www.nhtsa.dot.gov/people/injury/research/SafetySurvey/.
11. Boulanger, B.R., et al., Body habitus as a predictor of injury pattern after blunt trauma. J Trauma, 1992. 33(2): p. 228-32.
12. Mock, C.N., et al., The relationship between body weight and risk of death and serious injury in motor vehicle crashes. Accid Anal Prev, 2002. 34(2): p. 221-8.
13. Moran, S.G., et al., The association between body habitus, restraint use, and fatality in motor vehicle collisions. Annu Proc Assoc Adv Automot Med, 2001. 45: p. 107-23.
14. Arbabi, S., et al., The cushion effect. J Trauma, 2003. 54(6): p. 1090-3.
15. Choban, P.S., L.J. Weireter, Jr., and C. Maynes, Obesity and increased mortality in blunt trauma. J Trauma, 1991. 31(9): p. 1253-7.
16. Lichtenstein, M.J., A. Bolton, and G. Wade, Body mass as a determinant of seat belt use. Am J Med Sci, 1989. 297(4): p. 233-7.
17. Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System. 2003. http://www.cdc.gov/brfss/

Final Sample

Because of missing data, 17,620 or 7.6% of the total interviews were excluded leaving 230,344 respondents in the final sample. Table 1 gives the distribution for each of the variables included in the analysis.

Table 1: Distribution of Variables Included in the Final Sample of BRFSS respondents

Variable	Category	Frequency	Percent
State seat belt law			
	Primary	87022	37.6
	Secondary	144487	62.4
Race			
	White [a]	192626	83.6
	Black/African American	19181	8.3
	Other	18537	8.0
Hispanic			
	Non-Hispanic	214255	93.0
	Hispanic	16089	7.0
Income			
	Not Stated	29872	13.0
	Low (< $25,000)	61618	26.8
	Middle ($25,000-$50,000)	67319	29.2
	High (> $50,000) [a]	71535	31.1
Education			
	None [a]	341	0.1
	Grade School	8429	3.7
	Some High School	16576	7.2
	High School Grad	72812	31.6
	Some College	61584	26.7
	College Grad	70602	30.7
Sex			
	Male	95137	41.3
	Female	135207	58.7
Age			
	Mean and Std. Dev.	46.6	17.3
Smoking			
	Non-smoker	179273	77.8
	Smoker	51071	22.2
Drinks alcohol			
	No	109110	47.4
	Yes	121234	52.6
Drives after drinking			
	No	225512	97.9
	Yes	4832	2.1

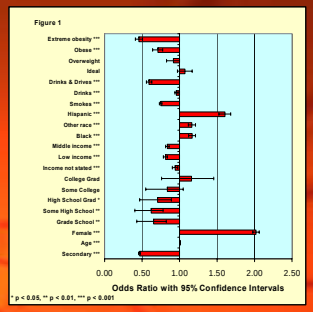
Results

Results of the logistic regression analysis are presented in Table 2. This table shows the contribution of each variable (or categories within variable) to the final regression model. A significance test is given for each variable and for the individual categories within multi-category variables. The estimated odds-ratio and 95% confidence interval for the odds ratio are also presented. Odds ratios less than one indicate that the variable is associated with a lower rate of seat belt use. Figure 1 is a plot of the odds ratios and is useful for making a quick comparison of how strongly each of the variables is associated with increased or decreased seat belt use. Figure 2 plots the rates of seat belt use by weight category separately for men and women in states with both primary and secondary seat belt laws.

Table 2: Results of Logistic Regression Analysis Predicting Seat Belt Use from State Law, Demographics, Other Behaviors, and Weight Status

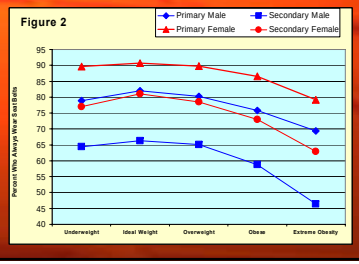
Variable	Category	Significance	Odds Ratio	95.0% C.I. Lower	95.0% C.I. Upper
State Law	Secondary	0.000001	0.46	0.45	0.48
Age	Continuous	0.000001	1.01	1.01	1.01
Sex	Female	0.000001	2.02	1.98	2.06
Education		0.000001			
	Grade School	0.006	0.65	0.49	0.88
	Some High School	0.002	0.62	0.46	0.83
	High School Grad	0.02	0.71	0.53	0.95
	Some College	0.24	0.84	0.62	1.12
	College Grad	0.33	1.16	0.86	1.56
Income		0.000001			
	Not Stated	0.001	0.94	0.91	0.98
	Low	0.000001	0.81	0.79	0.84
	Middle	0.000001	0.84	0.81	0.86
Race		0.000001			
	Black	0.000001	1.17	1.12	1.21
	Other	0.000001	1.16	1.12	1.21
Hispanic	Yes	0.000001	1.61	1.53	1.69
Smoker	Yes	0.000001	0.75	0.73	0.77
Uses Alcohol	Yes	0.0001	0.96	0.94	0.98
Drives After Drinking	Yes	0.000001	0.59	0.56	0.63
Weight		0.000001			
	Ideal	0.13	1.07	0.98	1.18
	Overweight	0.08	0.92	0.84	1.01
	Obese	0.000001	0.71	0.65	0.78
	Extreme obesity	0.000001	0.46	0.41	0.51
	Constant	0.000001	3.95		

Figure 1



* p < 0.05, ** p < 0.01, *** p < 0.001

Figure 2



Major Findings

After controlling for state seat belt laws, demographic variables, and other risky behaviors (smoking and alcohol use), weight status was associated with seat belt use. There is no effect for people who are underweight, ideal weight, or overweight. The effect occurs for the obese, and is stronger in those with extreme obesity. Though rates of seat belt use are higher in primary states and among females, rates of belt use among the obese and those with extreme obesity are reduced for both genders and in both primary and secondary states. Being obese is a risk factor for non-use of seat belts and as such increases risk of death and injury.

Discussion

It is tempting to conclude that the solution to this problem is to promote better weight control. However, weight control interventions have only modest, short-lived effects. The more realistic solution is to find ways to increase seat belt use among obese individuals. The factory-installed seat belts in automobiles do not fit some persons who are extremely obese. Currently, three automobile manufacturers – GM, Ford, and Chrysler – have seat belt extenders available. Efforts should be made to make the auto-buying public aware of the option of seat belt extenders and to encourage automakers, especially European and Japanese manufacturers, to make this option more readily available. There may be other engineering solutions and/or innovations that address the issue of comfort (e.g., wider cushioned belts, or buckles in the center). With the number of obese individuals in the United States growing, the availability of vehicles with the option of more comfortable seat belts may even afford a marketing advantage to the automaker willing to make such equipment readily available.

Solutions to the problem of lower seat belt use among obese persons may require policy changes. Our study confirms that primary seat belt laws have a strong positive association with rates of seat belt use. Efforts should continue to make policy makers aware of the public health issues surrounding non-use of seat belts for a growing portion of their constituents. Further, lawmakers may be in the position to require auto manufacturers to make some of the changes suggested above to further ensure the safety of drivers and passengers.