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Automobile Restraint Use among Patients in Motor Vehicle Crashes: Factors Associated with Noncompliance

Ashley A. Brent
Wright State University - Main Campus, brent.10@wright.edu

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Scholarly Project Final Report

Ashley Brent

Catherine Marco, MD; Wright State University Emergency Medicine

Clinical Science and Research

Introduction / Literature Review

Despite the 1968 U.S. law requiring that all vehicles have seat belts in every seat, many drivers and passengers choose not to use them. This is an important healthcare issue when the there is an estimated $917 billion spent annually on hospital services due to noncompliance with seat belt use.[1] Previous literature has demonstrated that patients who are noncompliant with seatbelts are not only "more likely to use more hospital resources because they are more severely injured", but also less likely to have health insurance, thus incurring more debt for the hospitals serving them[1]. Conversely, restraint compliance has been associated with "significantly lower mortality, shorter hospital stays, and decreased length of stay in the ICU as compared with those who are not restrained".[2] Therefore, we must look to patient demographic and clinical factors to understand why some do not use a seat belt.

There are several well-established factors that can contribute to an increased likelihood of a motor vehicle accident. Just a few of these of these factors include: alcohol intoxication, use of prescription opioids, benzodiazepines, and, in some cases, antidepressants.[3-5] However, it is important to understand if there is a compounded association of these factors with seat belt noncompliance. This is what the study seeks to establish. Therefore, it follows that some of the demographic and clinical variables this study is considering are: sex, ethnicity, age, drug intoxication and alcohol intoxication. Furthermore, with Ohio as a focused area of concern of the opioid epidemic, this research becomes especially important as the effects of opioid intoxication on restraint compliance will be studied. If there is a correlate between opioid intoxication and restraint noncompliance, along with the pre-established correlate between opioid intoxication and likelihood of a motor vehicle accident, we are one step closer to improving the education and medical care of patients addicted to opioids in the Dayton area.

Furthermore, it is not surprising that the use of seatbelts has been proven to reduce crash morbidity and mortality[6]. It has also been shown that patients are more likely to use seat belts following involvement in a motor vehicle crash. [7] But, how can we get patients to increase seat belt compliance before a crash ever happens? Part of that answer lies in understanding what factors are associated with noncompliance.

This study seeks to contribute literature on restraint use among patients in motor vehicle crashes. Specifically, it will address factors associated with restraint noncompliance. This is important because it may give us a better understanding of what patient attributes lead to restraint noncompliance. Thus, when these attributes are identified in patients, perhaps even before a motor vehicle accident ever occurs, we can better educate them on the importance of seat belt use. This is a step in the direction of reducing motor vehicle accident morbidity and mortality. The benefit to society comes from the potential to reduce accidental deaths, hospital debt, and overall safety for anyone on the road.

Hypothesis

The purpose of this study is to identify the prevalence of automobile safety restraint use and factors associated with noncompliance with restraints, among motor vehicle crash patients.

The research null hypothesis is that there is no association of any demographic or clinical factors with noncompliance with automobile restraint use.

The alternative hypothesis is that there is an association with any of the demographic or clinical factors with noncompliance with automobile restraint use. The factors that may demonstrate association are: age, sex, ethnicity, blood alcohol level, and drug toxicities.

Any association will lead to rejection of the null hypothesis.

Methodology

This study was a retrospective analysis of patients in motor vehicle crashes from EPIC records and the MVH Trauma Registry. The setting of this study is Miami Valley Hospital, an Urban hospital with a level 1 trauma center. The Wright State University Institutional Review Board approved this study design.

Eligible subjects included patients age 18 and over, who have been treated by the MVH Trauma Service following a motor vehicle crash from January to December 2017. This includes both passengers and drivers.

Trained research assistants collected and entered data into a spreadsheet for statistical analysis. All records were reviewed in the MVH Research Department, and no PHI was recorded. Sample size was determined a priori to be a minimum of 84 subjects. To detect a medium effect size (rho=0.3 or more) with a two-tailed test, 5% type I error and 80% power, at least 84 subjects were needed.[8] Ultimately, data were collected for 766 patients to examine the relationship between demographic or clinical factors and restraint noncompliance.

Variables for this study included: age, sex, ethnicity, if a restraint was used, mode of arrival to the Emergency Department, day of the week of injury, serum alcohol level, urine toxicology results (benzodiazepines, opiates, THC, cocaine, and methamphetamines), first three clinical diagnoses, and final disposition (discharge to home, discharge to rehabilitation, or expired).

Data Analysis

Age was described with mean and standard deviation. Student's t-test was used to compare age between patients with and without restraint use. All other patient characteristics were described with frequency count and percentage. Factors associated with restraint were tested with Chi-square tests. P-values < 0.05 were used to indicate statistical significance. Data were analyzed using SAS Version 9.4, (Statistical Analysis Software, Copyright (c) 2002-2017 by SAS Institute, Inc., Cary NC, USA). A statistician was consulted for this data analysis as well as the primary investigators on this project, Dr. Catherine Marco and Dr. Peter Ekeh.

Urine toxicology screening was missing for 374 patients and serum ETOH was missing for 227 patients. Data was missing at random and was not considered in the analysis of individual factors. This may create a bias.

Results

Among 766 eligible participants, the mean age was 45 years old and 55% of participants were male (Table 1). The overall rate of seatbelt noncompliance was 32%. The majority of patients arrived at the ED via ambulance (74%), followed by helicopter (23%), and walk-in (3%). A large

number of participants met the legal limit of intoxication (80 mg/dl) (N =119; 22%). Drug use was high among this population, including THC (30% positive among those tested), opiates (29%), benzodiazepines (24%), cocaine (10%), and methamphetamine (10%) (Figure 1). Patients who did not wear seat belts were more likely to be younger (38 year old average age no restraint vs 48 year old average age with restraint), male (62.4% no restraint vs. 51.8% restraint), intoxicated (30.5% vs. 17.0%), screen positive for cocaine (18.2% vs. 4.7%), THC (37.7% vs. 24.2%), and methamphetamine (15.6% vs. 5.9%) (Table 2). Therefore, the factors associated with noncompliance in this study were: younger age ($p < 0.001$), male gender ($p = 0.006$), ETOH intoxication ($p < 0.001$), and positive screening for THC ($p = 0.004$), methamphetamine ($p = 0.002$), or opiates ($p < 0.001$) (Figure 2). There was not enough evidence to detect significant differences by restraint use with respect to ethnicity, mode of arrival, disposition, day of week, opiate use, or benzodiazepine use.

Discussion and Conclusion

The results of this study indicate that male gender, younger age, ETOH intoxication, and a positive toxicology screen for THC, opiates, or methamphetamine are associated with restraint noncompliance.

When comparing some of the well-established factors that can contribute to an increased likelihood of an MVC (alcohol, opioids, benzodiazepines) to the factors associated with restraint noncompliance found in this study, there is significant overlap. [3-5] These factors, as well as the additional factors of age and gender identified in this study, have several implications.

Age and Gender

This study population demonstrated a diverse age range, with the majority of patients being between 25 and 65 years old. Younger patients were more likely to be noncompliant with restraint use. This could be explained by the optimistic bias, “the tendency to view the likelihood of negative events as higher for others than for oneself.” Previous studies have postulated that young adults “may believe that the risk is high [for a particular behavior], but not high enough to avoid engaging in the behavior.” Furthermore, similar studies have shown that “many youth and young adults believe that they are better and safer drivers than everyone else.”[12] The data presented here are in agreement with this literature. The unrestrained patients were, on average,

younger than the restrained patients. Thus, the decision making of younger patients may have been influenced by the optimistic bias.

In terms of gender, the majority of patients in this study were male (55.2%). Furthermore, the association of being male with restraint noncompliance was statistically significant. Previous literature has demonstrated that "the odds of male drivers being involved in fatal intersection crashes were 32 percent higher than for female drivers." Additionally, "it has been suggested that males are more apt to engage in risky driving behaviors, such as speeding and driving aggressively…and are more likely to put themselves and other road users in dangerous situations."[13] This research is consistent with previous literature in that significantly more males than females engaged in the dangerous driving behavior of restraint noncompliance.

Drugs and Alcohol

This study found that alcohol and certain drugs (THC, cocaine, and methamphetamine) are associated with restraint noncompliance. Previous studies have associated substances like alcohol, marijuana, opioids, cocaine and methamphetamine with an increased risk of motor vehicle crashes.[14,15,16,18, 19] Furthermore, these substances have a well-established associated with increased risk-taking behavior. Alcohol and other illicit drugs are associated with poor driving habits as well as a predictor for lack of seat belt use.[10] Patients that are given alcohol under experimental conditions demonstrate a failure to adequately evaluate outcomes, both good and bad, when the decisions are based on previous outcomes.[20] One experimental study, while small, demonstrated that drivers under controlled conditions repeatedly selected the more risky conditions even when coupled with the highest penalties for failure.[21] This research is consistent with previous literature in that patients who were unrestrained were more likely to be intoxicated with ETOH, or screen positive for THC, methamphetamines, or opiates.

The identification of these factors provides an opportunity to better educate patients with these attributes on the importance of seat belt use, perhaps before an MVC ever occurs. For example, one study found that "a crash-related Emergency Department (ED) visit was significantly associated with increased safety belt use at follow-up" for MVC patients in the ED who received a motivational interview during a "teachable moment".[22] These are all steps in the direction of

reducing motor vehicle accident morbidity and mortality. This also increases the potential to reduce accidental deaths, hospital debt, and overall safety for anyone on the road.

Limitations

This study has several limitations. First, these data were collected solely from the MVH Trauma Registry and may not be generalizable to other settings. Second, these data were only from patients who were admitted, and it is possible that patients who were discharged from the ED following a motor vehicle accident may have different characteristics. Third, this study is based on retrospective data and is dependent on the accuracy of these data. Finally, some missing data points may have affected the accuracy of these results.

Future Directions

In the future, it may be appropriate to explore other factors that may contribute to one's choice not to wear restraints. Some possibilities could be the patient's occupation, number of dependents, education level, insurance coverage, and socioeconomic status. Looking to some of the social determinants of health could expand on the findings of this study. Furthermore, studying the time of MVC and weather at the time of crash could also yield interesting results about factors associated with noncompliance.

Conclusions

In this study, 32% of patients in motor vehicle crashes were not compliant with seat belt use. Noncompliance with seat belt use was higher among patients who were male, younger age, intoxicated, or who had positive screens for cocaine, THC, or methamphetamine use. These results highlight the potential for targeted educational interventions on the importance of seatbelt use.

Table 1 Patient Characteristics

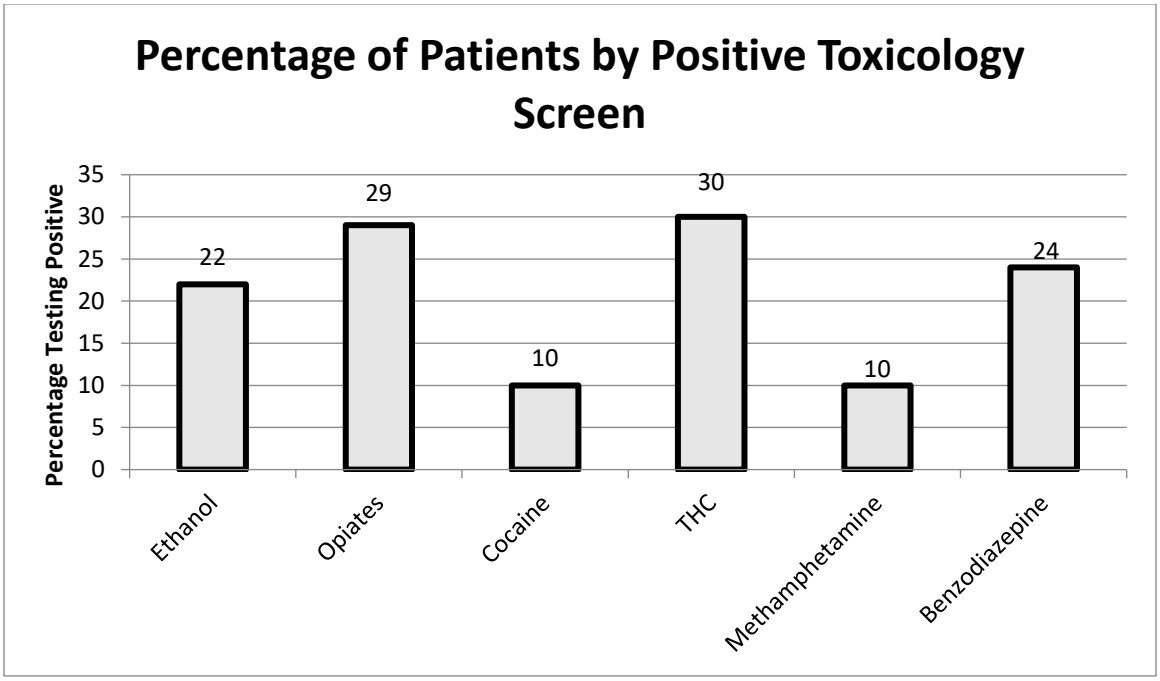
	All Patients	95% CI
No. Patients	766	
Age in years (mean ± SD)	44.7 ± 19.8	43.3 - 46.1
Gender		
Male	423 (55.2%)	51.7% – 58.7%
Female	343 (44.8%)	41.2 – 48.3
Ethnicity (N = 760)		
African American	159 (20.9%)	18.0 – 23.8
White	574 (75.5%)	72.5 – 78.6
Other	27 (3.6%)	2.2 – 4.9
Mode of Arrival in ED		
Walk-in	20 (2.6%)	1.5 – 3.7
Ambulance	570 (74.4%)	71.3 – 77.5
Helicopter	176 (23.0%)	20.0 – 26.0
Day of Week of Injury		
Mon	115 (15.0%)	12.5 – 17.5
Tue	96 (12.5%)	10.2 – 14.9
Wed	107 (14.0%)	11.5 – 16.4
Thr	121 (15.8%)	13.2 – 18.4
Fri	104 (13.6%)	11.1 – 16.0
Sat	115 (15.0%)	12.5 – 17.5
Sun	108 (14.1%)	11.6 – 16.6
Intoxicated (N = 539)		
Yes (>80)	119 (22.1%)	18.6 – 25.6
Positive Toxicology Screen (N=389)		
Opiate	112 (28.7%)	24.2 – 33.2
Cocaine	39 (10.0%)	7.0 – 13.0
THC	115 (29.5%)	25.0 – 34.0
Meth	38 (9.7%)	6.8 – 12.7
Benzo	92 (23.5%)	19.3 – 27.7
Disposition (N = 652)		
Discharged home	473 (72.6%)	69.1 – 76.0
To rehab or other facility	158 (24.2%)	20.9 – 27.5
Expired	21 (3.2%)	1.9 – 4.6

Table 2 Patient Characteristics by Restraint Use

	No Restraint N (95% CI)	Restraint N (95% CI)	p-value*
No. Patients	245 (32.0%)	521 (68.0%)	-
Age in years (mean ± SD)	37.8 ± 15.2, 35.9 – 39.7	48.0 ± 20.8, 46.2 – 49.8	<0.001[a]
Male	153 (62.4%), 56.4% – 68.5%	270 (51.8%), 47.5% – 56.1%	0.006
Ethnicity			0.61
African American	56 (23.0%), 17.8 – 28.3	103 (20.0%), 16.5 – 23.4	
White	179 (73.7%), 68.1 – 79.2	395 (76.4%), 72.7 – 80.1	
Other	8 (3.3%), 1.0 – 5.5	19 (3.7%), 2.1 – 5.3	
Mode of Arrival in ED			0.47
Walk-in	8 (3.3%), 1.0 – 5.5	12 (2.3%), 1.0 – 3.6	
Ambulance	176 (71.8%), 66.2 – 77.5	394 (75.6%), 71.9 – 79.3	
Helicopter	61 (24.9%), 19.5 – 30.3	115 (22.1%), 18.5 – 25.6	
Day of Week of Injury			0.68
Mon	33 (13.5%), 9.2 – 17.7	82 (15.7%), 12.6 – 18.9	
Tue	34 (13.9%), 9.5 – 18.2	62 (11.9%), 9.1 – 14.7	
Wed	28 (11.4%), 7.4 – 15.4	79 (15.2%), 12.1 – 18.2	
Thr	38 (15.5%), 11.0 – 20.0	83 (15.9%), 12.8 – 19.1	
Fri	33 (13.5%), 9.2 – 17.7	71 (13.6%), 10.7 – 16.6	
Sat	41 (16.7%), 12.1 – 21.4	74 (14.2%), 11.2 – 17.2	
Sun	38 (15.5%), 11.0 – 20.0	70 (13.4%), 10.5 – 16.4	
Intoxicated (>80)	62 (30.5%), 24.2 – 36.9	57 (17.0%), 13.0 – 21.0	<0.001
Opiate	43 (27.9%), 20.8 – 35.0	69 (29.2%), 23.4 – 35.0	0.78
Cocaine	28 (18.2%), 12.1 – 24.3	11 (4.7%), 2.0 – 7.4	<0.001
THC	58 (37.7%), 30.0 – 45.3	57 (24.2%), 18.7 – 29.6	0.004
Meth	24 (15.6%), 10.0 – 21.3	14 (5.9%), 2.9 – 8.9	0.002
Benzo	41 (26.6%), 20.0 – 33.6	51 (21.4%), 16.2 – 26.6	0.24
Disposition			0.32
Discharged home	151 (71.2%), 65.1 – 77.3	322 (73.2%), 69.0 – 77.3	
Rehab, other facil.	51 (24.2%), 18.3 – 29.8	107 (24.3%), 20.3 – 28.3	
Expired	10 (4.7%), 1.9 – 7.6	11 (2.5%), 1.0 – 4.0	

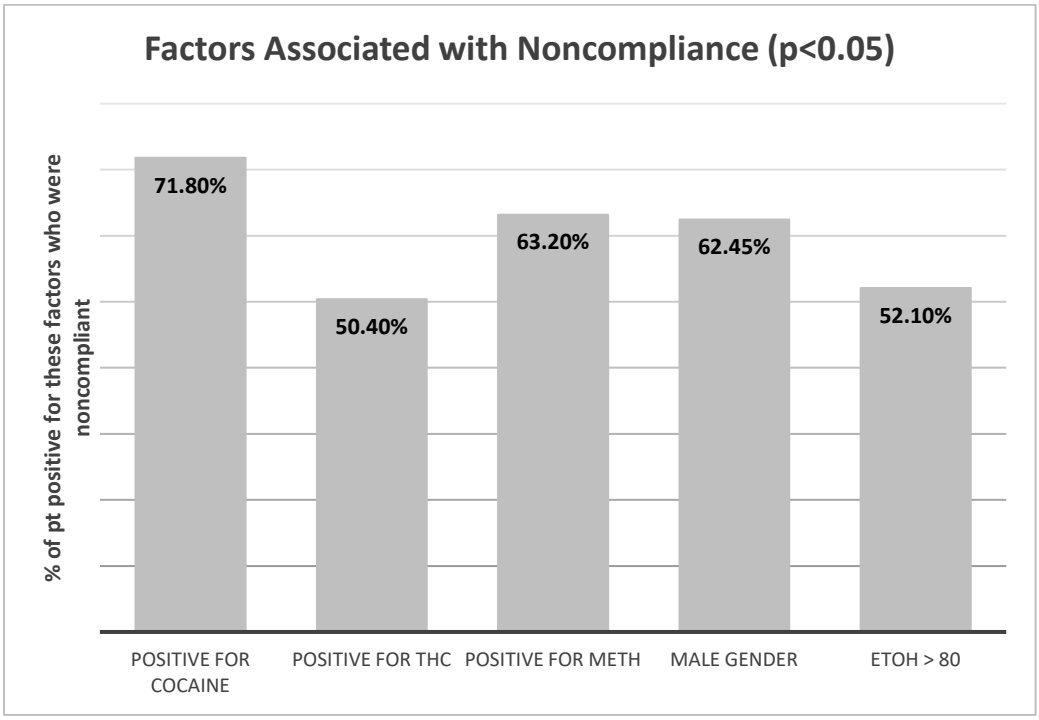
Chi-square p-value testing No Restraint vs. Restraint, ([a]ttest for age)

Figure 1. Positive toxicologic screen among patients in motor vehicle crashes*



*among 539 patients tested for alcohol and 389 patients tested for other drugs

Figure 2. Factors Associated with Noncompliance



Dr. Marco has read and approved this final project report.

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