Research Note

Restraint Use of Large Truck Occupants Involved in Fatal Crashes

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Introduction

Every year, there are more than 600 deaths of large truck occupants in fatal motor vehicle crashes [1-2]. Restraint use by large truck occupants is of concern. In this work, restraint use of large truck drivers and passengers involved in fatal crashes is examined.

Methodology

In this research note, the occupant type includes driver, passenger and unknown occupant in a large truck. "Restraint use" is categorized as "used" (shoulder and lap belt, child safety seat or restraint type unknown), "not used" and "unknown". Occupant is classified as a "fatality" or "survivor " of the crash. Unknown injury severity cases are not included in this study. Data from the Fatality Analysis Reporting System (FARS) for the period 1988-2002 were used. The FARS database is a national census of police-reported motor vehicle crashes resulting in fatal injuries. It is conducted by the National Center for Statistics and Analysis (NCSA) in the National Highway Traffic Safety Administration (NHTSA).

Results

Table 1 and Table 2 show large truck occupants killed and survived, respectively, in fatal crashes by year, occupant type and reported restraint use. The data indicate that for occupants whose restraint use is known (i.e. excluding occupants whose restraint use is unknown), a high percentage of occupants killed in large truck crashes were not restrained: 75 percent of drivers and 91 percent of passengers regardless of locations (in passenger vehicles over the same time period, 1988-2002, 66 percent of drivers

and 69 percent of passengers killed in crashes were unrestrained). A higher percentage of occupants who survived in fatal crashes were restrained than those who were killed. The data show an increase in the percentages of large truck occupants who were restrained from 1988 through 2002 in fatal crashes. This feature is also graphically illustrated by Chart 1 to Chart 4.

One may use survival status (killed or survived) as a dependent response variable, restraint use (restrained or unrestrained) and occupant type (driver or passenger) as independent variables to fit a logistic model in terms of total number for the period 1988-2002 (not including occupants where the restraint use is unknown). The results of the logistic analysis are in Table 3.
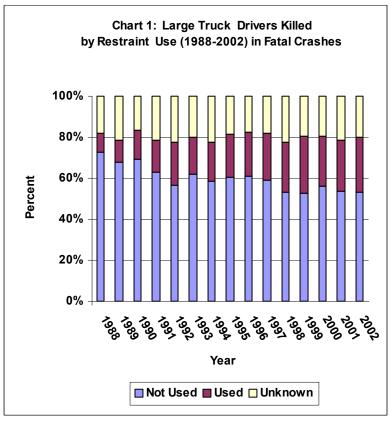
Table 3. Logistic Analysis

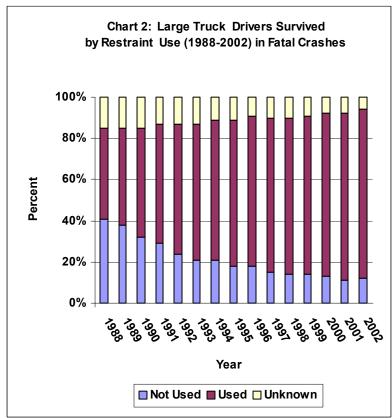| Maximum Likelihood Estimates			
Parameter	Estimate	S.E.	$Pr > \chi^2$
Intercept	-3.112	0.0234	<0.0001
Occupant (Passenger)	-0.546	0.0332	<0.0001
Restraint Use (Unrestrained)	2.241	0.0279	<0.0001
Odds Ratio Estimates			
Effect	Point Estimate	95%Wald Confidence Limits	
Occupant (Passenger vs. Driver)	0.580	0.543	0.618
Restraint Use (Unrestrained vs. Restrained)	9.400	8.900	9.926

The analysis shows that in an event of a fatal crash, the odds[†] of a large truck occupant who was killed being unrestrained is much greater
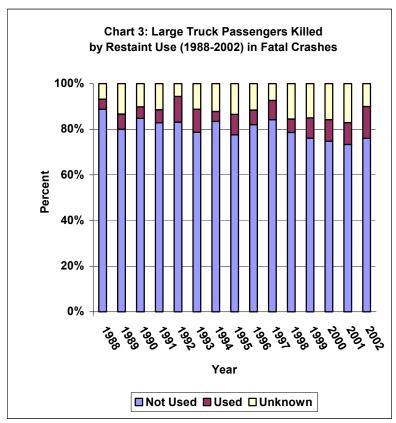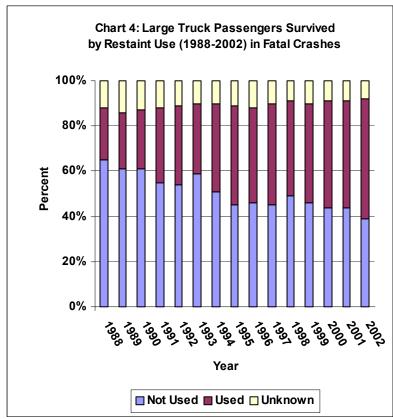
<table>
<tr><td colspan="10">Table 1
Large Truck Occupants Killed by Year, Occupant Type and Restraint Use in Fatal Crashes</td></tr>
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Year	Occupant Type	Restraint Use						Sub-Total	Total
		Not Used	%	Used	%	Unknown	%		
1988	Driver	554	73	72	9	137	18	763	
	Other Passenger	101	87	6	5	9	8	116	911
	Sleeper Sec. Passenger	29	97	0	0	1	3	30	
	Unknown	0	0	0	0	2	100	2	
1989	Driver	479	68	76	11	151	21	706	
	Other Passenger	100	79	10	8	17	13	127	858
	Sleeper Sec. Passenger	20	87	0	0	3	13	23	
	Unknown	0	0	0	0	2	100	2	
1990	Driver	405	69	84	14	97	17	586	
	Other Passenger	84	83	6	5	12	12	102	705
	Sleeper Sec. Passenger	16	100	0	0	0	0	16	
	Unknown	0	0	0	0	1	100	1	
1991	Driver	348	63	88	16	118	21	554	
	Other Passenger	77	82	6	6	11	12	94	661
	Sleeper Sec. Passenger	10	91	0	0	1	9	11	
	Unknown	0	0	0	0	2	100	2	
1992	Driver	289	56	107	21	116	23	512	
	Other Passenger	47	81	8	14	3	5	58	585
	Sleeper Sec. Passenger	12	92	0	0	1	8	13	
	Unknown	0	0	0	0	2	100	2	
1993	Driver	319	62	94	18	103	20	516	
	Other Passenger	57	75	9	12	10	13	76	605
	Sleeper Sec. Passenger	13	100	0	0	0	0	13	
	Unknown	0	0	0	0	0	0	0	
1994	Driver	325	59	105	19	124	22	554	
	Other Passenger	74	82	5	6	11	12	90	670
	Sleeper Sec. Passenger	23	88	0	0	3	12	26	
	Unknown	0	0	0	0	0	0	0	
1995	Driver	337	61	117	21	102	18	556	
	Other Passenger	60	76	8	10	11	14	79	648
	Sleeper Sec. Passenger	9	90	0	0	1	10	10	
	Unknown	0	0	0	0	3	100	3	
1996	Driver	331	61	116	22	94	17	541	
	Other Passenger	51	82	4	6	7	12	62	621
	Sleeper Sec. Passenger	13	81	1	6	2	13	16	
	Unknown	0	0	0	0	2	100	2	
1997	Driver	370	59	143	23	114	18	627	
	Other Passenger	59	80	7	10	7	10	73	723
	Sleeper Sec. Passenger	21	95	1	5	0	0	22	
	Unknown	1	100	0	0	0	0	1	
1998	Driver	340	54	155	24	142	22	637	
	Other Passenger	63	77	6	7	13	16	82	742
	Sleeper Sec. Passenger	18	86	0	0	3	14	21	
	Unknown	2	100	0	0	0	0	2	
1999	Driver	340	53	177	27	127	20	644	
	Other Passenger	62	70	10	11	16	19	88	759
	Sleeper Sec. Passenger	24	96	0	0	1	4	25	
	Unknown	0	0	0	0	2	100	2	
2000	Driver	372	57	160	24	123	19	655	
	Other Passenger	52	72	9	12	11	16	72	754
	Sleeper Sec. Passenger	19	83	0	0	4	17	23	
	Unknown	4	100	0	0	0	0	4	
2001	Driver	322	54	154	25	127	21	603	
	Other Passenger	53	67	10	13	16	20	79	708
	Sleeper Sec. Passenger	24	92	0	0	2	8	26	
	Unknown	0	0	0	0	0	0	0	
2002	Driver	311	53	157	27	120	20	588	
	Other Passenger	58	73	13	16	9	11	80	684
	Sleeper Sec. Passenger	14	93	0	0	1	7	15	
	Unknown	1	100	0	0	0	0	1	
Total	Driver	5442	60	1805	20	1795	20	9042	
	Other Passenger	998	78	117	9	163	13	1278	10634
	Sleeper Sec. Passenger	265	91	2	1	23	8	290	
	Unknown	8	33	0	0	16	67	24	

Source: NCSA FARS 1988-2002

		Restraint Use							
Year	**Occupant Type**	**Not Used**	**%**	**Used**	**%**	**Unknown**	**%**	**Sub-Total**	**Total**

Table 2
Large Truck Occupants Survived by Year, Occupant Type and Restraint Use in Fatal Crashes

Year	Occupant Type	Not Used	%	Used	%	Unknown	%	Sub-Total	Total
1988	Driver	1791	41	1927	44	645	15	4363	5119
	Other Passenger	384	59	175	27	86	14	645	
	Sleeper Sec. Passenger	107	96	2	4	2	4	111	
	Unknown	0	0	0	0	0	0	0	
1989	Driver	1613	38	1951	47	612	15	4176	4848
	Other Passenger	321	61	164	25	95	14	580	
	Sleeper Sec. Passenger	86	94	4	4	2	2	92	
	Unknown	0	0	0	0	0	0	0	
1990	Driver	1323	32	2189	53	589	15	4101	4894
	Other Passenger	389	56	204	29	100	15	693	
	Sleeper Sec. Passenger	92	93	3	3	4	4	99	
	Unknown	0	0	0	0	1	100	1	
1991	Driver	1070	29	2170	58	485	13	3725	4357
	Other Passenger	274	50	204	37	70	13	548	
	Sleeper Sec. Passenger	71	85	4	5	9	10	84	
	Unknown	0	0	0	0	0	0	0	
1992	Driver	838	24	2160	63	456	13	3454	4014
	Other Passenger	222	47	197	42	54	11	473	
	Sleeper Sec. Passenger	79	91	2	2	6	7	87	
	Unknown	0	0	0	0	0	0	0	
1993	Driver	795	21	2477	66	467	13	3739	4396
	Other Passenger	291	53	203	37	60	10	554	
	Sleeper Sec. Passenger	98	95	1	1	4	4	103	
	Unknown	0	0	0	0	0	0	0	
1994	Driver	847	21	2735	68	433	11	4015	4698
	Other Passenger	253	44	260	45	68	11	581	
	Sleeper Sec. Passenger	95	93	3	3	4	4	102	
	Unknown	0	0	0	0	0	0	0	
1995	Driver	670	18	2745	71	428	11	3843	4488
	Other Passenger	194	36	283	53	62	11	539	
	Sleeper Sec. Passenger	98	92	2	2	6	6	106	
	Unknown	0	0	0	0	0	0	0	
1996	Driver	733	18	3018	73	396	9	4147	4866
	Other Passenger	235	38	296	48	82	14	613	
	Sleeper Sec. Passenger	98	92	3	3	5	5	106	
	Unknown	0	0	0	0	0	0	0	
1997	Driver	635	15	3155	75	418	10	4208	4943
	Other Passenger	209	35	326	54	69	11	604	
	Sleeper Sec. Passenger	119	91	4	3	8	6	131	
	Unknown	0	0	0	0	0	0	0	
1998	Driver	597	14	3221	76	415	10	4233	5015
	Other Passenger	265	40	326	49	71	11	662	
	Sleeper Sec. Passenger	114	97	3	2	1	1	118	
	Unknown	2	100	0	0	0	0	2	
1999	Driver	572	14	3232	77	401	9	4205	4924
	Other Passenger	191	33	311	54	72	13	574	
	Sleeper Sec. Passenger	136	95	3	2	4	3	143	
	Unknown	0	0	0	0	2	100	2	
2000	Driver	542	13	3369	79	366	8	4277	5027
	Other Passenger	196	32	349	58	61	10	606	
	Sleeper Sec. Passenger	135	95	2	1	5	4	142	
	Unknown	1	50	0	0	1	50	2	
2001	Driver	481	11	3368	81	316	8	4165	4863
	Other Passenger	189	33	326	57	58	10	573	
	Sleeper Sec. Passenger	114		4		6		124	
	Unknown	1	100	0	0	0	0	1	
2002	Driver	448	12	3212	82	245	6	3905	4511
	Other Passenger	130	27	315	64	44	9	489	
	Sleeper Sec. Passenger	108	94	4	4	3	2	115	
	Unknown	2	100	0	0	0	0	2	
Total	Driver	12955	21	40929	68	6672	11	60556	70963
	Other Passenger	3743	43	3938	45	1052	12	8734	
	Sleeper Sec. Passenger	1550	93	44	3	69	4	1663	
	Unknown	6	60	0	0	4	40	10	

Source: NCSA FARS 1988-2002

Chart 1: Large Truck Drivers Killed by Restraint Use (1988-2002) in Fatal Crashes

Chart 2: Large Truck Drivers Survived by Restraint Use (1988-2002) in Fatal Crashes

Chart 3: Large Truck Passengers Killed by Restaint Use (1988-2002) in Fatal Crashes

Chart 4: Large Truck Passengers Survived by Restaint Use (1988-2002) in Fatal Crashes

than a large truck occupant who survived the fatal crash. In addition, the odds of the fatality being a large truck driver is almost twice that of the fatality being a large truck passenger (1/0.58=1.72). Examination of Table 1 and 2 shows 12 percent of large truck drivers and 13 percent of large truck passengers were killed in fatal crashes for the period 1988-2002 (not including occupants where the restraint use is unknown). On first glance, the similar fatality percentages between drivers and passengers and the results of the logistic analysis seem to be in conflict. However, the difference here can be explained by the difference in restraint use. The overall percentage of restraint use is 70 percent for drivers and 39 percent for passengers for the period 1988-2002 (not including occupants where the restraint use is unknown). Note that if the passengers in sleeper cabs are excluded, two similar odds ratio in logistic analysis are obtained as 0.64 and 9.48 in Table 3.

† The "odds" is different from the probability (possibility). Odds = probability/(1-probability). For example, if two probabilities of an unrestrained and a restrained occupant to be killed are respectively 95% and 55% in fatal crashes (assuming the effectiveness of restraint systems in reducing fatalities is about 40% in fatal crashes [3]), then the odds ratio of an occupant to be killed for unrestrained vs. restrained is 15.5 (= [0.95/0.05] / [0.55/0.45]).

References

[1] National Highway Traffic Safety Administration. Traffic Safety Facts 2001. Washington, DC: US Department of Transportation.
[2] 2002 Annual Assessment. National Center for Statistics and Analysis, NHTSA, http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2003/Assess02.pdf
[3] Evans, L. *The Effectiveness of Safety Belts in Preventing Fatalities*, Accident Analysis and Prevention, 18: 229(1986).

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