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Publication Date
2010

Peer reviewed

SafeTREC Safe Transportation Research & Education Center

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2010
RR-2010-5
http://www.safetrec.berkeley.edu

ABSTRACT

Because hit-and-run crashes account for a significant share of pedestrian fatalities, a better understanding of these crashes will assist efforts to reduce pedestrian fatalities. Of the more than 48,000 pedestrian deaths that were recorded in the United States between 1998 and 2007 (Fatality Accident Reporting System [FARS]), 18.1% of them were the victims of hit-and-run crashes, and the percentage of fatal pedestrian hit-and-runs has been rising as the number of all pedestrian fatalities has decreased. Using FARS data on single pedestrian fatal victim crashes between 1998-2007, logistic regression analyses were conducted to identify factors related to hit-and-run and to identify factors related to the identification of the hit-and-run driver. Results indicate an increased risk of hit-and-run in the early morning, during non-daylight, and on the weekend. Results also indicate that certain driver demographic characteristics (young, male), behavior (notably alcohol use), and history (e.g., suspended license or history of DWI/DUI convictions) are associated with hit-and-run. There also appears to be an association between the type of victim and the likelihood of the driver being identified. Alcohol use and early morning, the time frame when persons may be leaving bars, were among the leading factors that increased the risk of hit-and-run. Reducing alcohol-related crashes could substantially reduce pedestrian fatalities as a result of hit-and-run. Driver characteristics will assist in the development of countermeasures, however, more information about this population may be necessary.

BACKGROUND

Between 1998 and 2007, while the total number of annual pedestrian deaths decreased, the proportion of hit-and-run pedestrian deaths has in fact increased. Hit-and-run crashes are defined as collisions where the driver of the striking vehicle flees the scene before offering information or aid to the victim. Hit-and-run crashes accounted for 18.1% of the approximately 48,000 pedestrian fatalities between 1998 and 2007 across the U.S., with a wide variation on a state-by-state basis, ranging from 6.6% in Mississippi to 29.8% in the District of Columbia (FARS).

By fleeing, the driver increases risk for the victim because flight often results in delayed notification of emergency responders and delays in emergency medical services *(1)*. It can also increase the victim's exposure to being struck again. In approximately half the cases, the driver is never apprehended or identified, making it difficult to characterize the causes of the crash, which hinders efforts to devise countermeasures or other prevention efforts.

Even if the driver is never identified, there remains a body of information that can provide a partial picture of hit-run fatal pedestrian crashes. For example, temporal information is available, making it possible to attempt to determine patterns. Statistics show that weekends have higher rates than weekdays for all pedestrian-involved crashes, including hit-and-run *(1, 2, 3)*. Pedestrian hit-and-runs are also more likely to occur at night than during the day *(1, 2)*.

Another factor easily ascertained in most hit-and-run fatal pedestrian crashes are road conditions. According to Tay et al., a hit-and-run crash is more likely to happen on a high-speed road; another likely locale is a non-intersection in an urban setting, which is generally more deadly for pedestrians than a rural location *(1)*. Approximately 79% of hit-and-run fatalities involving pedestrians occur in locations other than signalized intersections. Crash severity is also associated with the incidence of pedestrian hit-and-run: a driver's likelihood of fleeing a crash increases with crash severity *(1)*.

Information on drivers who flee the scene of a pedestrian collision is fundamentally incomplete due to the nature of their offense and the fact that only half of these drivers are ever identified. Available statistics are based only on those drivers who have been identified, though this group may differ from those drivers who are never identified.

Within those limitations, however, analysis of identified drivers reveals certain trends. Drivers older than 65 are generally less likely to flee after fatally hitting a pedestrian compared with drivers in their 20s or 30s. Males flee about 60% more often than females. Drivers of older cars appear to be more likely to leave the scene *(2, 4)*. Drivers with expired, suspended, or revoked licenses are more likely flee than validly licensed drivers *(5)*.

Alcohol use and DUI/DWI are associated with hit-and-run pedestrian fatalities, though data are incomplete. For example, Solnick and Hemenway found that a minority of drivers in these crashes were tested for blood alcohol concentration (BAC). Those leaving the scene were more likely to exhibit a positive BAC. Furthermore, drivers who fled had a higher likelihood of a previous arrest for driving while intoxicated. Solnick and Hemenway noted that both alcohol usage and pedestrian fatalities in hit-and-run crashes show an increased incidence at night and on the weekends *(4)*.

BAC is also an important factor for pedestrians in fatal hit-and-run crashes. Johnson used police reports from Texas to show that approximately 33% of all fatal pedestrian-involved crashes included a pedestrian under the influence, with a BAC averaging around 0.20, which represents a high level of intoxication. At the national level, 40% of pedestrian fatalities involved pedestrians with BAC over 0.10 *(6)*.

Victim characteristics are also available for fatal pedestrian hit-and-run crashes. Some characteristics of the hit-and-run victim may influence the driver's decision to flee. Drivers are less likely to flee after hitting a young pedestrian (under 11 years old) or an older one (65 or older).

Limited research has been undertaken to explore drivers' motivation to flee the scene after fatally hitting a pedestrian. Solnick and Hemenway noted that the presence of alcohol can be a motivator for drivers to run, because drivers perceive that they are more obviously at fault or likely to be judged as being at fault, and because their judgment may be impaired due to alcohol *(4)*. Drivers with previous arrests and drivers who perceive they are at fault and fear they will be severely punished are more likely to flee *(2, 4)*. Although there is no single most important factor that can predict pedestrian hit-and-run, a major contributing factor is the *perception* by the driver of the probability of being caught (as distinguished from the actual probability of being caught).

The likelihood of identifying a hit-and-driver has been shown to be associated with certain circumstances of the crash. Drivers who flee after hitting a young pedestrian (under 11 years old) are likely to be identified, as are those whose victim is female *(2)*. Drivers in all types of hit-and-run crashes are significantly less (2.5 times) likely to be identified if the crash occurs at night than during the day. This is most likely an issue of available light and visibility, though it also may be associated with the greater likelihood of alcohol consumption at night. Lower traffic volume may also offer a greater chance to leave the scene quickly and without detection *(3)*.

Little research has focused on hit-and-run crashes, and even less has focused on pedestrian-involved hit-and-run crashes. This study aims to build upon the small body of previous research by evaluating recent, national data to evaluate the continuing pattern of pedestrian hit-and-run. This study focuses on a particular type of hit-and-run by evaluating single pedestrian victim fatalities where only one motor vehicle was involved. The purpose of including only these collisions is to be sure that the driver characteristics apply to the actual hit-and-run driver and the crash circumstances are only included once per collision.

METHODS

Data from FARS, a surveillance system operated by the U.S. Department of Transportation (DOT)'s National Highway Traffic Safety Administration (NHTSA), were used in this study. All motor vehicle collisions that occur on public roadways and result in one or more fatalities within 30 days of the recorded crash are included in FARS.

Pedestrian fatal crashes that occurred in all 50 U.S. states and the District of Columbia for a 10-year period (1998-2007) were eligible for analysis. Crashes where more than one pedestrian was killed were excluded. Crashes involving more than one motor vehicle were also excluded. Hit-and-run crashes classified as "Hit Motor Vehicle in Transport"; "Hit Parked Vehicle or Object"; "Driver Leaves Scene After Non-Collision Event"; and" Other Involved Person, Not a Driver, Left Scene" were also excluded. Drivers included in the analysis were in the striking vehicle, were in the hit-and-run vehicle, or were identified as the hit-and-run driver.

The dependent variables are hit-and-run (yes or no) and driver identified (yes or no). Covariates include characteristics of the crash environment, temporal characteristics, characteristics of the fatal pedestrian victim, and characteristics of the driver. Crash environment characteristics include population density and region, with population density as defined according to the Federal Highway Administration (FHWA). They also include road conditions: traffic control functional status, speed limit, and light condition. Light is taken from the reporting officer's determination. Temporal crash characteristics include time of day, time of week, and

season. Time of week is defined as weekend and weekday where weekend includes Friday 5pm-midnight, Saturday, and Sunday. Seasons are defined as winter (Dec.-Feb.), spring (Mar.-May), summer (June-Aug.), and fall (Sept.-Nov.). The categorization of seasons was determined based on typical lighting and weather patterns. Pedestrian victim characteristics include age, sex, and location at time of crash. As alcohol use from pedestrian fatal victims may be difficult to determine, pedestrian alcohol use was not included. Driver characteristics include age, sex, alcohol use, prior violations, license status, and old vehicle. Prior violations are those that occurred within the last three years. Alcohol use was determined from blood alcohol content (BAC). BAC was categorized as <0.10 and ≥ 0.10. Old vehicle is defined as a model year at least five years prior to the crash.

The statistical software, SAS 9.2 (SAS Institute, Cary, NC), was used to derive frequency distributions of relevant variables. *P*-values were obtained from the chi-square computed for non-missing values. SAS PROC LOGISTIC was used to conduct logistic regression analyses for: all pedestrian fatalities modeled for odds of hit-and-run (model 1; hit-and-run); pedestrian fatalities where driver was identified modeled for odds of hit-and-run (model 2; driver identified hit-and-run); and hit-and-run pedestrian fatalities modeled for odds of driver identification (model 3; hit-and-run driver identification). The impact of crash and pedestrian victim characteristics on hit-and-run status were assessed using pedestrian fatalities (model 1). Since a substantial amount of data were missing among the hit-and-run driver characteristics, the analyses were repeated to include driver characteristics for pedestrian fatalities where driver age and sex were known (model 2). One can evaluate the impact of the inclusion of the driver characteristics in model 2, however, this model includes only those drivers who were identified. Therefore, logistic regression analyses were also conducted for hit-and-run pedestrian fatalities with the main outcome as driver identified (model 3). Odds ratios (ORs), measures of the association, are presented for all models for the dichotomous outcomes. The odds ratios (ORs) indicate the increased risk compared to the referent group (e.g. an OR = 4.0 would indicate a risk 4 times that of the referent group). Sensitivity analyses were conducted for all final models to evaluate temporal changes (2003-2007 versus 1998-2002).

Nearly 40,000 pedestrian fatal crashes were evaluated to assess the crash and victim characteristic relations with hit-and-run (model 1). Nearly 35,000 of these crashes were evaluated where drivers were identified to assess the impact of driver characteristics (model 2). Approximately 7,700 hit-and-run crashes were analyzed to assess factors related to driver identification (model 3).

RESULTS

Table 1 presents the total number and row percents for characteristics of interest stratified by hit-and-run status. A total of 43,045 single pedestrian fatalities occurred in 1998-2007 as a result of single motor vehicle crashes. Nearly 18% of pedestrian fatalities were the result of driver hit-and-run. Models 1 and 2 are presented in table 2. The first model includes crash and pedestrian characteristics (n=39,133). The second model includes crash, pedestrian, and driver characteristics where the driver is identified (n=34,940).

TABLE 1 Characteristics associated with pedestrian fatality as a result of single motor vehicle hit-and-run, FARS 1998-2007 (p<0.0001)

	N	% Hit-and-Run
Crash (N = 43,045)		
Time of Day		
Midnight-3:59 AM	6,207	35.3
4:00-7:59 AM	5,097	18.5
8:00-11:59 AM	3,577	7.8
Noon-3:59 PM	4,416	8.0
4:00-7:59 PM	10,840	11.6
8:00-11:59 PM	12,634	19.6
Unknown	274	72.3
Time of Week		
Weekday	25,420	14.5
Weekend	17,611	22.7
Unknown	14	64.3
Season		
Winter	11,584	16.5
Spring	9,399	18.1
Summer	9,638	20.4
Fall	12,424	17.1
Light condition		
Daylight	12,856	9.3
Some light	16,009	23.4
Dark	13,912	19.4
Unknown	268	22.8
Population density		
Rural	12,115	14.9
Urban	30,404	19.1
Unknown	526	17.9
Region		
Northeast	7,199	16.0
Midwest	6,692	19.9
South	18,158	16.8
West	10,996	19.6
Traffic control		
None/non-functioning	35,352	18.4
Traffic control functioning	7,348	15.3
Unknown	345	18.6
Speed limit		
<=30	9,292	20.0
35-50	20,259	17.5
55+	11,274	14.8
Unknown	2,220	28.3

	N	% Hit-and-Run
Driver		
Age		
<16	77	32.5
16-20	4,841	11.0
21-25	5,137	13.3
26-30	4,312	11.2
31-35	4,083	9.3
36-45	7,781	8.7
46-55	5,848	5.2
56-60	2,030	3.2
61-65	1,352	3.3
66-70	934	3.7
71-75	878	3.6
76-80	603	3.3
81 and older	564	4.6
Unknown	4,605	95.2
Sex		
Female	10,710	6.7
Male	28,102	10.4
Unknown	4,233	95.9
Alcohol use		
<.10	8,868	5.5
>=.10	1,605	30.5
not tested, unknown	32,572	20.6
Prior DWI		
No	37,214	8.1
Yes	768	30.6
Unknown	5,063	88.1
Prior other moving violation		
No	30,845	7.8
Yes	7,137	11.5
Unknown	5,063	88.1
Prior suspension		
No	33,422	6.9
Yes	4,560	20.1
Unknown	5,063	88.1
Valid license		
No	3,399	31.0
Yes	34,769	6.5
Unknown	4,877	90.2
Old vehicle		
No	3,595	7.0
Yes	35,102	9.6
Unknown	4,348	93.6

	N	% Hit-and-Run
Pedestrian		
Age		
0-5	1,428	12.9
6-10	1,219	11.7
11-15	1,427	13.2
16-20	2,405	22.0
21-25	2,803	25.7
26-30	2,518	23.6
31-35	2,773	23.9
36-45	7,657	21.4
46-55	6,991	19.0
56-60	2,470	15.2
61-65	1,944	13.8
66-70	1,811	12.9
71-75	2,014	12.5
76-80	2,098	9.2
81 and older	3,055	8.4
Unknown	432	29.6
Sex		
Female	13,169	15.6
Male	29,829	18.9
Unknown	47	8.5
Location		
In Crosswalk	4,108	16.8
On Roadway	34,572	17.0
Other location	3,664	24.6
Unknown	701	32.1

TABLE 2 Crash, pedestrian, and driver characteristics associated with pedestrian fatalities as a result of single motor vehicle hit-and-run, FARS 1998-2007

	Model 1 – crash + pedestrian characteristics (N = 39,133)				Model 2 – crash, pedestrian + driver characteristics (N = 34,940)			
Crash characteristics	OR	95% CI		*p*	OR	95% CI		*p*
Time of Day								
Midnight-3:59 AM	4.344	3.606	5.233	<.0001	3.624	2.772	4.740	<.0001
4:00-7:59 AM	2.144	1.792	2.565	<.0001	1.712	1.321	2.220	<.0001
8:00-11:59 AM	referent				referent			
Noon-3:59 PM	1.002	0.834	1.203	0.9858	0.984	0.764	1.268	0.9025
4:00-7:59 PM	1.186	0.999	1.409	0.0517	1.202	0.944	1.530	0.1361
8:00-11:59 PM	1.980	1.651	2.375	<.0001	1.892	1.458	2.454	<.0001
Weekend vs. Weekday	1.377	1.301	1.459	<.0001	1.193	1.095	1.299	<.0001
Summer vs. Other seasons	1.086	1.016	1.160	0.0146	1.039	0.942	1.146	0.4497
Light conditions								
Light	referent				referent			
Some light	1.610	1.436	1.805	<.0001	1.425	1.207	1.681	<.0001
Dark	1.347	1.194	1.520	<.0001	1.317	1.105	1.570	0.0021
Region								
Northeast	referent				referent			
Midwest	1.376	1.241	1.526	<.0001	1.135	0.982	1.314	0.0875
South	1.030	0.941	1.128	0.5213	0.766	0.674	0.870	<.0001
West	1.293	1.176	1.421	<.0001	0.927	0.811	1.060	0.2692
Urban vs. rural	1.237	1.151	1.330	<.0001	1.005	0.904	1.117	0.9298
Traffic control functioning vs. not function/none	0.825	0.754	0.902	<.0001	0.896	0.785	1.023	0.1039
Speed limit >=55	0.610	0.567	0.656	<.0001	0.617	0.553	0.689	<.0001
Pedestrian characteristics								
Age								
0-15	0.940	0.841	1.052	0.2812	1.172	1.006	1.365	0.0415
16-25	1.127	1.040	1.221	0.0035	1.225	1.091	1.376	0.0006
26-65	referent				referent			
66+	0.690	0.633	0.753	<.0001	0.767	0.674	0.874	<.0001
Male vs. Female	1.062	0.997	1.131	0.0623	0.962	0.877	1.054	0.4063
Location								
Crosswalk	referent				referent			
Road	0.770	0.688	0.862	<.0001	0.775	0.655	0.916	0.0028
Other	1.712	1.489	1.968	<.0001	1.926	1.580	2.347	<.0001
Driver characteristics								
Age								
<=25					1.770	1.424	2.202	<.0001
26-65					referent			
66+					1.292	1.045	1.597	0.0180
Male vs. Female					1.279	1.158	1.413	<.0001
Alcohol								
<.10					3.936	3.340	4.638	<.0001
>=.10					1.810	1.615	2.028	<.0001
Not tested/unknown					referent			
Prior DWI*					1.784	1.457	2.185	<.0001
Prior other moving violation*					1.118	1.010	1.238	0.0309
Prior suspensions*					1.470	1.306	1.655	<.0001
Valid license					0.235	0.211	0.263	<.0001
Vehicle older than 5 years					1.448	1.224	1.713	<.0001
*within the past 3 years								

Environmental and Temporal Crash Characteristics

As shown in Table 1, the early morning (midnight-4 AM) has the highest share of hit-and-run pedestrian fatalities (35.3%), as do the weekend (22.7%), summer (20.4%), and conditions when there was "some" light (23.4%) as noted on the police report. The results are consistent in both models 1 and 2 as shown in Table 2. Fleeing the crash is more likely in the early morning (OR=4.3, $p<.0001$ and OR=3.6, $p<.0001$ respectively), where there is limited daylight (OR=1.6, $p<.0001$ and OR=1.4, $p<.0001$ respectively), and on the weekend (OR=1.4, $p<.0001$ and 1.2, $p<.0001$ respectively).

As shown in Table 1, hit-and-run pedestrian fatalities were slightly more likely to occur in urban locations (19.1% vs. 14.9% in rural locations) and locations with no or non-functioning traffic controls (18.4% vs. 15.3% with functioning traffic controls). An increased risk of hit-and-run was associated with urban location and no/non-functioning traffic control (table 2, models 1 and 2), however, was not significant where the driver was identified (model 2). Hit-and-run collisions were less likely to occur in higher speed limit locations (models 1 and 2).

Pedestrian Fatal Victim Characteristics

Drivers were less likely to flee from collisions involving younger and older pedestrian victims; fewer than 13% fled after killing a victim younger than 10 or 66 years or older (Table 1). Holding other circumstances constant, hit-and-run collisions were 30% less likely when the victim was at least 66 years old (models 1 and 2). The odds were higher for victims younger than 15 year olds when controlling for driver characteristics for driver identified crashes (model 2). Drivers were more likely to flee when the pedestrian was in a location other than the crosswalk or road (OR=1.7, $p<.0001$ and 1.9, $p<.0001$; models 1 and 2 respectively) (Table 2).

Driver Characteristics

Over 11% of the fatalities analyzed in the adjusted model had unidentified drivers involved (Table 2). A higher percent of hit-and-run fatalities had missing driver characteristics. Hit-and-run drivers were more likely to be male, have prior violations, suspension, and an older vehicle and less likely to have a valid driver's license (Tables 1 and 2). In the adjusted model where the driver was identified (Table 2), young age (≤25 years), positive blood alcohol content (<0.10 and ≥0.10), and prior DWI significantly increased the risk of leaving the scene 1.8, 3.9, 1.8, and 1.8 times respectively.

Table 3 presents the characteristics of interest for hit-and-run fatalities stratified by driver identification status. A total of 3,301 hit-and-run drivers were identified. In general, the proportion of missing crash and pedestrian characteristics were similar, although, a little less is known about the location where drivers were unidentified. Drivers were more likely to be identified during the day and in the daylight.

TABLE 3 Characteristics associated with hit-and-run driver identification, FARS 1998-2007

Crash (N = 7,696)	N	% Driver Identified	**Pedestrian**	N	% Driver Identified
Time of Day*			Age*		
Midnight-3:59 AM	2,194	41.2	0-5	184	54.9
4:00-7:59 AM	943	36.3	6-10	143	62.2
8:00-11:59 AM	278	48.9	11-15	188	60.6
Noon-3:59 PM	353	55.2	16-20	530	48.1
4:00-7:59 PM	1,257	48.1	21-25	720	46.4
8:00-11:59 PM	2,473	43.5	26-30	594	40.9
Unknown	198	22.7	31-35	662	39.3
Light condition*			36-45	1,640	39.9
Daylight	1,190	53.0	46-55	1,327	39.5
Some light	3,742	40.9	56-60	375	45.1
Dark	2,703	41.8	61-65	269	43.1
Unknown	61	19.7	66-70	233	42.5
Population density*			71-75	252	47.2
Rural	1,802	47.8	76-80	194	49.0
Urban	5,800	41.3	81 and older	257	40.9
Unknown	94	45.7	Unknown	128	18.8
Region*			Sex*		
Northeast	1,153	47.5	Female	2,058	47.7
Midwest	1,333	47.3	Male	5,634	41.1
South	3,053	40.9	Unknown	4	50.0
West	2,157	40.4	Location*		
Speed limit**			In Crosswalk	691	44.4
<=30	1,857	46.8	On Roadway	5,879	40.3
35-50	3,539	44.0	Other location	901	62.5
55+	1,671	43.0	Unknown	225	28.0
Unknown	629	25.0			

* p-value <0.0001

** p-value <0.05

The results of the adjusted model (model 3) for pedestrian hit-and-run crashes are shown in Table 4. In this model, the odds ratios for time of day were not statistically significant. Drivers were less likely to be identified in urban, higher speed limit, southern U.S., and western U.S. locations. Drivers were more likely to be identified when the victims were young, female, and in locations other than a crosswalk or road.

TABLE 4 Crash and pedestrian victim characteristics associated with hit-and-run driver identification, FARS 1998-2007

	Hit-and-run pedestrian fatalities (N = 6,538)			
Crash characteristics	OR	95% CI		*p*
Time of Day				
Midnight-3:59 AM	1.225	0.861	1.742	0.2589
4:00-7:59 AM	0.913	0.643	1.296	0.6100
8:00-11:59 AM	referent			
Noon-3:59 PM	1.225	0.854	1.757	0.2699
4:00-7:59 PM	1.290	0.926	1.799	0.1326
8:00-11:59 PM	1.292	0.913	1.828	0.1488
Light conditions				
Daylight	referent			
Some light	0.704	0.570	0.870	0.0012
Dark	0.674	0.539	0.843	0.0005
Region				
Northeast	referent			
Midwest	0.853	0.710	1.026	0.0918
South	0.651	0.552	0.769	<.0001
West	0.627	0.529	0.744	<.0001
Urban vs. rural	0.647	0.563	0.743	<.0001
Speed limit >=55	0.793	0.692	0.909	0.0009
Pedestrian characteristics				
Age				
0-15	1.757	1.425	2.167	<.0001
16-25	1.334	1.161	1.534	<.0001
26-65	referent			
66+	1.095	0.930	1.289	0.2755
Male vs. Female	0.836	0.746	0.936	0.0020
Location				
In Crosswalk	referent			
On Roadway	0.894	0.747	1.072	0.2260
Other location	2.144	1.707	2.693	<.0001

DISCUSSION

This study used the most recent 10 years of FARS data to evaluate crashes with a single pedestrian fatal victim and where only one motor vehicle was involved. These crash types represent some of the most severe cases and where there was likely little contribution from other party types. Consistent with previous research, drivers are more likely to flee when circumstances are such that they are less likely to be caught, like when visibility is poor or when there are few potential witnesses. Places with lower visibility and fewer witnesses also make it easier to protect driver identity.

Also consistent with prior research, pedestrian victim characteristics were associated with hit-and-run and driver identification. Pedestrian victim characteristics may influence guilt which might affect leaving the scene. They may also influence the willingness of witnesses to be come

involved. The results of these analyses indicate that older victims were less likely to be left, however, younger victims were more likely to be left among driver identified analyses. Law enforcement may put more effort into identifying drivers who kill young victims, which would affect the results. It may also be that older and younger victims are more likely to be hit during the day time when witnesses are available.

Similar to previous research, driver characteristics were associated with hit-and-run. It is reasonable to suggest that drivers who leave the scene fear the consequences more than drivers who stay. Perhaps younger hit-and-run drivers are more likely to drink and drive and, therefore, the consequences would be greater. Similarly, older drivers may fear that they face greater consequences due to age or are more likely to fail to detect that they hit a pedestrian. Alcohol use, driving history, and vehicle age increased the risk of hit-and-run. Vehicle age could be a marker for socioeconomic status, which has been correlated with alcohol-impaired driving *(2, 4)*.

A few findings from this study differed from prior research. Solnick and Hemenway found an increase in hit-and-run crashes in the summer, postulating that the association of hit-and-run crashes with weekends, nights, and summers may be due to increased consumption of alcohol at those times. Summer elevated the risk slightly in both of the models from this study, but it was not significant in the driver identified model where driver alcohol status was included. Also, Solnick and Hemenway found that drivers in the South were least likely to flee *(2)*, the descriptive statistics of the more recent data suggest that drivers in the Northeast are least likely to flee (16.0%), followed closely by the South (16.8%). Holding other variables constant, however, the results do not conclusively show which region has a smaller percentage of hit-and-run collisions. The variations in the results suggest that there are other factors that are affecting the regional differences. Leaving the scene could vary by population density.

LIMITATIONS AND FUTURE RESEARCH

It should be noted that missing covariates resulted in the loss of 9.1% of the eligible crashes. However, many key findings of these analyses were consistent with the small body of previous research. Alcohol use and early morning, the time frame when persons may be leaving bars and parties, were among the leading factors that increased the risk of hit-and-run. Pedestrian alcohol use, which was not evaluated, may also contribute to this risk. Reducing alcohol-related crashes would decrease injury and fatality but could substantially reduce pedestrian fatality as a result of hit-and-run.

In order to obtain a robust sample of pedestrian-involved crashes and sub-sample of driver hit-and-run crashes, we used data from FARS, a national database of fatal collisions. Because the analysis excluded non-fatal pedestrian collisions, the generalizability of our results to pedestrian injury collisions could be limited. Research that included injury collisions could add more knowledge, because the decision of the driver to flee the scene is likely influenced by the severity of the pedestrian's injuries, among other factors.

In this study, many characteristics of the environment (e.g. pedestrian location, traffic controls, urban setting, regional density) were associated with hit-and-run but were not significant among driver identified analyses controlling for driver characteristics. It is not clear from these analyses if driver characteristics were better predictors of hit-and-run because approximately half of hit-and-run drivers are never identified and those who are listed as identified do not necessarily have their identities confirmed. Future research should attempt to understand the characteristics of both types of drivers.

While the degree of urbanity (urban vs. rural) was used in the analyses, it is a crude measure for driver and pedestrian exposure. Pedestrian volume is often difficult to obtain. Future research might consider evaluating the impact of estimates of pedestrian volume for detailed analyses of specific areas where this data are available. For such areas, vehicle miles traveled by time of day and time of year could also be evaluated.

Research to achieve better understanding of the social and physical context may assist educational efforts and countermeasures. Future research could also focus on better understanding geospatial characteristics. For example, the correlation of hit-and-run crashes and the separation distance from various points of interest, such as bars. By identifying specific factors, resources can be allocated for education, enforcement, and other efforts effectively and efficiently. For example, if young women leaving bars are more likely to be victims, then PSAs can be tailored to reach that demographic. If drivers with prior violations are more likely to hit-and-run then suspension and revocation policies may be evaluated for improvements. If the issue is lighting, then street lights can be improved or installed.

ACKNOWLEDGMENT

This paper is based on a study that was funded by the National Highway Traffic Safety Administration (NHTSA) titled "An In-Depth Examination of Pedestrian-Involved Hit and Run Crashes," contract number, DTNH22-06-D-00039.

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