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Determining the Incidence of Distraction Among Trauma Patients in All Modes of Transportation

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Invited Discussant: Jamie J. Coleman, MD

BACKGROUND: The use of distracting technology is an increasing source of risk for injury among trauma patients. Both drivers and pedestrians show increased unsafe behavior. The data for prevalence and risk for distraction in trauma has varied widely. Our hypothesis is that distraction is more highly prevalent and widely distributed among all mechanisms of injury and variety of trauma patients.

METHODS: A 10 question survey of adult trauma victims at a Level I trauma center regarding distraction at time of event was performed, examining age, gender, ethnicity, education level, mode of injury and role in the accident (driver, passenger, pedestrian, bicyclist, motorcyclist). Multiple variable logistic regression was performed to identify risk factors for distraction.

RESULTS: From June 2016 to October 2018, 1316 patients were surveyed, and 1011 (76.8%) patients reported their role in the traffic accident. The prevalence of distraction was 21.73% among drivers, 9.01% among passengers, 16.50% among pedestrians, 20.00% among bicyclists, and 8.09% among motorcyclists. Males (OR=1.84; CI=1.26-2.67) as well as all Others (OR=2.09; CI=1.10-3.98) showed statistically significant increased risk for distraction. Motorcyclist (OR=0.25; CI=0.13-0.50) and passenger (OR=0.37; CI=0.18-0.77) roles during collision were a lowered risk of distraction. Furthermore, Asian/Pacific Islanders (OR=1.62; CI=0.94-2.79) trended towards being at greater risk for distraction.

CONCLUSIONS: Distraction is prevalent among a wide range of traffic accident victims, not just drivers. Males as well as all Others are more likely to be distracted. In contrast, motorcyclists and passengers are less likely to be distracted. Further studies to assist in determining effective interventions and public safety efforts aimed at specific at-risk groups beyond motor vehicle drivers are warranted.

LEVEL OF EVIDENCE: *We defer to the editor's judgment regarding this as we could not determine the appropriate level of evidence.*

Study Type: Epidemiological

Key Words: motor vehicle collision, distraction, traffic, motorcycle collision, pedestrian distraction, transportation

Background

It is well known that distracted travel contributes to increased safety risks on the road. Distracted driving accounted for 9% of total crashes and fatalities in 2016,[1] and more than 23% of drivers have been found to experience some form of distraction.[2] The increase in cell-phone usage since the turn of the century, for example, has been shown to add to sources of distraction posing a safety hazard.[3] About 60% of drivers have reported cell phone distraction within 30 days of questioning and studies show that cell phone conversations reduced visual attention.[4,5,6] Texting in particular was found to be most distracting while a hands-free cell phone was least distracting.[3,7] This research encouraged the development of legislation banning hand-held cell phone usage and texting at the wheel, leading to decreases in inattentive driving.[8]

Despite its effectiveness, the majority of research and prevention does not address the issue of distraction in regards to other modes of transportation. Distraction in non-drivers is also important to consider because some research has found that up to 31.2% of bicyclists are distracted while commuting.[9] Also, pedestrian distraction increases crossing times and raises rates of unsafe behavior.[10,11] Motorcyclists are especially susceptible to accidents when another driver is distracted.[12] We therefore strove to assess the variety of situations in which trauma patients were injured. The ultimate goal was to obtain a cohesive database of distracted traumas to limit correctable incidents and stimulate prevention programs. We hypothesize that distraction is widely distributed among all modes of transportation and varieties of trauma patients.

Methods

Trauma patients at the University of California, Irvine Medical Center (UCIMC) were prospectively enrolled in an IRB approved study from June 2016 to October 2018. Screening, confirmation of consent from the patient, and administration of the survey were conducted by emergency medicine research associates and members of a clinical research program comprised

of undergraduate students between the hours of 8 AM to 12 AM daily. Associates were specifically trained in the performance of the study.

Eligible patients for the study included: all adults involved in a transportation related trauma, English or Spanish speakers only due to the survey's limited translations, and patients admitted to Trauma/Acute Care Surgery/Emergency Department via ambulance or Burn Service. Patients who declined or were unable to participate due to age or the severity of their injury were excluded.

If eligible, the patient received a non-judgmental scripted explanation of the study including an emphasis on anonymity/confidentiality and the optional nature of the 10 question survey. Upon consenting to participate, the patient explained how his/her accident occurred. Patients reported distraction at time of the event (if applicable), mode of injury (motor vehicle collision, struck by an automobile, mechanical fall, bicycle accident), role in the accident (driver, passenger, pedestrian, bicyclist, motorcyclist), age, gender, completed education level (no schooling, elementary, high school, some college, college 2 years, college 4 years, master's degree, professional, doctorate degree), and ethnicity (Latino, Caucasian, African American, Asian/Pacific Islander, Native American, other) (Figure 1). In this study, the ethnicity category "other" refers to all who identified as an unlisted option while "Other" refers to African Americans and Native Americans in addition to those identifying as an unlisted option. The Other ethnicity category was created for statistical reasons due to the low sample sizes of certain individual variables. De-identified written paper data was stored in a binder within the Emergency Department to be later transferred to electronic versions, which log the information into online spreadsheets. All data points were analyzed by Pearson chi-squared test to identify significant differences in distraction within individual categories and multiple variable logistic regression was conducted to identify risk factors for distraction. No identifiable information or Protected Health Information (PHI) was obtained.

Results

A total of 1316 patients answered the study's survey. Of these, only 961 were completed with 355 remaining incomplete due to a patient missing questions or choosing to stop (Figure 2). Retrospective data input was not possible as we did not collect PHI. Out of the total 1316, 1032 reported nature of their collision and 1011 reported their role during the collision. In addition, 1240 reported age, 1247 reported gender, 1037 reported level of education completed, and 1036 reported ethnicity. 194 various particular distractions (eating, sleepiness, etc.) reported by 177 patients were also collected with 17.01% of distractions being related to cell phone use (Table 1). For univariable analysis we included all patients who answered any of the single survey questions to increase sample sizes for chi-squared tests (Table 2). This was not the case for the multiple variable logistic regression, which included only the 961 patients who fully completed the surveys (Table 3).

Demographic characteristics gathered from patients highlighted factors prominent in those at greater risk for distraction. Pearson chi-squared tests found no significant differences in levels of distraction for age ($p=0.86$) and education ($p=0.28$) (Table 2). However, gender contained statistically significant differences ($p<0.01$) with 16.71% of males (n=736) and 11.15% of females (n=511) reporting distraction (Table 2). Logistic regression confirmed results and specified that male gender increased risk for distraction (OR=1.84; CI=1.26-2.67) (Table 3). Although not statistically significant, ethnicity also trended towards increased distraction levels ($p=0.08$) with logistic regression presenting Asian/Pacific Islander (OR=1.62; CI=0.94-2.79) at higher risk (Table 2 and 3). All Other ethnicities (OR=2.09; CI=1.10-3.98) were at statistically significant higher risk compared to Caucasians and Latinos (Table 2 and 3).

Data collected on nature of collision and role during collision provided further information on which modes of transportation were more likely to distracted. Pearson chi-

squared tests calculated no significant differences in distraction among the nature of collisions (p=0.30) (Table 2). However, role during collision was found to have significant differences (p<0.01) with 9.01% of passengers (n=111) and 8.09% of motorcyclists (n=136) reporting distraction compared to 21.73% of drivers (n=566), 16.50% of pedestrians (n=103), and 20.00% of bicyclists (n=95) (Table 2). Logistic regression was performed to confirm findings and indicated passengers (OR=0.37; CI=0.18-0.77) and motorcyclists (OR=0.25; CI=0.13-0.50) to be at a decreased risk for distraction (Table 3).

Discussion

Transportation distraction is a known safety hazard to those on the road. The present study therefore sought to compile data on all modes of distracted traumas to expand current knowledge of patient injury. Specifically, we examined whether distraction was present across all forms of transportation and trauma patients. Additional data points of particular distraction types were also gathered, revealing distractions involving cell-phone use to be especially prevalent as expected. [3,4,5,6] However, specific types of cell phone use did not contribute significantly to findings.

By administering a survey to 1316 patients at the UCIMC Emergency Department, we found that presence of male gender (OR=1.84; CI=1.26-2.67) increased risk for distraction (Table 3). Previous studies regarding gender corroborate this finding. In 2016, more than twice as many males were involved in fatal crashes than females.[13] It has also been shown that males display riskier attitudes and distracted behavior on the road despite self-reporting safe driving practices, which most likely contributed to the gender differences.[14,15] Our data analysis additionally revealed that all Other ethnicities (OR=2.09; CI=1.10-3.98) were also statistically at increased risk for distraction while the Asian/Pacific Islander ethnicity only trended towards increased risk for distraction (OR=1.62; CI=0.94-2.79) (Table 3). There is a small amount of

evidence suggesting that cultural differences and traffic practices may contribute to this finding.[16] Further study is required to confirm this possible variable.

Passengers (OR=0.37; CI=0.18-0.77) and motorcyclists (OR=0.25; CI=0.13-0.50) were conversely found to be at decreased risk for distraction (Table 3). Although motorcyclist fatalities occurred almost 28 times more frequently than other vehicle fatalities in 2016,[17] we believe that it is highly unlikely to be due to motorcyclist distraction. The majority of motorcycles require manual shifting and all require coordination, balance, and keen attention.[12,18] Motorcyclists were therefore less likely to be distracted, a finding emphasized by a previously mentioned study revealing that motorcyclists are particularly susceptible to distracted drivers in other vehicles rather than their own.[12] In fact, banning cell phone use for car drivers has been shown to reduce motorcycle fatalities.[12]

Most importantly, however, the lack of significant differences in distraction levels among various ages (p=0.86), levels of education (p=0.28), nature of collisions (p=0.30), and certain roles during collision (driver, pedestrian, and bicyclist) support our hypothesis (Table 2 and 3). Inattention was noted in a wide distribution of cases outside of the well-documented car driver. This asserts that distraction is indeed a prevalent danger to a greater population than regularly scrutinized in the majority of traffic safety studies.

During the course of this study, there were several limitations. This project was conducted at one medical center, limiting the sample size and population from which the data was collected. Certain ethnicities might have been under or over represented as a result. A number of non-responders unable to complete the survey due to severe injury, altered mental status, or language barrier further narrowed the possible number of participants and could present selection bias. Non-responders who chose not to participate could also present self-selecting bias. Of note, the study relied upon patient participation and therefore likely contains self-reporting

bias. The topic of distraction on the road is a sensitive subject. Although our research associates took care to utilize non-judgmental language, the Emergency Department is still a stressful environment and patients might not have found themselves in the optimal position to provide an impartial answer. Presence of bias would affect the accuracy of our data and possibly understate distraction severity. No method of verifying patient distraction was available as research associates had no access to Emergency Medical Services (EMS) or police reports.

Overall, our findings support that distraction research should be conducted on other modes of transportation and on all varieties of individuals. By focusing only upon car drivers, research neglects other possible dangers associated with non-car drivers such as pedestrians and bicyclists. Further studies are required to gain an improved understanding of at-risk groups so that they may be targeted for long-term prevention and awareness programs.

Author Contribution: Brittany Le assisted in data collection, literature search, and writing. Dr. Cesar Figueroa provided revision and data interpretation. Dr. Craig Anderson conducted data analysis. Dr. Shahram Lotfipour contributed to the study design. Dr. Cristobal Barrios served as principal investigator and therefore contributed to study design, writing, revision, and data interpretation.

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Figure 1 legend/asterisks:

*The English capacity question was not included.

** Patients were provided specific answer selections for each question upon a yes response.

Figure 1: Patient Survey Questions

Figure 2: Patient Flow Chart

Figure 1

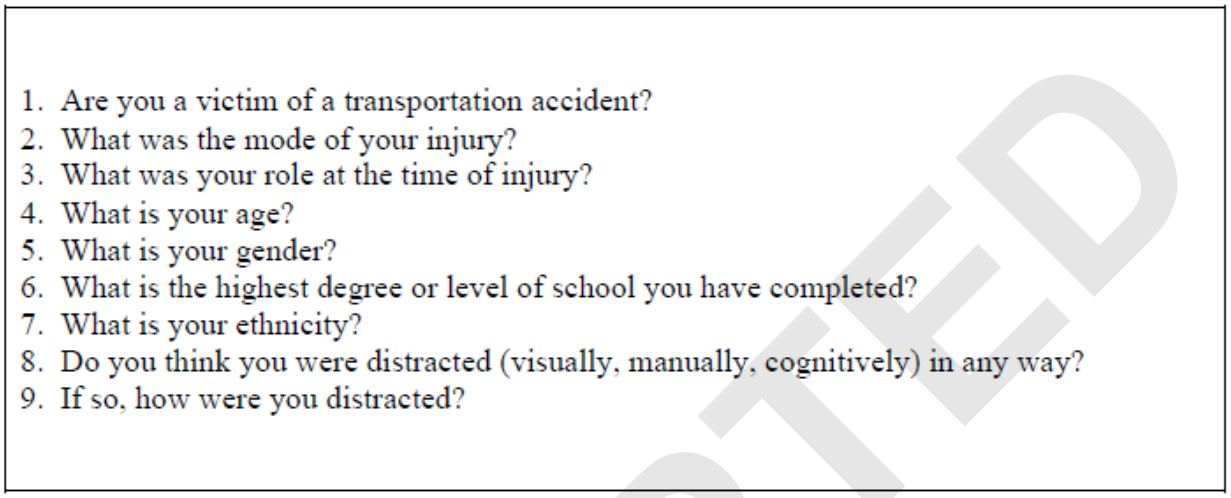

Figure 2

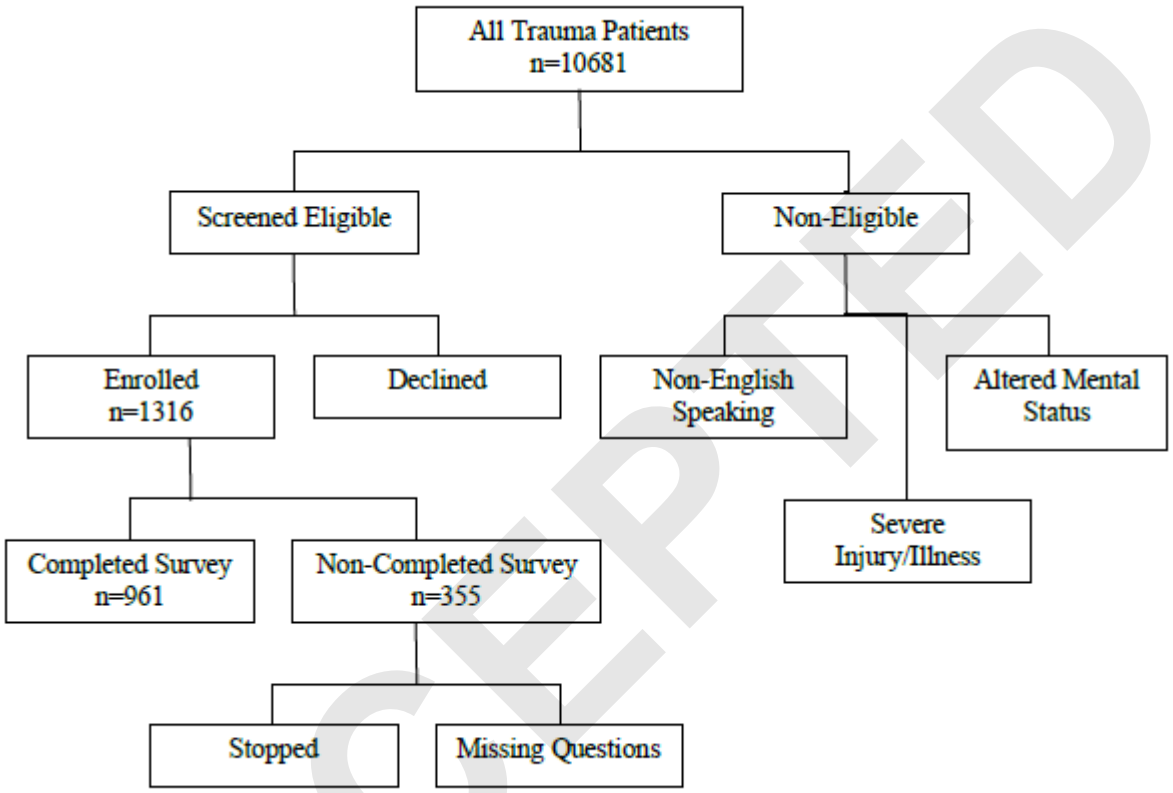

Table 1: Reported Distractions

Cell Phone Use	33 (17.01%)
Talking on cell phone	15 (7.73%)
Texting	6 (3.09%)
Web browsing/checking email/playing games	2 (1.03%)
Listening to music	6 (3.09%)
Looking for dropped/lost cell phone	2 (1.03%)
Other type of cell phone use	2 (1.03%)
Using other types of electronic devices	2 (1.03%)
Navigation system	5 (2.58%)
Eating/drinking	6 (3.09%)
Distracted by another person/pet in vehicle	13 (6.70%)
Intoxicated	21 (10.82%)
Blurred vision/obscured vision	4 (2.06%)
Looking behind/at mirror during lane change	3 (1.55%)
Running on street and focusing on path	2 (1.03%)
Avoiding animals on road	2 (1.03%)
Watching/avoiding a vehicle in another lane	8 (4.12%)
Changing gears	3 (1.55%)
Cognitively occupied/thinking of something else	22 (11.34%)
Sleepy/drowsy/tired	21 (10.82%)
Single Responses	22 (11.34%)
Unspecified	27 (13.92%)

Table 2: Levels of distraction by demographics, nature of collision, and role during collision.

		Non-Distracted	Distracted	p
Age	18-24 years	240 (84.51%)	44 (15.49%)	0.864
	25-34 years	253 (84.90%)	45 (15.10%)	
	35-44 years	161 (86.10%)	26 (13.90%)	
	45-64 years	277 (87.38%)	40 (12.62%)	
	65 and older	131 (85.06%)	23 (14.94%)	
Sex	Male	613 (83.29%)	123 (16.71%)	0.006
	Female	454 (88.85%)	57 (11.15%)	
Education	Less than high school	84 (83.17%)	17 (16.83%)	0.281
	High school or some college	501 (81.86%)	111 (18.14%)	
	2 or 4-year degree	212 (86.53%)	33 (13.47%)	
	Advanced degree	62 (78.48%)	178 (21.52%)	
Race/ethnicity	Latino	386 (84.84%)	69 (15.16%)	0.082
	Caucasian	324 (83.29%)	65 (16.71%)	
	Asian/Pacific Islander	101 (78.91%)	27 (21.09%)	
	All other	47 (73.44%)	17 (26.56%)	
Nature of Collision	Motor vehicle collision	597 (81.34%)	137 (18.66%)	0.298
	Struck by an automobile	186 (86.92%)	28 (13.08%)	
	Mechanical fall	16 (80.00%)	4 (20.00%)	
	Bicycle accident	53 (82.81%)	11 (17.19%)	
Role during Collision	Driver	443 (78.27%)	123 (21.73%)	<0.0005
	Passenger	101 (90.99%)	10 (9.01%)	
	Pedestrian	86 (83.50%)	17 (16.50%)	
	Bicyclist	76 (80.00%)	19 (20.00%)	
	Motorcyclist	125 (91.91%)	11 (8.09%)	

Table 3: Specific risk factors for distraction.

		n	Odds Ratio	95% CI
Age	18-24 years	218	1.34	0.80 - 2.26
	25-34 years	238	1.31	0.80 - 2.16
	35-44 years	150	1.15	0.66 - 2.02
	45-64 years	239	1.00	
	65 and older	116	1.22	0.67 - 2.21
Sex	Female	394	1.00	
	Male	567	1.84	1.26 - 2.67
Education	Less than high school	94	0.99	0.53 - 1.83
	High school/ some college	574	1.00	
	2 or 4-year degree	223	0.71	0.45 - 1.11
	Advanced degree	70	1.21	0.64 - 2.27
Race/ethnicity	Latino	420	1.00	
	Caucasian	359	1.21	0.80 - 1.85
	Asian/Pacific Islander	120	1.62	0.94 - 2.79
	All Other	62	2.09	1.10 - 3.98
Role during Collision	Driver	533	1.00	
	Passenger	104	0.37	0.18 - 0.77
	Pedestrian	101	0.70	0.40 - 1.24
	Bicyclist	91	0.80	0.45 - 1.42
	Motorcyclist	132	0.25	0.13 - 0.50