



An exploratory study of the relationship between road rage and crash experience in a representative sample of US drivers

Elisabeth Wells-Parker *, Jennifer Ceminsky, Victoria Hallberg, Ronald W. Snow, Gregory Dunaway, Shawn Guiling, Marsha Williams, Bradley Anderson

Social Science Research Center, Mississippi State University, PO Box 5287, Mississippi State, MS 39762, USA

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Abstract

The phenomenon of road rage has been frequently discussed but infrequently examined. Using a representative sample of 1382 US adult drivers, who were interviewed in a 1998 telephone survey, exploratory analyses examined the relationship between self-reported measures of road rage, generally hazardous driving behaviors, and crash experience.

Regarding specific road rage behaviors, most respondents reported having engaged in verbal expressions of annoyance; however only 2.45% reported ever having been involved in direct confrontation with another car or driver. After controlling for gender, age, driving frequency, annual miles driven and verbal expression, an angry/threatening driving subscale of road rage was significantly associated with hazardous driving behaviors that included frequency of driving over the legal blood alcohol limit, receipt of tickets in the past year, and habitually exceeding the speed limit as well as crash experience. However, the verbal/frustration expression subscale was not associated with crash experience or hazardous driving indicators, except for number of tickets, after controlling for other crash-related factors such as gender and age. Direct confrontation by deliberately hitting another car or leaving the car to argue with and/or injure another driver was rarely reported. Results suggest that angry/threatening driving is related to crash involvement; however, after controlling for exposure and angry/threatening and hazardous driving the relationship of milder expressions of frustration while driving and crash involvement was not significant. © 2002 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Road rage has captured the attention of the media and the public in recent years. Substantial numbers of drivers on US roads believe that they have experienced hostile, unsafe or aggressive acts on the part of other drivers (National Highway Traffic Safety Administration, 1999). However, there is no consistent definition of what constitutes road rage, and little systematic information about road rage as a phenomenon distinct from hazardous driving and general aggression. Hazardous driving is a well-established phenomenon (Beirness, 1993; Lajunen et al., 1997, 1999). There is

extensive evidence that hazardous driving practices and aggressive tendencies are associated with crash risk (Selzer and Vinokur, 1974; Elander et al., 1993). In contrast to general concepts of hazardous or high risk driving, the concept of road rage implies specific incidents of anger and aggression intentionally directed at another driver, vehicle, or object (e.g., construction barriers). Extreme forms of road rage, which are incidents that often capture media attention, involve direct physical assaults with the vehicle or a weapon, or direct confrontation with another driver or passenger with the intent of injury or actual injury. Road rage may be expressed by intentionally engaging in hazardous driving behaviors that are known to increase the risk of a crash occurring. Examples of such hazardous acts include deliberately tailgating or cutting another driver off of the road because one is angry with the other

* Corresponding author. Tel.: +1-662-325-7127; fax: +1-662-325-7966.

E-mail address: bwpark@ssrc.msstate.edu (E. Wells-Parker).

driver. Road rage may also involve provocation of other drivers, such as use of obscene gestures. Milder forms of road rage may include verbally expressing anger in relatively unobtrusive ways such as yelling through a closed window, complaining to oneself or to other passengers in the vehicle or using vehicle signals such as the lights to express frustration. Hennessy and Wiesenthal (1997) found that such mild forms of driver aggression occur frequently in day to day traffic interactions especially in congested traffic areas. Little is known about these mild forms of driver anger in terms of risk of traffic incidents. Relatively mild levels of frustration that may be commonly expressed in tense traffic situations could sufficiently disrupt driver attention and concentration to increase crash risk (Deffenbacher et al., 1994).

In the current study, several different concepts of road rage, including verbal and gestural expressions, hazardous driving behaviors committed because of anger, and direct confrontations with other vehicles or drivers, are explored using self-reports from a general US population sample. Associations between different definitions of road rage, self-reported crashes, driving exposure, demographics and other crash risk factors including habitually speeding, drinking and driving, and traffic violations are examined. It was expected that road rage, especially the more extreme forms of road rage involving provocation and threatening driving, would be related to both habitually engaging in risky driving and to more frequent crash reports. It was of special interest to explore the relationships between milder expressions of road rage and crash experience. This exploratory study should be useful in determining which concepts of road rage are related to important traffic outcomes such as crashes.

2. Method

Items used to measure road rage comprise a scale developed by James (James and Nahl, 2000). These items were included in a national telephone survey on driver behavior and traffic safety. Using random digit dialing the Survey Research Unit in the Social Science Research Center at Mississippi State University surveyed 1842 households and collected interviews from 1508 (81.9%) of those households in January and February of 1999. In each household, an adult over 17 was randomly selected based on age at next birthday. Of those interviewed, 1382 (91.7%) indicated that they drove a motor vehicle, and questions contingent on driving were asked only of these 1382 drivers. The mean age of the interviewed sample was 53.12 (S.D. = 16.85). Mean years of education was 13.91 (S.D. = 2.81). Fifty four percent of the sample

indicated a family income under \$40 000 per year, with 9% under \$10 000, and 9% over \$100 000. Females comprised 57.6% of the interviewed sample; 77.7% were Caucasian; 12% were African American; 4.6% were Hispanic; 2.2% were Asian; 0.5% were Native American; and 2.7% did not choose a race designation. Because white females were overrepresented, US Census estimates were used to weight observations. The sampling error for binomial questions under an assumption of a 50/50 split is at maximum 2.5% (Snow, 2000). Limitations of the data include the reliance on self-report and the possibility that incidence of road rage behaviors, crashes, and other risky driving practices may be underreported because of memory lapses or deliberate response biases (Elander et al., 1993).

2.1. Measures of road rage, crash involvement, and other driving behaviors

The 17 items comprising the measure of road rage (James and Nahl, 2000) include four items that are relatively mild verbal or gestural expressions of annoyance and anger but do not involve high risk driving acts. Content of these items include expressions of annoyance involving complaining about another driver to oneself or to passengers, giving another driver a dirty look, honking the horn or yelling through a window. These relatively innocuous expressions of annoyance were grouped together to form a verbal/frustration expression subscale of road rage. Five items involve driving behaviors that are potentially hazardous and could increase crash risk, such as speeding past other cars to express displeasure, preventing others from entering a lane or from passing, chasing another driver, or making sudden threatening driving moves. Two items involve clearly hazardous behaviors of tailgating or trying to cut another car off the road because of anger. The seven items that involve hazardous driving out of anger or as a threat toward another driver were grouped together to form a threatening/angry driving subscale of road rage. Three items involve direct contact or confrontation with another vehicle or driver by deliberately hitting another vehicle or by leaving the car to either argue with or to hurt another driver and are the most directly confrontational and extreme expressions of road rage. These three confrontational items were grouped together. Three additional items did not clearly belong to the three a priori defined groups. One of these items involves making obscene gestures, which in contrast to the milder expressions of frustration, is a more directly threatening or provocative behavior that is likely to aggravate and insult another driver. Another item indicates simply thinking about injuring another driver and could be an indicator of

escalation of frustration to more aggressive acts. The remaining item, carrying a weapon for use in driving incidents, could be preparatory to violent confrontations in the driving situation but does not represent behaviors or thoughts during the act of driving. Responses to the 17 road rage items were given on a Likert-type scale ranging from never (0) to often (3).

Two crash measures – involvement in any serious crash and involvement in any crash over the prior 12 month period – were available in the survey data as dichotomous variables. These crash measures are imperfect measures of crash risk as a driver. Specifically the respondents were not asked to identify driver status, when asked of involvement in a serious crash, and for both indicators, no determination of fault was made. Several measures indicated whether respondents habitually engaged in risky driving practices. Specifically, respondents were asked how frequently in the past 12 months they had driven over the legal blood alcohol content (BAC) limit. For analysis, answers were categorized as never (0); once only (1) or more than once (2). Respondents were asked whether they had received a ticket for a moving violation during the past 12 months and whether they usually drove below, at or only slightly above or well above the limit. Responses to the speed limit item were dichotomized (below, at, or slightly above the speed limit (0) versus well above the limit (1)) for analysis purposes because few respondents indicated driving below the limit. For use as control variables, responses to questions about yearly miles driven, age, and education were categorized.

2.2. Analysis techniques

Prevalence rates expressed as percentages were estimated for the general population using the above described weighting scheme. Unweighted data were used in analyses of relationships among variables. For simplicity in this exploratory study, analyses of variance, multiple regression analyses, including logistic regression analysis, and *t*-tests were used for examination of relationships between suggested road rage subscales, crash involvement, and other high risk driving behaviors such as speeding and drinking/driving. Dichotomies of responses to road rage items were examined to further explore road rage patterns and crash involvement.

3. Results

3.1. Prevalence rates of road rage behaviors

Table 1 shows reported rates for each of the road rage items. Prevalence estimates from weighted data never differed from observed rates by more than one percentage point and are not shown. Relatively innocuous verbal expressions of anger and aggression toward other drivers were common with most respondents indicating that they had said bad things to themselves or complained to passengers about other drivers. Most drivers indicated that they had on occasions given another driver a dirty look, and about 40% indicated that they had honked or yelled through a window at

Table 1
Item frequencies and factor loadings of road rage items^a

Item	Valid responses (unweighted%)				Loading $\geq 0.40^b$		
	Never	Rare	Sometimes	Often	F1	F2	F3
Say bad things to yourself about another driver (SAYBAD)	15	23	40	22		0.80	
Complain/yell about another driver to your passenger (COMPLAIN)	26	22	39	13		0.79	
Give other drivers dirty looks (DIRTY LOOK)	42	17	32	8		0.66	
Honk/yell at someone through window (HONK)	62	18	17	3		0.60	
Obscene gestures at other driver (OBSCENE)	84	9	6	1	0.50		
Think about physically hurting other driver (THINK HURT)	89	5	4	1	0.40		
Follow/chase other driver in anger (CHASE)	97	3	<0.05	0	0.48		
Make sudden or threatening driving moves (THREAT)	95	4	1	≤ 0.01	0.70		
Tailgate others to force move (TAILGATE)	87	7	6	≤ 0.1	0.55		
Speed past other car/rev engine to show displeasure (SPEED)	87	8	6	≤ 0.05	0.51		
Keep someone from entering lane from anger (KEEP OUT)	81	12	6	1	0.59		
Deliberately prevent other driver from passing (PREVENT PASS)	91	5	3	≤ 0.05	0.67		
Try to cut another car off road (CUT OFF ROAD)	98	1	<0.05	≤ 0.01	0.52		
Get out of car to argue with another driver (ARGUE)	98	2	<0.05	≤ 0.01			0.64
Deliberately hit another car (HIT CAR)	99	<0.05	<0.01	0			0.78
Get out of the car to hurt other driver (HURT)	99	<0.05	<0.01	0			0.85
Carry weapon if needed for driving incident (WEAPON)	96	1	2	1	NA	NA	NA

^a Items from James and Nahl (2000).

^b Factor 1 angry/threatening driving; Factor 2 verbal/frustration expression; Factor 3 direct confrontation.

another driver out of annoyance. In contrast, only 16% admitted to a more provocative form of anger expression by making obscene gestures toward other drivers, and only 10% admitted to escalation of aggression to actually thinking about hurting another driver. Less than 1% reported frequently making obscene gestures or often thinking about hurting another driver. Few respondents admitted to ever engaging in each of the potentially hazardous driving behaviors, such as speeding past other cars, tailgating, or preventing lane entry or passing as expressions of anger toward other drivers (Table 1). Even more blatant and threatening expressions of anger by hazardous driving were rarely reported. Less than 5% reported ever having chased other drivers in anger, ever making threatening driving moves or ever trying to cut another car off of the road. Actual confrontations were rare. Less than 2% of respondents reported that they had ever left their car to argue with or injure another driver or ever deliberately hit another car. Less than 5% of the sample indicated carrying a weapon in case it was needed in a driving incident. Because the weapons item does not represent an expression of frustration or anger in the actual driving situation, it was omitted from further analysis.

Principal component factor analysis with varimax rotation was used to confirm item groupings. When the 14 items that were assigned to the three original groupings were analyzed, factor structure paralleled the three proposed groupings in that three factors with eigenvalues greater than one emerged, and items with highest loadings on each of three factors conformed to the item groupings. When the obscene gestures and the thoughts of injury items were added to the analysis, the three factor solution again corresponded to the a priori groupings and the two additional items had highest loadings on the angry/threatening driving factor (Table 1).

Road rage subscales using 16 of 17 James and Nahl (2000) items (i.e., omitting the weapons item) were formed based on the a priori groupings and the factor analysis. For the four item verbal/frustration subscale the internal consistency estimate, mean and standard deviation were 0.72, 4.75, and 2.88, respectively and scores ranged from 0 through 12. The two items denoting obscene gestures and thoughts of injuring other drivers were added to the angry/hazardous driving grouping to form an angry/threatening driving subscale, which had a range of scores from 0 through 19 and an internal consistency estimate of 0.72. The subscale mean was 1.32 (S.D. = 2.34). Because the three confrontational items were reported by less than 2% of respondents, these items were not used to form a subscale. Rather a dichotomous classification was formed so that respondents, who never reported confrontational behavior could be compared to those who reported ever engaging in any of the confrontational behaviors.

The angry/threatening driving subscale and the verbal/frustration expression subscale were modestly correlated (0.44). The biserial correlations between the direct contact categories (never versus at least one report) and the subscales were significant ($P < 0.01$) though modest, and were 0.28 with the threatening/angry driving scale and 0.07 with the verbal expression scale.

3.2. Demographics and exposure

As expected subscale scores for road rage varied with both gender and age. On both subscales, males had higher scores than females; younger drivers had higher scores than older drivers (Table 2). On the angry/threatening driving subscale, males scored almost twice as high as females, and drivers under 30 scored on average about 3.5 times higher than did those drivers over age 55 (Table 2).

No clearly consistent pattern was seen for educational attainment. Threatening/angry driving scores did not differ significantly by educational level; however, respondents with low levels of education (< 12 yr) reported lower verbal/frustration expression (Table 2). No statistically significant racial or ethnic differences emerged (Table 2). Few differences were observed with income levels, although respondents with lower levels of income tended to have lower scores on the verbal expression subscale than did those with higher incomes.

Driving exposure was consistently related to both subscale scores with those driving less than 14 000 miles yearly showing significantly lower scores on both subscales as compared to those driving more yearly miles (Table 2). Similarly those reporting driving every day showed higher scores than those driving less frequently (Table 2).

3.3. Road rage, habitual speeding, driving over the legal limit and traffic violations

Table 3 shows associations of the two road rage subscales with the generally hazardous driving practices of frequent speeding, driving over the legal alcohol limit during the past year, and receiving hazardous driving tickets during the last year. Means and marginal means for the road rage sub-scales are shown in Table 4. Even after controlling for verbal rage expression, gender, age, and exposure, the angry/threatening driving subscale was consistently associated with each of the generally hazardous driving indicators. In contrast, the verbal expression subscale was only associated with receiving tickets during the past 12 months after controlling for gender, age, exposure and angry/threatening driving.

Table 2
Demographics and exposure by road rage subscale scores

		<i>N</i>	Verbal/frustration	Angry/threat driving
			<i>M</i> (S.D.)	<i>M</i> (S.D.)
Gender	(1) Male	596	5.03 (2.84)	1.78 (2.79)
	(2) Female	769	4.52 (2.88)	0.97 (1.84)
	<i>t</i> (d.f.) ^a		3.26 (1361) *	6.08 (976)*
Age	(1) <30 yr	244	5.88 (3.06)	2.22 (3.11)
	(2) 30–55	734	5.03 (2.68)	1.33 (2.21)
	(3) >55 yr	364	3.56 (2.71)	0.66 (1.60)
	<i>F</i> (d.f.)		57.91 (2, 1336)*	34.96 (2, 1337)*
Contrasts	1 vs (2+3) <i>t</i> (d.f.) ^a		8.03 (1336)*	5.90 (286)*
	2 vs 3 <i>t</i> (d.f.) ^a		8.29 (715)*	5.78 (947)*
Education	(1) <12	91	4.01 (2.87)	1.10 (2.11)
	(2) = 12 (HS)	410	4.91 (2.99)	1.43 (2.52)
	(3) = 13–16 (COL)	390	4.94 (2.95)	1.25 (2.27)
	(4) >16	456	4.71 (2.67)	1.32 (2.25)
	<i>F</i> (d.f.)		2.95 (3, 1339)*	0.69 (3, 1340)
Contrasts	1 vs other <i>t</i> (d.f.) ^a		2.70 (1339)*	
	2 vs (3+4) <i>t</i> (d.f.) ^a		0.50 (1339)	
	3 vs 4 <i>t</i> (d.f.) ^a		1.17 (1339)	
Race ^b	(1) African-American	142	4.50 (3.07)	1.54 (2.42)
	(2) Caucasian	1098	4.84 (2.86)	1.26 (2.33)
	(3) Hispanic	57	4.44 (2.87)	1.39 (2.26)
Contrasts	1 vs 2; <i>t</i> (d.f.) ^a		1.27 (1327)	1.30 (176)
Income	(1) <30	379	4.60 (2.96)	1.37 (2.48)
	(2) 31–60	392	5.08 (2.81)	1.46 (2.57)
	(3) >60	267	5.15 (2.69)	1.30 (2.16)
	<i>F</i> (d.f.)		3.9 (2, 1031)*	0.33 (2, 1035)
Contrast	1 vs (2+3); <i>t</i> (d.f.) ^a		2.77 (1031)*	
Miles driven last year	(1) 1–9 K	342	4.21 (3.0)	1.07 (2.11)
	(2) >9; ≤14 K	333	4.69 (2.67)	1.15 (2.03)
	(3) >14; ≤25 K	356	5.24 (2.67)	1.56 (2.55)
	(4) >25 K	178	5.35 (3.01)	1.88 (3.04)
	<i>F</i> (d.f.)		10.41 (3, 1202)*	6.20 (3, 1203)*
Contrast	1+2 vs 3+4 <i>t</i> (d.f.) ^a		5.03 (1202)*	3.95 (534)*
Driving frequency for past year	(1) Every day	1168	4.94 (2.86)	1.41 (2.39)
	(2) Less	201	3.67 (2.77)	0.82 (1.96)
	<i>t</i> (d.f.) ^a		5.82 (1365)*	3.85 (312)*

^a For all contrasts, if Levine's test for equality of variance was significant, ($P \leq 0.05$), then the test under the assumption of unequal variance is shown.

^b The sample included only seven Indians and 27 Asians. These categories are not included for contrasts.

* $P < 0.01$.

3.4. Road rage and crashes

It was expected that threatening/angry driving would be directly related to self-reported crashes after controlling for hazardous driving practice (i.e., driving over the legal limit, routinely speeding, and receipt of citations for hazardous moving violations), demographic factors, and verbal anger expression. As expected, ever having had a serious crash was associated with angry/threatening driving even after controlling for verbal expression, gender, age, exposure, and each of the three

hazardous driving practices. The association between angry/threatening driving and having been in a crash during the past year was weakest after controlling for generally hazardous driving practices (Table 3) and strongest in the model that omitted the generally hazardous behaviors. When divided at gender means those below the angry/driving mean were 2.21 times (95% CI = 1.53–3.19) more likely to report involvement in a crash during the previous year than respondents at or below the mean. Similarly, those above the angry/threatening driving mean were 1.51 (95% CI = 1.17–

1.94) more likely to report serious crash involvement than those at or below the mean. Verbal expression was not significantly associated with either serious crashes or crashes during the past year after controlling for gender, age, exposure, and angry/threatening angry driving (Table 3).

3.5. Confrontation, angry/threatening driving and crashes

Respondents who never (0) reported one of the more extreme and confrontational road rage incidents (deliberately hitting another car or getting out of a car to argue with or to injure another driver), and those who reported at least one possible confrontation (1) were compared regarding reports of serious crashes and reports of recent crashes (in the past 12 months). In order to explore the relation between the occurrence of these more confrontational incidents and angry/threatening driving, respondents were further subdivided according to whether the respondent was above or below his or her gender mean for angry/threatening driving.

Only 37 respondents reported ever having a confrontational incident. However almost twice the percentage of confrontational respondents (45.9%) as compared to

non-confrontational respondents (23.2%) reported ever having been in a serious vehicle crash ($X^2 = 10.24$ (1, 1372), $P < 0.01$). A similar pattern was shown for having an accident as a driver within the past 12 months: 18.9% of confrontational respondents reporting a recent accident, and 9% of non-confrontational respondents reporting a recent accident ($X^2 = 4.22$ (1, 1371) $P < 0.05$). When subdivided by angry/threatening driving scores, non-confrontational respondents, who scored above their gender mean had slightly more accidents (27.7%) than did non-confrontational respondents, who scored below the mean (21%; $X^2 = 6.37$ (1, 1321), $P < 0.01$). Among confrontational respondents, only five had angry/threatening driving scores below the gender mean. None of those five reported being involved in a serious accident or a recent accident. Among the remaining 32 confrontational drivers, most (53%) reported having had a serious accident and 22% reported having had a recent accident. Among non-confrontational drivers, only 12% of those scoring above their gender mean on angry/threatening driving reported a recent crash, while only 6.6% of those scoring below the gender mean on angry/threatening driving reported a recent crash ($X^2 = 16.20$ (1, 1320), $P < 0.001$).

Table 3
Angry/threatening driving, verbal anger expression, hazardous driving behavior and crashes

		Angry/threatening driving ^a	Verbal expression ^b
<i>Crashes</i>			
(A) Ever in serious	<i>F</i>	7.688***	0.001
	<i>MS</i>	30.953	
	<i>n, d.f.^c</i>	(8, 1166)	(8, 1166)
(B) Any as driver in past year	<i>F</i>	2.738* 4.857** ^d	0.033
	<i>MS</i>	10.879 20.862	0.202
	<i>n, d.f.^c</i>	(8, 1164) (5, 1175)	
<i>Hazardous driving indicators</i>			
(A) Driving over legal limit in past year (no, once, twice, or more often)	<i>F</i>	27.13***	0.499
	<i>MS</i>	110.099	3.017
	<i>n, d.f.^c</i>	1171, 6	1171, 6
(B) Usually drive well over limit (yes, no)	<i>F</i>	30.502****	0.169
	<i>MS</i>	128.503	1.025
	<i>n, d.f.^c</i>	1172, 5	1172, 5
(C) Moving violations in past year (yes, no)	<i>F</i>	8.527***	5.655**
	<i>MS</i>	36.514	34, 212
	<i>n, d.f.^c</i>	1175, 5	1175, 5

^a Controlling for gender, age, annual mileage, hazardous driving indicators, verbal expression.

^b Controlling for gender, age, annual mileage, hazardous driving indicators, angry/threatening driving.

^c D.f. for model.

^d Hazardous driving indicators omitted from model.

* $P = 0.098$ two tailed.

** $P < 0.05$ two tailed.

*** $P < 0.01$ two tailed.

**** $P < 0.001$ two tailed.

Table 4
Means for angry/threatening driving and for verbal frustration by categories of crashes and hazardous driving

Category	N	Angry/threatening driving				Verbal frustration					
		Marginal ^b		Marginal ^c		Marginal ^d		Marginal ^e			
		M ^a	(SE)	M	(SE)	M ^a	(SE)	M	(SE)		
<i>Serious crash</i>											
Yes	280	1.85	1.63	(0.12)	1.62	(0.12)	5.23	4.90	(0.15)	4.92	(0.15)
No	886	1.18	1.25	(0.07)	1.24	(0.07)	4.71	4.80	(0.08)	4.80	(0.08)
<i>Crash in past year</i>											
Yes	108	1.91	1.76	(0.19)	1.64	(0.19)	5.28	4.88	(0.24)	4.84	(0.23)
No	1057	1.28	1.30	(0.06)	1.30	(0.06)	4.79	4.83	(0.08)	4.83	(0.08)
<i>Ticket in past year</i>											
Yes	162	2.52	1.84	(0.18)			6.06	5.32	(0.07)		
No	1204	1.18	1.28	(0.06)			4.58	4.77	(0.21)		
<i>Typical speed</i>											
Below, at, slightly above limit	1150	1.28	1.30	(0.06)			4.80	4.83	(0.07)		
Well above limit	22	4.64	3.75	(0.44)			6.95	5.05	(0.05)		
<i>Impaired driving</i>											
Never	1255	1.16	1.22	(0.06)			4.70	4.82	(0.07)		
Once, twice	71	2.79	2.13	(0.26)			6.13	5.12	(0.32)		
> Twice	35	4.39	3.64	(0.35)			6.45	4.69	(0.44)		

^a No adjustments.

^b After adjusting for demographics (age and gender), annual mileage and verbal frustration.

^c After adjusting for demographics, annual mileage, verbal frustration, and hazardous driving behaviors.

^d After adjusting for demographics, annual mileage, and angry/threatening driving.

^e After adjusting for demographics, annual mileage, angry/threatening driving, and hazardous driving behaviors.

4. Discussion

In the current study, one common conception of road rage in which an angry driver engages in potentially dangerous driving maneuvers directed toward another vehicle is expressed in the measure of angry/threatening driving. It is not surprising that results from this national survey confirm that angry/threatening driving, while not normative behavior, is associated with higher crash involvement as well as general indicators of hazardous driving such as habitually speeding, driving after excessive alcohol consumption and receipt of traffic tickets.

A more extreme definition of road rage involves direct confrontation. Publicized incidents usually involve confrontations resulting in injury or death. Although data on such extreme occurrences were not available in the current study, several questions pertained to direct confrontations in which the individual left the car to argue with or injure another driver or intentionally hit another vehicle, and these confrontations were associated with more self-reported crashes. One possible explanation of this pattern of results is that confrontational incidents often may be the sequelae of crashes. If angry/threatening driving increases crash risk, the occurrence of a crash may be likely to lead to a confrontational incident especially for a driver

with tendencies to directly express anger and engage in threatening behavior in driving contexts.

Milder expressions of road rage involve unobtrusive verbal expressions or use of lights or horn to indicate annoyance. Survey results suggest that a majority of drivers occasionally express milder frustration in driving situations and these milder forms, in the absence of escalation to more threatening behaviors and risky driving, were not significantly associated with self-reported crashes after accounting for known crash risk factors such as age, gender, and exposure. Contextual characteristics of the driving situation, such as traffic congestion or urban sprawl, were not investigated and may play a role in exacerbating crash risk. It would be important for research to focus on normative but milder expressions of frustration in actual traffic situations, such as driving in congested traffic that may demand high levels of vigilance and attention. Further research also should focus on more specific measures of crash incidents and the behaviors that directly preceded the specific crash as well as the behaviors that were the sequelae of the crash.

Although the current study has limitations associated with the self-reported, cross-sectional and correlational nature of the data, the study has the advantage of using a nationally representative sample to investigate several common definitions of road rage behavior. Results

suggest that expression of road rage by hazardous driving or direct confrontation with another driver is related to crash involvement. However, these expressions of road rage may simply be forms of hazardous and aggressive driving practices that are well-established precursors of crash risk, which would suggest that an emphasis on enforcing proven sanctions against hazardous driving, such as licensing actions, are the most appropriate strategies for targeting expressions of road rage that are associated with crash risk.

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