

NDOT Research Report

Report No. 514-13-803



**Investigating the Decision-Making Processes
That Contribute to Impaired Driving**



August 25, 2015

**Nevada Department of Transportation
1263 South Stewart Street
Carson City, NV 89712**



TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 514-13-803	2. Government Accession No.	3. Recipients Catalog No.
4. Title and Subtitle Investigating the Decision-Making Processes That Contribute to Impaired Driving		5. Report Date August 25, 2015
6. Performing Organization Code		
7. Author(s) Duckworth, M. P., J. G. Renqvist, V. B. Dahir		8. Performing Organization Report No. P514-13-803
9. Performing Organization Name and Address University of Nevada, Reno 1664 N Virginia Street Reno, NV 89557		10. Work Unit No.
11. Contract or Grant No.		
12. Sponsoring Agency Name and Address Nevada Department of Transportation 1263 S Stewart Street Carson City, NV 89712		13. Type or Report and Period Covered Final Report
14. Sponsoring Agency Code		
15. Supplementary Notes		
<p>16. Abstract</p> <p>Alcohol-impaired (AI) driving continues to cause a disproportionate number of fatalities within the college and young adult populations, indicating optimal prevention programs for AI driving have yet to be developed. The current study tested the efficacy of two theoretically- and empirically-based online video advertisements at reducing AI driving willingness and behavior in a sample of 108 college students at high risk for future AI driving. The relations of AI driving risk factors to AI driving willingness and behavior in a larger sample of 600 college students was also tested. Findings revealed that students who viewed either advertisement reported decreases in general willingness to drive after drinking, while participants who did not view an advertisement reported increases in general willingness to drive after drinking. While viewing an advertisement was not associated with decreased AI driving, study participants reported a significant decrease in AI driving overall. Findings revealed AI driving risk and decision-making factors to have both shared and unique relations to driving after “perhaps too much to drink” and driving “shortly after three or more drinks.” Findings from the current study provide preliminary support for the efficacy of both advertisements in reducing general willingness to drive after drinking within the subgroup of the college population most at risk for AI driving. Additionally, this study takes one of the first steps in developing an AI driving model that accounts for the influence of sociodemographic, dispositional, historical, and current AI driving risk factors as well as rational and emotional decision-making factors.</p>		
17. Key Words Drunk driving, impaired drivers, decision making, social factors, alcohol use		18. Distribution Statement Unrestricted.
19. Security Classif (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. Of Pages 175
		22. Price

Disclaimer

This work was sponsored by the Nevada Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of Nevada at the time of publication. This report does not constitute a standard, specification, or regulation.



University of Nevada, Reno

Investigating the Decision-Making Processes



Photo by James Palinsad, unedited, <https://www.flickr.com/photos/99329675@N02/11064883376/>

That Contribute to Impaired Driving

August 25, 2015

Melanie P. Duckworth, Ph.D.

Associate Professor

Health Risk and Traumatic Injury Research Group

University of Nevada, Reno

and Principal Investigator

Jenna G. Renqvist, M.A.

Graduate Research Assistant

Health Risk and Traumatic Injury Research Group

University of Nevada, Reno

and Co-Investigator

Veronica Blas Dahir, Ph.D.

Director, Grant Sawyer Center for Justice Studies

College of Liberal Arts Grants and Contracts Officer

Manager, Research Services, Center for Research Design and Analysis

University of Nevada, Reno

and Co-Investigator

Acknowledgements

We would like to thank Megan Greenlaw and Gwendolyn Carlson of the Health Risk and Traumatic Injury Research Group for their assistance with focus group testing and filming the advertisements. We would also like to thank our talented student actors Alana Ridge, Matthew Denney, Rand Velasco, Tori Sandoval, Tara Brown, Gunner Scott, Luke Pickman, and Andrew Ahrendt.

We would also like to thank Ken Mammen, Manju Kumar, and Ken Chambers from the Nevada DOT Research Program and Penna Powers-Bryan Haynes consultants for their guidance, help with the advertisement development, and collaborative efforts throughout this project.

Table of Contents

Executive Summary.....	iii
Introduction.....	1
Methodology.....	1
Advertisement Development (Deliverables 1.1 and 2.1.).....	1
Sample.....	4
Measures.....	4
Data Collection Procedures.....	6
Data Screening and Analysis.....	7
Results.....	10
Evaluation of the Relation of Rational and Emotional Factors to Impaired Driving Within the College Population (Deliverable 3.1.).....	10
Test of the Emotional and Rational Advertisements' Impact on College Students' Willingness to Drive While Impaired (Deliverable 4.1).....	13
Test of the Efficacy of the Emotional and Rational Advertisements on Future Reports of Impaired Driving (Deliverable 5.1.).....	17
Discussion.....	18
Future Directions.....	23
Conclusions.....	24
References.....	25
 <i>Appendices</i>	
Appendix A: Rational and Emotional Advertisement Scripts.....	A1-A12
Appendix B: Focus Group Summaries.....	B1-B25
Appendix C: Rational and Emotional Advertisements.....	C1
Appendix D: Recruitment Materials.....	D1-D4
Appendix E: Pre-Advertisement Survey.....	E1-E32

Appendix F: Post-Advertisement Survey.....F1-F24
Appendix G: One-Month Follow-Up Survey.....G1-G26
Appendix H: Three-Month Follow-Up Survey.....H1-H25

Executive Summary

AI driving continues to cause a disproportionate number of fatalities within the college and young adult populations. Reduction of the prevalence of AI driving would result in significant decreases in the number MVC injuries and fatalities that occur due to AI driving (now over 11,000 per year; Blincoe et al., 2014). The Health Risk and Traumatic Injury Research Group (HRTI) at the University of Nevada, Reno developed and tested the efficacy of two theoretically- and empirically-based (rational and emotional) online video advertisements at reducing AI driving willingness (measured both by general willingness to drive after drinking and AI driving willingness in specific AI driving vignettes) and alcohol-impaired (AI) driving in a sample of 108 student attending the University of Nevada, Reno on behalf of the Nevada Department of Transportation (NDOT) Research Program. Advertisement content was developed, focus group testing was conducted, advertisements were filmed and edited, and data collection was completed between January, 2014 and July, 2015.

The two advertisement scripts were created based on the theoretical and empirical dual-process decision-making model research literature. The advertisement scripts were then subjected to focus group testing and modified until the rational and emotional scripts could be differentiated consistently in accordance with predetermined, theoretically-based, quantitative and qualitative criteria (see Advertisement Development section for details). To ensure the compatibility of the advertisement features with current standards used in the advertising field, advertisement content and structure was discussed with experts from an advertisement firm employed by NDOT to provide statewide AI driving prevention advertisements.

Study participants between 18 and 24 years of age were recruited for a pre-advertisement survey through on-campus flyers and classroom announcements on the main University of Nevada, Reno campus and the online psychology subject pool website (SONA). The pre-advertisement survey obtained information including sociodemographics, AI driving risk factors (e.g., sensation seeking, high school binge drinking), dual-process decision-making factors (e.g., AI driving attitudes, perceived AI driving risk), and recent alcohol-impaired driving behavior (see Data Collection Procedures section for details).

Participants completing the pre-advertisement survey included a cohort of 600 college students. The majority of student participants were white (60.2%), female (71.0%), and single (93.1%), with a reported annual income of less than \$10,000 (50.3%). Participants ranged in age from 18 to 24 years, with a mean age of 20.0 (SD = 1.7), and reported an average of 14.5 years of formal education (SD = 1.4). Consistent with AI driving rates reported in the collegiate AI driving literature, a total of 25.3% of pre-advertisement participants (n = 152) endorsed driving a motor vehicle within 2 hours after drinking alcoholic beverages in the past 30 days.

Participants who completed the pre-advertisement survey and endorsed driving within two hours of consuming alcoholic beverages in the past 30 days were emailed an invitation to continue participation in the study. Of the 152 participants who qualified, 71% chose to continue study participation. Responding participants were randomly assigned to one of the three study conditions (i.e., rational advertisement, emotional advertisement, or no advertisement/survey only control) by an algorithm programmed into the Qualtrics survey website, shown the advertisement associated with their randomly assigned condition, and prompted to complete the post-advertisement survey.

The final sample consisted of a total of 108 participants, of which 32.4% ($n = 35$) were randomly assigned to the rational advertisement condition, 33.3% ($n = 36$) were randomly assigned to the emotional advertisement condition, and 34.3% ($n = 37$) were randomly assigned to the no advertisement condition. To encourage participation and decrease drop-out, participants qualified for one psychology experience credit (PEC) for completion of the pre-advertisement survey, a \$25 online gift card to either Amazon® or Starbucks® for completion of the post-advertisement survey, a \$35 online gift card to either Amazon® or Starbucks® for completion of the one-month follow-up survey, and a \$50 online gift card to either Amazon® or Starbucks® for completion of the three-month follow-up survey. A total of 92.6% of study participants completed the one-month follow-up survey, and 93.5% of participants completed the three-month follow-up survey, with 96.2% of participants completing at least one follow-up survey.

Findings from analyses conducted with the 600 students who completed the pre-advertisement survey revealed that age, frequency of alcohol use, AI driving attitudes, and perceived ability to mitigate AI driving risks were related to driving after “perhaps too much to drink,” with older participants who endorsed more frequent alcohol use, had more positive attitudes about AI driving, and perceived themselves as more able to mitigate AI driving risks were more likely to report driving after perhaps too much to drink. Age, sensation seeking, frequency of alcohol use, AI driving attitudes, AI driving normative beliefs, and perceived ability to mitigate AI driving risks were related to driving “shortly after three or more drinks,” with older participants who endorsed higher sensation seeking tendencies, more frequent alcohol use, more positive attitudes about AI driving, more positive normative beliefs, and perceived themselves as more able to mitigate AI driving risks were more likely to report driving shortly after consuming three or more drinks.

Findings revealed that students who viewed either AI driving advertisement reported decreases in general willingness to drive after drinking from pre-advertisement to post-advertisement and from pre-advertisements to three-month follow-up, while participants who did not view an advertisement reported increases in general willingness to drive after drinking from pre-advertisement to post-advertisement and from pre-advertisement to three-month follow-up. Surprisingly, AI driving advertisements did not affect student AI driving willingness in AI driving vignettes, a result that may have been due to changes in AI driving willingness in AI driving vignettes across condition over time. Rates of AI driving also did not differ across advertisement conditions, however there was a significant decrease in AI driving in study participants from pre-advertisement to one-month follow-up and pre-advertisement and three-month follow-up, indicating that merely participation in the study may have been associated with a decrease in AI driving engagement. The lack of differences between study conditions may have also been due to students' limited exposure to the advertisements ($M = 3.0$).

Findings from the current study provide preliminary support for the efficacy of both theoretically- and empirically-based AI driving advertisements in reducing general willingness to drive after drinking among college students who are at particularly high risk for AI driving. These findings indicate broader testing of similar theoretically- and empirically-based online video advertisements within a larger young adult population is warranted. The current study also identified several key factors contributing to general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and AI driving behavior within a large sample of college students. This study takes one of the first steps necessary in developing an integrative AI driving model that accounts for the influence of sociodemographic, dispositional, historical, and current AI driving risk factors as well as rational and emotional decision-making factors. Future

studies replicating and clarifying the relations among these variables are needed to continue to refine models of AI driving for the high risk college population.

Introduction

Two theoretically- and empirically-based online video advertisements were created and utilized to assess the efficacy of such advertisements on general willingness to drive after drinking and AI driving willingness in AI driving vignettes and AI driving behavior within a college sample. Advertisement script development began in January 2014, focus group testing occurred between March 2014 and August 2014, advertisement filming and editing occurred between September 2014 and October 2014, and data collection began in October 2014 and ended in July 2015.

Methodology

Advertisement Development (Deliverables 1.1 and 2.1).

Two theoretically- and empirically-based online video advertisements based on the dual-process theory decision-making pathways (i.e., rational and emotional) were created. Theoretically-based advertisement scripts were created after a thorough review of the dual-process decision-making theory literature. AI driving willingness was measured both by general willingness to drive after drinking and by AI driving willingness in AI driving vignettes to increase the comparability of study results to published studies investigating willingness in the larger risky decision-making literature. To minimize the impact of factors other than advertisement content on general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and AI driving behavior, the advertisements were designed to be identical on all controllable characteristics (i.e., actor(s), setting, and length) except the content of the actors' statements. The message in the rational advertisement was similar to those used in current AI driving prevention advertisements. In the rational advertisement, college student actors presented facts about AI driving, such as the legal blood alcohol content levels and costs of

various negative AI driving consequences (e.g., “One out of every three car crashes involves alcohol. Even if you’re lucky enough not to kill or injure someone, you can still get a DUI, and those are like, \$10,000 dollars a pop. That’s a year’s worth of tuition or rent not even including the damage to your property and to other people’s property;” see *Appendix A* for the full rational advertisement script.) Conversely, the message in the emotional advertisement condition suggested undergraduates at UNR have negative experiences with and opinions about people who engage in AI driving (e.g., “I remember this one time, at a party, I saw my designated driver taking shots. I walked up to him and I was like, ‘are you seriously going to put my life at risk because you can’t control your drinking problem? I actually have plans for the rest of my life!’ I stormed off and took a cab home. I don’t talk to him anymore;” see *Appendix A* for the full emotional advertisement script.) This persuasive strategy is based on a past intervention in which Blanton et al. (2001) exposed students to “bogus” statistics suggesting negative peer opinions in order to decrease students’ willingness to engage in unprotected sex. A no advertisement/survey only control condition was included to control for the effect of survey completion and time on general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and behavior.

Focus Group Testing and Professional Consultation. A series of four online focus groups in which college students provided both qualitative and quantitative evaluations of the rational and emotional advertisement scripts were conducted. Qualitative focus group results were discussed by study staff, and advertisement scripts were revised to ensure the acceptability of advertisement content to the college population. After each focus group, statistical analyses were conducted to ensure the rational and emotional advertisement scripts were representative of the intended constructs, but did not differ significantly on general script characteristics (e.g.,

interestingness, familiarity, and perceived effectiveness). Focus groups were concluded only after the rational and emotional advertisement scripts could be differentiated consistently in accordance with predetermined, theoretically-based, quantitative and qualitative criteria (see *Appendix B* for full qualitative and quantitative results of online focus groups). To ensure the compatibility of the current advertisements with current standards used in the advertisement field, advertisement content and structure was also discussed and modified based on feedback from experts from an advertisement firm employed by NDOT to provide statewide AI driving prevention advertisements.

Actor recruitment. An advertisement offering \$50 as compensation for participation in a brief advertisement was posted on the UNR Theater Department Facebook page and survey flyers were posted on public bulletin boards across the UNR campus. Eight actors were hired. Evidence from empirical studies indicates that use of multiple communicators that are attractive and members of the participants' "in group" (i.e., 18-24 years of age, male or female, UNR students) maximizes the impact of the message being communicated (Carli, 2001; Joseph, 1982; Mackie, Worth, & Asuncion, 1990; Wilder, 1990). Therefore, male and female UNR students between the ages of 18 and 24 that had experience relevant to acting and were considered to be generally attractive by study staff were recruited. Both advertisements (rational and emotional) involved the same actors and settings to control for actor and setting effects. The advertisements were recorded by the graduate student researcher and Health Risk and Traumatic Injury Research Group members. Advertisements were edited using Adobe Premier Pro and Adobe After Effects (Adobe Systems Incorporated, 2014). Consistent with recommendations for maximizing likability and recall (Hsieh & Chen, 2011; McAfee et al., 2013; Meyer et al., 2003; Newstead & Romaniuk, 2010; Perkins, Linkenbach, Lewis, & Neighbors, 2010; Renger & Steinfeldt, 2002;

Rigotti & Wakefield, 2012; Yu et al., 2012), each online advertisement had an approximate running time of two minutes. Edited advertisements were published as private YouTube videos, to which only study participants and research staff had access (see *Appendix C* for full video advertisements).

Sample

Participants completing the pre-advertisement survey included a cohort of 600 English-speaking, self-referred, college students who were recruited through on-campus flyers, classroom announcements, and the online psychology subject pool website (SONA; see *Appendix D* for recruitment materials). The majority of study participants were white (60.2%), female (71.0%), and single (93.1%), with a reported annual income of less than \$10,000 (50.3%). Participants ranged in age from 18 to 24 years, with a mean age of 20.0 ($SD = 1.7$), and reported an average of 14.5 years of formal education ($SD = 1.4$). Consistent with AI driving rates reported in the collegiate AI driving literature, a total of 25.3% of pre-advertisement participants ($n = 152$) qualified for continued study participation in the study by endorsing driving a motor vehicle within 2 hours after drinking alcoholic beverages in the past 30 days. Of the 152 participants who qualified, 71% chose to continue study participation. The final sample consisted of a total of 108 participants, of which 32.4% ($n = 35$) were randomly assigned to the rational advertisement condition, 33.3% ($n = 36$) were randomly assigned to the emotional advertisement condition, and 34.3% ($n = 37$) were randomly assigned to the no advertisement condition.

Measures

The online surveys assessed participant sociodemographics (e.g., age, gender, ethnicity), AI driving risk factors, and rational and emotional decision-making factors (see Table 1). See

Appendices E-H for full online surveys (including deliverable AI Driving Willingness Vignettes). All online surveys were developed by the HRTI Research Group.

Table 1

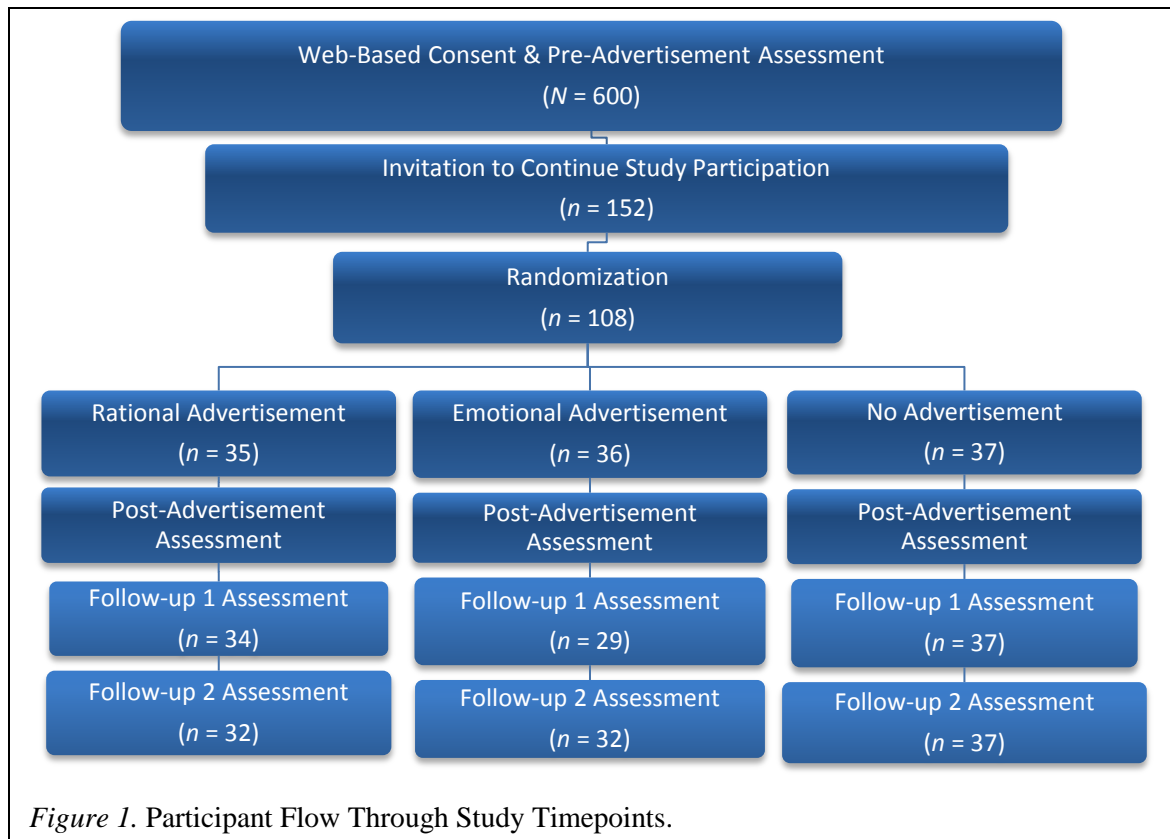
Measures and Corresponding Time Points for All Conditions

Measure	Pre- Advertisement	Post- Advertisement	FU1	FU2
Sociodemographic Questionnaire	✓			
AID Risk Factors				
Personal and Family History of Alcohol Abuse	✓			
Greek Membership	✓			
Brief Sensation Seeking Scale	✓			
Comprehensive Effects of Alcohol	✓		✓	✓
Positive Alcohol Expectancies	✓		✓	✓
Current Alcohol Use	✓		✓	✓
AID Decision-Making Factors				
Attitudes and Normative Beliefs	✓	✓	✓	✓
Perceived Risk	✓	✓	✓	✓
Perceived Impaired Driving Ability	✓	✓	✓	✓
General Willingness to Drive After Drinking	✓	✓	✓	✓
AI Driving Willingness in Vignettes	✓	✓	✓	✓
AI Driver Prototype	✓	✓	✓	✓
AID Behavior	✓		✓	✓

Note. AID = Alcohol-Impaired driving

Data Collection Procedures

Web-based consent and randomization. The study, its synopsis, and a link to the web-based consent form and pre-advertisement survey were posted on SONA website. After providing consent via the web-based consent form and submitting an email address, participants meeting the age and English fluency inclusion criteria completed the pre-advertisement survey. Participants who completed the pre-advertisement survey and endorsed driving within two hours of consuming alcoholic beverages in the past 30 days were emailed an invitation to continue participation in the study. Participants who responded the email invitation were randomly assigned to one of the three study conditions (i.e., rational advertisement, emotional advertisement, or no advertisement/survey only control) by an algorithm programmed into the Qualtrics survey website, shown the advertisement associated with their assigned condition, and prompted to complete the post-advertisement survey (see Figure 1).



Random assignment of participants to study condition resulted in a final sample of 108 participants (35 participants in the rational advertisement condition, 36 participants in the emotional advertisement condition, and 37 participants in the no advertisement control condition). A total of 92.6% (100/108) of study participants completed the one-month follow-up survey, and 93.5% (101/108) of participants completed the three-month follow-up survey, with 96.2% of participants completing at least one follow-up survey. Participants required an average of 26 minutes to complete the pre-advertisement survey, 20 minutes to complete the post-advertisement survey, 30 minutes to complete the one-month follow-up survey, and 30 minutes to complete the three-month follow-up survey. The measures administered at each time point are presented in Table 1.

Incentives. To encourage participation and decrease drop-out, participants qualified for one psychology experience credit (PEC) for completion of the pre-advertisement survey, a \$25 online gift card to either Amazon® or Starbucks® for completion of the post-advertisement survey, a \$35 online gift card to either Amazon® or Starbucks® for completion of the one-month follow-up survey, and a \$50 online gift card to either Amazon® or Starbucks® for completion of the three-month follow-up survey.

Data Screening and Analysis

The SPSS System (version 22) for Windows (SPSS, 2014) was used for all analyses. Before data analysis, data cleaning procedures recommended by Tabachnick and Fidell (2013) were used to determine the accuracy, completeness, and normality of all relevant variables. Differences between study completers and non-completers on sociodemographic, AI driving risk factors, and AI driving decision-making variables were tested using one-way analysis of variance (ANOVA) for continuous variables and chi-square tests for categorical variables. Log-linear and

square root transformations were utilized to normalize skewed and kurtotic variable distributions. Procedures were then used to identify univariate outliers (i.e., examination of z scores) and multivariate outliers (i.e., examination of Mahalanobis' distance and leverage scores). A significance level of $\alpha = .05$ was used to evaluate the strength of across-condition comparisons.

To analyze the relative efficacy of theoretically- and empirically-based advertisements in reducing general willingness to drive after drinking and AI driving behavior, two ANOVAs were conducted. A 3x2 repeated measures ANOVA was utilized to analyze the relative effect of advertisement condition (rational, emotional, no advertisement) and frequency of alcohol use (less than 7 times per month, 7 or more times per month) on AI driving willingness in AI driving vignettes. As individual AI driving variables were so severely skewed and kurtotic that neither outlier deletion nor transformations were sufficient to return the distributions to normality, a composite AI driving behavior variable was created [Composite AI Driving Risk Behavior Score = (number of times driving within two hours of consuming alcoholic beverages*0.5) + (number of times drove after "perhaps too much to drink" in the past month*1.0) + (number of time drove after three or more drinking in the past month*2.0)]. Two logistic regression analyses were used to ascertain which AI driving risk factors and rational and emotional decision-making factors were significantly associated with engagement in AI driving behavior (i.e., driving after "perhaps too much to drink" vs. not, or driving "shortly after consuming three or more drinks" vs. not) at pre-advertisement ($N = 600$). Variables for each analysis were selected with consideration of the theoretically indicated variables as well as the relations among variables in the local data. Correlational analyses were performed to test the relations among sociodemographic, AI driving risk, and rational and emotional decision-making factors included in the primary analyses (see Table 2).

Table 2

Correlations Among Relevant Sociodemographic, AI Driving Risk, and Rational and Emotional Decision-Making Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	-	0.03	-0.05	0.05	.14**	.26**	.15**	.14**	.14**	-.17**	.21**	-0.02
2. Gender		--	-.16**	0.01	0.01	0.03	-0.05	0.01	0.08	.22**	-.18**	-.15**
3. Sensation Seeking			--	.28**	.12**	.34**	.14**	0.05	0.00	-.21**	.17**	.23**
4. High School Binge Drinking				--	.12**	.47**	.21**	.14**	0.01	-.19**	.25**	.10*
5. AI Driving Consequences					--	.18**	0.08	0.06	0.06	-.13**	.20**	-.09*
6. Frequency of Alcohol Use						--	.22**	.19**	0.02	-.28**	.29**	.11*
7. Attitudes							--	.39**	.20**	-.39**	.36**	.14**
8. Normative Beliefs (friends)								--	.39**	-.21**	.22**	-0.02
9. Normative Beliefs (UNR)									--	-0.02	.09*	-0.07
10. Perceived Risk										--	-.32**	-.21**
11. Perceived Ability to Mitigate Risks											--	0.00
12. Self - AI Driver Difference												--

Note. AI = Alcohol-impaired. $p < .05$. ** $p < .01$. *** $p < .001$.

Results**Evaluation of the Relation of Rational and Emotional Factors to Impaired Driving****Within the College Population (Deliverable 3.1).**

Age, Frequency of Alcohol Use, Frequency of Binge Drinking, AI Driving Attitudes, and Perceived Ability to Mitigate AI Driving Risks are Related to Driving After “Perhaps too Much to Drink.” Consideration of the theoretically indicated variables as well as the relations among variables in the local data indicated the inclusion of the following variables in the binary logistic regression analysis predicting driving after “perhaps too much to drink” in the past 60 days: age, ethnicity, sensation seeking, frequency of high school binge drinking, AI driving consequences experienced, positive alcohol use expectancies, frequency of alcohol use, AI driving attitudes, AI driving normative beliefs (close friends), perceived AI driving risk, perceived ability to mitigate AI driving risks, and difference between self and AI driver prototype. After deletion of 97 cases with missing values, data from 478 undergraduates was available for analysis: 411 who did not drive after “perhaps too much to drink” and 67 who drove after “perhaps too much to drink.” The full model predicting AI driving engagement after “perhaps too much to drink” was significant, $\chi^2(13, N = 478) = 133.08, p < .001$, and accounted for 43.8% of the variance in this domain. Prediction success was mixed, with 96.8% of participants who did not drive after “perhaps too much to drink” correctly predicted and 43.3% of participants who drove after “perhaps too much to drink” correctly predicted. Age, frequency of alcohol use, AI driving attitudes, and perceived ability to mitigate AI driving risks reliably predicted driving after “perhaps too much to drink” (see Table 3). Older participants who endorsed more frequent alcohol use, had more positive attitudes about AI driving, and perceived themselves as more able to mitigate AI driving risks were more likely to report driving after “perhaps too much to drink.”

Age, Sensation Seeking, Frequency of Binge Drinking, AI Driving Attitudes, and**Perceived Ability to Mitigate AI Driving Risks are Related to Driving Shortly After Three****or More Drinks.”** Consideration of the theoretically indicated variables as well as the relations

among variables in the local data indicated the inclusion of the following variables in the binary

logistic regression analysis predicting driving “shortly after consuming three or more drinks” in

the past 60 days: age, ethnicity, sensation seeking, frequency of high school binge drinking, AI

driving consequences experienced, positive alcohol use expectancies, frequency of alcohol use,

AI driving attitudes, AI driving normative beliefs (close friends), perceived AI driving risk,

perceived ability to mitigate AI driving risks, and difference between self and AI driver

prototype. After deletion of 97 cases with missing values, data from 478 undergraduates were

available for analysis: 398 who did not drive shortly after consuming three or more drinks and 80

who drove shortly after consuming three or more drinks. The full model predicting driving

“shortly after consuming three or more drinks” was significant, $\chi^2(13, N = 478) = 141.47, p$

$<.001$, and accounted for 43.1% of the variance in this domain. Prediction success was mixed,

with 97.5% of participants who did not drive shortly after consuming three or more drinks

correctly predicted and 40.0% of participants who drove “shortly after consuming three or more

drinks” correctly predicted. Age, sensation seeking, frequency of alcohol use, AI driving

attitudes, AI driving normative beliefs, and perceived ability to mitigate AI driving risks reliably

predicted driving shortly after consuming three or more drinks (see Table 3). Older participants

who endorsed higher sensation seeking tendencies, more frequent alcohol use, more positive

attitudes about AI driving, more positive normative beliefs, and perceived themselves as more

able to mitigate AI driving risks were more likely to report driving shortly after consuming three

or more drinks.

Table 3.

Alcohol-Impaired Driving Risk and Decision-Making Factors Predicting Driving After Drinking Alcohol Within the Past 60 Days

	Driving after perhaps too much to drink				Driving shortly after three or more drinks			
	β	SE	OR	95% CI	β	SE	OR	95% CI
AID Risk Factors								
Age	.30**	.10	1.35	1.11-1.64	.21*	.09	1.23	1.02-1.48
Ethnicity	-.44	.36	.65	0.32-1.30	-.08	.32	.92	0.50-1.72
Sensation Seeking	.60	.32	1.82	0.98-3.38	.77**	.30	2.17	1.21-3.88
High School Binge Drinking	.04	.02	1.04	1.00-1.08	.03	.02	1.03	0.99-1.07
AID Consequences								
1	.43	.42	1.53	0.67-3.49	.45	.40	1.57	0.72-3.45
2 or more	-.15	.60	0.86	0.30-2.78	.32	.54	1.38	0.48-3.93
Positive Alcohol Use Expectancies	.11	.09	1.11	0.94-1.32	.13	.08	1.14	0.97-1.34
Frequency of Alcohol use	.44**	.14	1.55	1.18-2.02	.37**	.13	1.45	1.13-1.87
Decision-Making Factors								
AID Attitudes	.74***	.21	2.11	1.41-3.15	.76***	.19	2.14	1.47-3.12
AID Normative Beliefs	-.00	.14	1.0	0.76-1.31	.23*	.12	1.26	1.01-1.59
Perceived AID Risk	-.18	.20	0.83	0.56-1.24	-.08	.20	0.92	0.63-1.35
Perceived Ability to Mitigate AID Risks	.41*	.17	1.50	1.08-2.09	.48**	.16	1.62	1.18-2.21
Self-AI Driver Difference	.43	.26	1.54	0.92-2.57	-.20	.25	0.82	0.50-1.35

Note. AID = Alcohol-Impaired Driving; Wald test: * $p < .05$ ** $p < 0.01$ *** $p < 0.001$

Test of the Rational and Emotional Advertisements Impact on College Students'**Willingness to Drive While Impaired (Deliverable 4.1).**

With the exception of relationship status, *t*-tests and chi-square analyses did not revealed significant differences across those who completed both follow-up surveys (full completers; $n = 98$), those who completed either the one-month follow-up survey or the three-month follow-up survey (partial completers; $n = 5$), and those who did not complete either follow-up survey (drop-outs; $n = 5$). Post-hoc analyses indicated that participants completing both follow-up surveys were more likely to be single at baseline than those who did not complete either follow-up survey, $\chi^2(1, N = 103) = 6.44, p < .05$. No significant differences among participants in the rational advertisement, emotional advertisement, and no advertisement conditions were observed across sociodemographic or AI driving risk factors at pre-advertisement, indicating randomization was successful (see Table 4).

Students Who Viewed an AI Driving Advertisement Reported a Decrease in General Willingness to Drive After Drinking While Participants Who Did Not View an Advertisement Reported an Increase in General Willingness to Drive After Drinking. To evaluate the comparative usefulness of advertisement condition (i.e., rational advertisement, emotional advertisement, no advertisement control) in explaining general willingness to drive after drinking, self-reported ratings of willingness to drive after drinking at pre-advertisement, post-advertisement, one-month follow-up, and three-month follow-up were submitted to a one-way mixed-model ANCOVA, with advertisement condition as the fixed effect, time as the repeated measure, and frequency of alcohol use and positive alcohol use expectancies and included as covariates. After controlling for the effects of the covariates, there was a significant interaction effect of advertisement condition by time, Wilks's $\lambda = 0.85, F(6, 95) = 2.50, p = .02, \eta^2 = .08$, which implies that there were significant differences in the change in general willingness to drive after drinking over time across advertisement conditions.

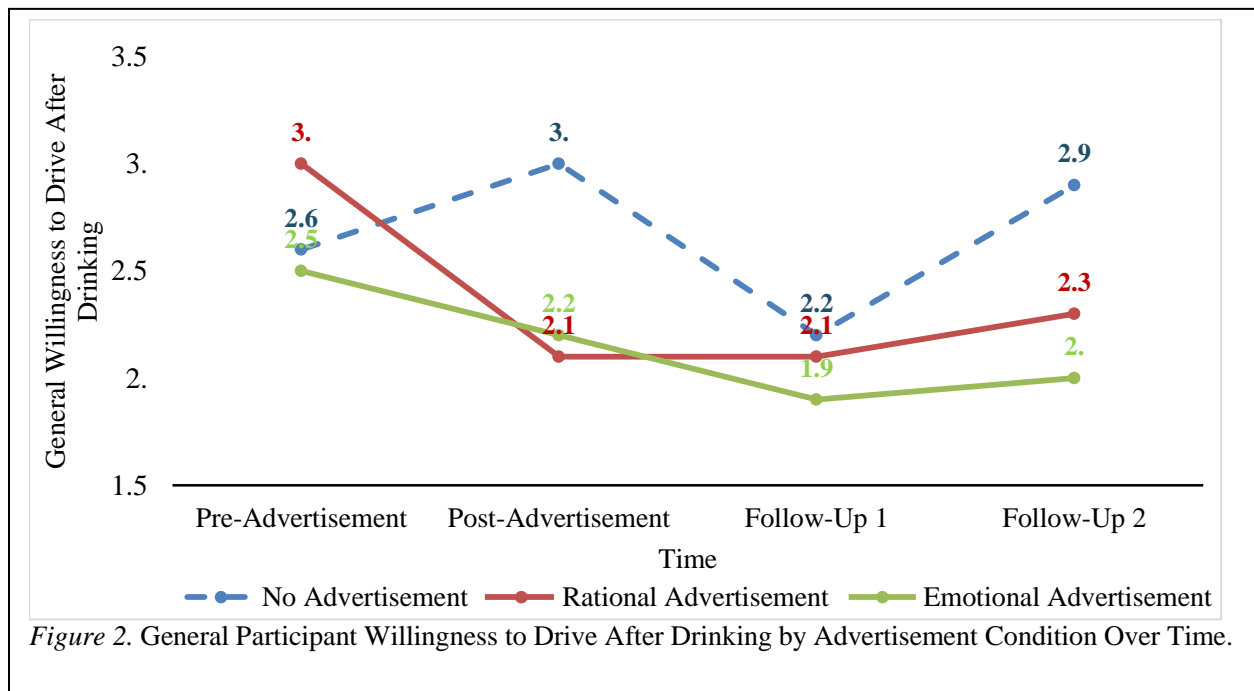
Table 4.

Descriptive Statistics for Sociodemographic and AI Driving Risk Factors by Condition

Variable	Condition			<i>p</i>
	Control (n = 37) M (SD)	Rational (n = 35) M (SD)	Emotional (n = 36) M (SD)	
Age	20.8 (1.5)	21.0 (1.9)	20.6 (1.6)	.62
Education	4 (1.4)	15.1 (1.2)	14.8 (1.4)	.17
Ethnicity (Caucasian)	68.6%	58.8%	75.0%	.35
Gender (Female)	71.4%	61.8%	72.2%	.59
Relationship Status (Single)	100%	85.3%	94.1%	.07
Income (<\$9,999)	60.0%	41.2%	50.0%	.74
Sensation Seeking	3.6 (0.7)	3.7 (0.6)	3.6 (0.5)	.76
Family History of Alcohol Abuse	61.8%	66.7%	57.6%	.75
High School Binge Drinking	9.4 (10.0)	7.1 (8.5)	7.4 (8.5)	.52
AI Driving Negative Consequences (at least 1 witnessed or experienced)	77.1%	85.3%	72.2%	.41
Greek Membership	25.7%	20.6%	22.2%	.97
Positive Alcohol Expectancies	12.0 (1.6)	12.2 (2.3)	12.1 (1.9)	.53
Frequency of Alcohol Use	7.2 (4.4)	8.8 (5.5)	9.3 (6.4)	.28

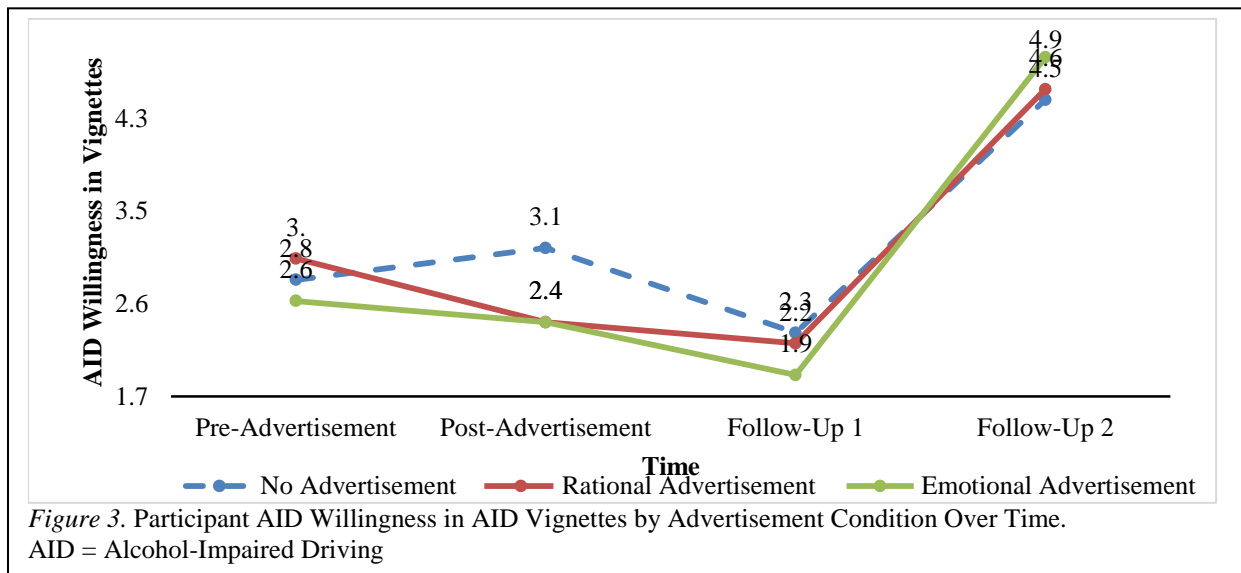
Note. Pre = Pre-advertisement, Post = Post-Advertisement. Control = No Advertisement Condition; Rational = Rational Advertisement Condition; Emotional = Emotional Advertisement Condition

Planned contrasts comparing participants in either advertisement condition to participants in the no advertisement condition on general willingness to drive after drinking revealed significant between-condition differences at post-advertisement, $t(92) = 2.28, p = .02$, and three-month follow-up, $t(92) = 2.11, p = .04$, with participants viewing an AI driving advertisement reported a *decrease* in general willingness to drive after drinking from pre- to post-advertisement survey and a *decrease* in general willingness to drive after drinking from pre-advertisement to three-month follow-up, while participants who did not view an advertisement reported an *increase* in general willingness to drive after drinking from pre- to post-advertisement survey and an *increase* in general willingness to drive after drinking from pre-advertisement to three-month follow-up (see Figure 2). Unexpectedly, planned contrasts comparing advertisement conditions on general willingness to drive after drinking at post-advertisement survey, one-month follow-up, and three-month follow-up were not significant. These findings suggest there were no significant differences in general willingness to drive after drinking between the two advertisement conditions from pre- to post-advertisement, from pre-advertisement to one-month



follow-up, and from pre-advertisement to three-month follow-up.

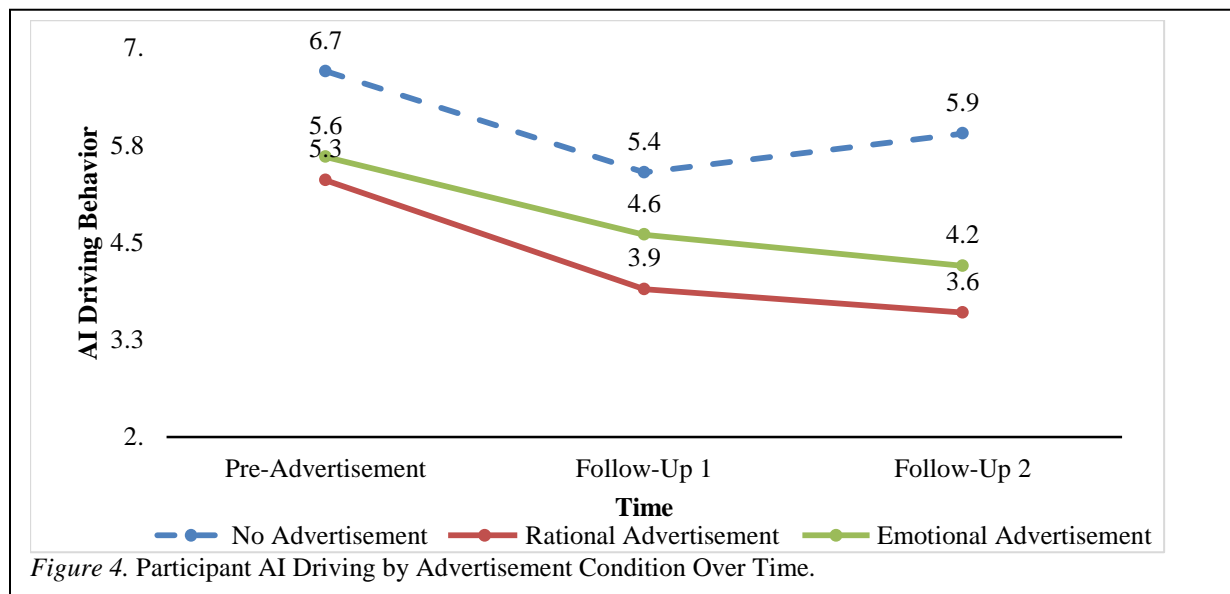
AI Driving Advertisements Did Not Affect Student AI Driving Willingness in AI Driving Vignettes. To evaluate the comparative usefulness of advertisement condition (i.e., rational advertisement, emotional advertisement, no advertisement control) and frequency of alcohol use in explaining AI driving willingness in AI driving vignettes, self-reported AI driving willingness ratings in AI driving vignettes at pre-advertisement, post-advertisement, one-month follow-up, and three-month follow-up were submitted to a 3X2 mixed-model ANCOVA, with advertisement condition (rational, emotional, and no advertisement) and frequency of alcohol use (less than 7 times in the past month, 7 or more times in the past month) as the fixed effects, time as the repeated measure, and gender included as a covariate. After controlling for the effects of the covariates, there was no interaction effect of advertisement condition by time, Wilks’s $\lambda = 0.85$, $F(6, 95) = 2.50$, $p = .02$, $\eta^2 = .08$ (see Table X) or frequency of alcohol use by time, Wilks’s $\lambda = 0.92$, $F(3, 86) = 2.31$, $p = .08$, $\eta^2 = .08$, which implies that there were no significant differences in the change in AI driving willingness in AI driving vignettes or the change in frequency of alcohol use over time across advertisement conditions. There was a significant main effect of time on AI driving willingness in AI driving vignettes, Wilks’s $\lambda = 0.88$, $F(3, 86) = 4.02$, $p = .01$, $\eta^2 = .12$, indicating that there were significant changes in AI driving willingness in AI driving vignettes over time (See Figure 3).



Test of the Efficacy the Emotional Online Video Advertisement on Future Reports

of Impaired Driving (Deliverable 5.1).

Although Rates of AI Driving Did Not Differ Across Advertisement Conditions, Participants Evidenced a Significant Decrease in AI Driving Behavior Overall. To evaluate the comparative usefulness of advertisement condition (i.e., rational advertisement, emotional advertisement, no advertisement) in explaining engagement in AI driving behavior, composite AI driving behavior scores at pre-advertisement, one-month follow-up, and three-month follow-up were submitted to a one-way mixed-model ANCOVA, with advertisement condition as the fixed effect, time as the repeated measure, and sensation seeking, high school binge drinking, frequency of alcohol use at pre-advertisement, and number of advertisement exposures included as covariates. After controlling for the effects of the covariates, there was no significant interaction effect of advertisement condition by time, Wilks's $\lambda = 0.98$, $F(4, 95) = 0.46$, $p = .76$, $\eta^2 = .01$, which implies that there were no significant differences in the change in AI driving behavior over time across advertisement conditions. Post-hoc t -tests revealed a significant reduction in AI driving engagement from pre-advertisement to follow-up one, $t(100) = 3.54$, $p =$



Decision-Making and Impaired Driving, 18 .001, and from pre-advertisement to follow-up two, $t(101) = 2.66, p = .009$, indicating that study participants reported significantly less AI driving behavior at the one and three-month follow-ups than at pre-advertisement.

Discussion

The present study examined the relative efficacy of theoretically- and empirically-based AI driving advertisements at reducing general willingness to drive after drinking and AI driving behavior within a sample of 108 college students who endorsed driving after drinking alcohol within the past month. Findings revealed that students randomly assigned to one of the advertisement conditions reported decreases in general willingness to drive after drinking from pre-advertisement to post-advertisement and from pre-advertisement to the three-month follow-up, while students randomly assigned to the no advertisement condition evidenced an increase in general willingness to drive after drinking from pre-advertisement to post-advertisement and from pre-advertisement to three-month follow-up.

The independent and additive contributions of theoretically- and empirically-identified AI driving risk factors and rational and emotional decision-making factors on general willingness to drive after drinking and AI driving willingness in AI driving vignettes and AI driving behavior was also tested within a sample of 600 college students. Findings indicate that AI driving risk factors and rational and emotional decision-making factors alone accounted for 43% of the variance in driving after perhaps too much to drink and driving shortly after consuming three or more drinks, with both rational and emotional decision-making factors making significant contributions to the explained variance in each AI driving behavior.

There is a notable lack of effective theoretically- and empirically-based prevention and intervention programs for AI driving. Existing programs that have some theoretical basis are often implemented in uncontrolled settings, where exposure to program materials must be

Decision-Making and Impaired Driving, 19
estimated, rather than objectively counted (Durkin et al., 2012; Meyer et al., 2003; Perkins et al., 2010; Turner et al., 2008; van den Putte et al., 2011; Wakefield Spittal, Yong, Durkin, & Borland, 2008; Wakefield, Spittal, Yong, Durkin, & Borland, 2011). Rarely do programs complete the time-intensive process of conducting focus groups *and* preliminary efficacy testing with program materials before deploying programs at the community level. These practices complicate the evaluation of the effectiveness of these programs, which may be resulting in consumer resources being used to perpetuate ineffective prevention and intervention programs (Baranowski et al., 2009; Hardeman et al., 2005; Noar, 2006; Renger & Steinfeldt, 2002). Findings from the current study confirm the need for high rigor in developing and implementing programs that are designed to reduce AI driving.

The rational and emotional AI driving advertisements utilized in the current study were the result of a thorough review of the theoretical and empirical literature (Agostinelli & Miller, 1994; Armitage et al., 2002; Blanton et al., 2001; Fairlie et al., 2010; Finken et al., 1998; Gerrard et al., 2008; Gibbons, Gerrard, Blanton, & Russell, 1998; Gibbons, Gerrard, Lane, Mahler, & Kulik, 2005; Greening & Stoppelbein, 2000; Hingson et al., 2003; Kidwell & Jewell, 2013; LaBrie, Kenney, Mirza, & Lac, 2011; Marczinski & Fillmore, 2009; Marczinski, Harrison, & Fillmore, 2008; Martens et al., 1990; McCarthy et al., 2007; Parker et al., 1992; Reyna & Farley, 2006; Thornton et al., 2002; Webb & Sheeran, 2006). Theoretically-based advertisement scripts were then subjected to rigorous focus group testing with members of the target population (college students). These preliminary steps ensured the development of theoretically-consistent and empirically-sound advertisements, increasing the validity and generalizability of study results. Findings from the current study suggest that this intensive process of advertisement development was effective in producing advertisements that had the desired effect on general willingness to drive after drinking. The tightly controlled nature of the study design and the use of a high-risk subgroup of the college population (students endorsing recent driving after

drinking) allow for both more confident and more generalizable conclusions about the effectiveness of the current AI driving advertisements to be drawn.

Despite extensive online focus group testing with advertisement scripts, paired *t*-tests did not identify significant differences between the rational and emotional advertisement conditions on general willingness to drive after drinking or AI driving willingness in AI driving vignettes. Several possible explanations for these unexpected findings may be posited. The lack of significant differences between the advertisement conditions may have been due to the increased impact of the advertisements when presented in video form as compared to the script form used during focus group testing. The increased relevance and impact of the video advertisements may have affected the differences between advertisements found during focus group testing. Alternatively, although the advertisements targeted different decision-making pathways, these pathways have overlapping constructs. The changes within the advertisement conditions may also be explained by changes in these shared constructs. Finally, individual AI driving risk factors may have differentially influenced advertisement effects, masking differences between the advertisement conditions. Findings from future studies testing the effectiveness of preventive AI driving advertisements with larger samples could identify the relative efficacy of the different advertisement types with various high risk subgroups of the college population.

Past AI driving studies have provided evidence for the contribution of sociodemographic, AI driving risk, and rational and emotional decision-making factors to AI driving (e.g., Harford et al., 2002; Hingson et al., 2003; 2009; NHTSA, 2010; Fairlie et al., 2010; Flowers et al., 2008; Gerrard et al., 2008; Gibbons et al., 1998; 2005; Gibbons, Gerrard, & Lane, 2003; Jonah, 1997; LaBrie et al., 2011; McCarthy et al., 2007; Reyna & Farley, 2006; Webb & Sheeran, 2006; Zakletskaia et al., 2009). The current study is the first to test a predictive model of general willingness to drive after drinking and AI driving willingness in AI driving vignettes that includes previously supported sociodemographic and AI driving risk factors as well as variables

that capture both rational and emotional decision-making constructs that have been proposed to be most relevant to AI driving. Study findings indicate that rational and emotional decision-making factors account for approximately 43% of the variance in general willingness to drive after drinking and AI driving willingness in AI driving vignettes, with both rational and emotional decision-making factors making significant contributions to the explained variances. These findings are quite promising as they indicate that the majority of the variance in general willingness to drive after drinking and AI driving willingness in AI driving vignettes within the college population can be accounted for by factors that can be impacted by AI driving interventions, such as the advertisements used in this study.

The dual-process decision-making theory literature suggests rational and emotional decision-making pathways are influenced by both shared and unique factors (Gerrard et al., 2008; Gibbons, et al., 1998; Thornton et al., 2002). Findings from the current study strongly support these previous findings. Study findings indicate that both rational and emotional decision-making factors contribute to general willingness to drive after drinking and AI driving willingness in AI driving vignettes and underscore the importance of continuing to target *both* rational and emotional decision-making factors in AI driving prevention and intervention programs.

Study Strengths and Limitations

The current study has a number of conceptual and methodological strengths. The current study was conducted with a subgroup of the high risk college population (18 to 24-year-old students who endorsed recent driving after drinking), as such study findings are generalizable to the subgroup of the high risk college population that is most at risk of AI driving. Additionally, participants in the current study were randomly assigned to one of the two advertisement conditions or the no advertisement control condition. Randomization allows a high level of confidence to be applied to study findings as the effects of potentially confounding factors (e.g.,

sociodemographics, self-selection into condition) are controlled. The current study also recruited a sample large enough to effectively power the planned analyses, further increasing confidence in the accuracy of the reported findings. Additionally, the comprehensive assessment battery utilized in the current study allows study findings to provide clarity on the relations of sociodemographic, AI driving risk, and rational and emotional decision-making factors to general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and AI driving behavior within the high risk college population at a level that did not exist prior to the currently reported results.

Several study strengths apply directly to the experimental manipulation. Subjecting the advertisement scripts to rigorous focus group testing with members of the target population increased the relevance and acceptability of the theoretically- and empirically- based advertisement content (Durkin et al., 2012; Evans-Lacko et al., 2013; McAfee et al., 2013; Noar, 2006; Renger & Steinfeld, 2002; Worden et al., 1988). The compatibility of the current advertisements with standards used in the advertisement field was ensured through consultation with experts from an advertisement firm currently employed to provide statewide AI driving prevention advertisements for NDOT. Video advertisements, rather than written or radio advertisements, were utilized to increase the impact of the presented information (Noar, 2006). As online video advertisements are associated with higher recall of presented information than television advertisements (The Nielsen Company, 2012), the use of the online medium to disseminate AI driving video advertisements in the current study likely amplified their overall impact. The use of college student actors in the advertisements was an additional study strength, as using actors who are members of the target population's "in group" to deliver program material has been shown to increase the impact of presented information (Carli, 2001; Joseph, 1982; Mackie et al., 1990; Wilder, 1990). In sum, the current study conducted preliminary efficacy testing for rigorously developed online video advertisements in which participants were

randomly assigned to condition and provided specific advertisement dosages via the medium known to be most effective, which significantly increases the confidence that can be placed in study findings.

Certain study limitations must be acknowledged. The results of the current study are based on self-report. Alternative methods of data collection could include observation (e.g., obtaining video recordings from bars), collaterals reports (e.g., close friends, significant others), or use of legal records (e.g., police reports obtained from DUI checkpoints or alcohol-involved MVCs). Although some level of the social desirability effect could have been present given the generally negative attitudes and normative beliefs surrounding AI driving (Davis, et al., 2010; Flowers et al., 2008; Krumpal, 2013; Lindhjem & Navrud, 2011), the online nature of the surveys likely decreased the social desirability effect on study participants (Crutzen & Gortiz, 2010; Dillman & Smyth, 2007; Huang, 2006; Maguire, 2009). This study targeted college students, therefore the results may not be immediately generalizable to the larger population of AI drivers. However, applying the current intervention to this population allowed the persons in the most at risk subgroup of the general population to be targeted. The limited number of exposures to the AI driving advertisements ($M = 3.0$) may have limited the effect of the advertisement on general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and AI driving behavior, however the significant advertisement condition by time interaction effect for general willingness to drive after drinking suggests the advertisements had sufficient potency to have the desired effect on that construct.

Future Directions

The current study provides critical information on the efficacy of theoretically- and empirically-based online video advertisements at reducing general willingness to drive after drinking. These promising results suggest replication with a larger sample is warranted. Not only do these findings suggest a broader implementation of these advertisements may reduce AI

Decision-Making and Impaired Driving, 24
driving rates, but findings also exemplify the value of employing intensive focus group testing and preliminary efficacy testing prior to deployment of community-level AI driving prevention or intervention programs. It is critical that researchers consider preliminary focus group and efficacy testing as essential steps in the process of creating scientifically-sound AI driving prevention and intervention programs. Focusing on building AI driving prevention and intervention programs that are empirically-supported before large-scale dissemination is paramount to the responsible use of consumer resources and making the maximal positive impact on AI driving morbidity and mortality rates.

Widespread internet accessibility and usage in college and young adult populations increases the potential reach of online AI driving prevention and intervention programs and decreases the cost and burden of program dissemination, making the type of AI driving advertisement used in the current study ideal for larger-scale dissemination. The methodology and materials utilized in the current study (i.e., intensive focus group testing with members of the target population, preliminary advertisement testing) could be applied with other at-risk populations to produce advertisements that have the maximum likelihood of impacting the target population. Advertisements similar to those used in the current study could be easily converted and communicated through various media (e.g., billboards, radio advertisements, television advertisements) for more comprehensive dissemination. If applied on a larger scale, the impact of rational and emotional decision-making advertisements on objective measures of AI driving, such as alcohol-related MVCs and DUI offenses should be evaluated to determine the impact of the advertisements on the most burdensome consequences of AI driving: serious injuries and fatalities.

Conclusions

AI driving continues to cause a disproportionate number of fatalities within the college and young adult populations. Reduction of the prevalence of AI driving would result in

Decision-Making and Impaired Driving, 25

significant decreases in the number MVC injuries and fatalities that occur due to AI driving (now over 11,000 per year; Blincoe et al., 2014). The current study takes one of the first steps necessary in developing an integrative AI driving model that accounts for the influence of sociodemographic, dispositional, historical, and current AI driving risk factors as well as rational and emotional decision-making factors. Findings from the current study provide preliminary support for the efficacy of both theoretically- and empirically-based AI driving advertisements in reducing general willingness to drive after drinking among college students who are at particularly high risk for AI driving and identify key factors that likely contribute to general willingness to drive after drinking, AI driving willingness in AI driving vignettes, and AI driving behavior within the college population.

References

- Adobe Systems Incorporated. (2014). Premier Pro CC (2014.1) [Software]. Available from <https://www.adobe.com/creativecloud/catalog/desktop.html>.
- Adobe Systems Incorporated. (2014). After Effects CC (2014.1) [Software]. Available from <https://www.adobe.com/creativecloud/catalog/desktop.html>.
- Agostinelli, G., & Miller, W. R. (1994). Drinking and thinking: how does personal drinking affect judgments of prevalence and risk? *Journal of Studies on Alcohol*, 55(3), 327–37. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8022181>
- Armitage, C. J., Norman, P., & Conner, M. (2002). Can the Theory of Planned Behaviour mediate the effects of age, gender and multidimensional health locus of control? *British Journal of Health Psychology*, 7(3), 299–316. doi:10.1348/135910702760213698
- Baranowski, T., Cerin, E., & Baranowski, J. (2009). Steps in the design, development and formative evaluation of obesity prevention-related behavior change trials. *International Journal of Behavioral Nutrition and Physical Activity*, 6(1), 6.

Blanton, H., VandenEijnden, R. J. J. M., Buunk, B. P., Gibbons, F. X., Gerrard, M., & Bakker,

A. (2001). Accentuate the negative: social images in the prediction and promotion of condom use. *Journal of Applied Social Psychology, 31*(2), 274–295. doi:10.1111/j.1559-1816.2001.tb00197.

Blincoe, L. J., Miller, T. R., Zaloshnja, E., & Lawrence, B. A. (2014). *The economic and societal impact of motor vehicle crashes, 2010*. (Report No. DOT HS 812 013).

Washington, DC: National Highway Traffic Safety Administration.

Crutzen, R., & Göritz, A. S. (2010). Social desirability and self-reported health risk behaviors in web-based research: Three longitudinal studies. *BMC Public Health, 10*(1), 720.

doi:10.1186/1471-2458-10-720

Davis, C. G., Thake, J., & Vilhena, N. (2010). Social desirability biases in self-reported alcohol consumption and harms. *Addictive Behaviors, 35*(4), 302–311.

doi:10.1016/j.addbeh.2009.11.001

Dillman, D. A., & Smyth, J. D. (2007). Design effects in the transition to web-based surveys.

American Journal of Preventive Medicine, 32(S5), S90–S96.

doi:10.1016/j.amepre.2007.03.008

Durkin, S., Brennan, E., & Wakefield, M. (2012). Mass media campaigns to promote smoking cessation among adults: An integrative review. *Tobacco Control, 21*(2), 127-138.

Fairlie, A. M., Quinlan, K. J., Dejong, W., Wood, M. D., Lawson, D., & Witt, C. F. (2010).

Sociodemographic, behavioral, and cognitive predictors of alcohol-impaired driving in a sample of U.S. college students. *Journal of Health Communication, 15*(2), 218–32.

doi:10.1080/10810730903528074

Finken, L. L., Jacobs, J. E., & Laguna, K. D. (1998). Risky drinking and driving/riding

decisions: The role of previous experience. *Journal of Youth and Adolescence, 27*(4), 493–

511. doi:10.1023/A:1022804219685

Flowers, N. T., Naimi, T. S., Brewer, R. D., Elder, R. W., Shults, R. A., & Jiles, R. (2008).

Patterns of alcohol consumption and alcohol-impaired driving in the United States.

Alcoholism, Clinical and Experimental Research, 32(4), 639–44. doi:10.1111/j.1530-0277.2008.00622.x

Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., & Pomery, E. a. (2008). A dual-process approach to health risk decision making: The prototype willingness model.

Developmental Review, 28(1), 29–61. doi:10.1016/j.dr.2007.10.001

Gibbons, F. X., Gerrard, M., Blanton, H., & Russell, D. W. (1998). Reasoned action and social reaction: Willingness and intention as independent predictors of health risk. *Journal of Personality and Social Psychology*, 74(5), 1164–80. Retrieved from

Personality and Social Psychology, 74(5), 1164–80. Retrieved from

<http://www.ncbi.nlm.nih.gov/pubmed/9599437>

Gibbons, F. X., Gerrard, M., Lane, D. J., Mahler, H. I. M., & Kulik, J. A. (2005). Using UV photography to reduce use of tanning booths: a test of cognitive mediation. *Health Psychology : Official Journal of the Division of Health Psychology, American Psychological Association*, 24(4), 358–63. doi:10.1037/0278-6133.24.4.358

Psychological Association, 24(4), 358–63. doi:10.1037/0278-6133.24.4.358

Gibbons, F. X., Gerrard, M., & Lane, D. J. (2003). A social reaction model of adolescent health risk. In J. Suls & K. Wallston (Eds.), *Social psychological foundations of health and illness*. Oxford, UK: Blackwell.

Greening, L., & Stoppelbein, L. (2000). Young drivers' health attitudes and intentions to drink and drive. *The Journal of Adolescent Health*, 27(2), 94–101. Retrieved from

<http://www.ncbi.nlm.nih.gov/pubmed/10899469>

Hardeman, W., Sutton, S., Griffin, S., Johnston, M., White, A., Wareham, N. J., & Kinmonth, A. L. (2005). A causal modelling approach to the development of theory-based behaviour change programmes for trial evaluation. *Health Education Research*, 20(6), 676-687.

- Harford, T. C., Wechsler, H., & Muthén, B. O. (2002). The impact of current residence and high school drinking on alcohol problems among college students. *Journal of Studies on Alcohol*, 63(3), 271–9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12086127>
- Hingson, R., Heeren, T., Zakocs, R., Winter, M., & Wechsler, H. (2003). Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. *Journal of Studies on Alcohol*. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12608480>
- Hsieh, Y. C., & Chen, K. H. (2011). How different information types affect viewer's attention on internet advertising. *Computers in Human Behavior*, 27(2), 935-945.
- IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
- Huang, H. M. (2006). Do print and web surveys provide the same results? *Computers in Human Behavior*, 22(3), 334–350. doi:10.1016/j.chb.2004.09.012
- Jonah, B. A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident; Analysis and Prevention*, 29(5), 651–65. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9316713>
- Kidwell, B., & Jewell, R. D. (2013). The moderated influence of internal control : An examination across health-related behaviors. *Journal of Consumer Psychology*, 13(4), 377–386.
- Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: A literature review. *Quality and Quantity*, 47(4), 2025–2047. doi:10.1007/s11135-011-9640-9
- LaBrie, J. W., Kenney, S. R., Mirza, T., & Lac, A. (2011). Identifying factors that increase the likelihood of driving after drinking among college students. *Accident; Analysis and Prevention*, 43(4), 1371–7. doi:10.1016/j.aap.2011.02.011

- Lindhjem, H., & Navrud, S. (2011). Are internet surveys an alternative to face-to-face interviews in contingent valuation? *Ecological Economics*, *70*(9), 1628–1637.
doi:10.1016/j.ecolecon.2011.04.002
- Maguire, K. B. (2009). Does mode matter? A comparison of telephone, mail, and in-person treatments in contingent valuation surveys. *Journal of Environmental Management*, *90*(11), 3528–3533. doi:10.1016/j.jenvman.2009.06.005
- Marczinski, C. A., & Fillmore, M. T. (2009). Acute alcohol tolerance on subjective intoxication and simulated driving performance in binge drinkers. *Psychology of Addictive Behaviors*, *23*(2), 238–47. doi:10.1037/a0014633
- Marczinski, C. A., Harrison, E. L. R., & Fillmore, M. T. (2008). Effects of alcohol on simulated driving and perceived driving impairment in binge drinkers. *Alcoholism, Clinical and Experimental Research*, *32*(7), 1329–37. doi:10.1111/j.1530-0277.2008.00701.
- Martens, C. H., Ross, L. E., & Mundt, J. C. (1991). Young drivers' evaluation of driving impairment due to alcohol. *Accident; Analysis and Prevention*, *23*(1), 67–76. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/2021405>.
- Mackie, D. M., Worth, L. T., & Asuncion, A. G. (1990). Processing of persuasive in-group messages. *Journal of Personality and Social Psychology*, *58*(5), 812.
- McAfee, T., Davis, K. C., Alexander, R. L., Pechacek, T. F., & Bunnell, R. (2013). Effect of the first federally funded US antismoking national media campaign. *The Lancet*, *382*(9909), 2003-2011.
- McCarthy, D. M., Lynch, A. M., & Pederson, S. L. (2007). Driving after use of alcohol and marijuana in college students. *Psychology of Addictive Behaviors*, *21*(3), 425–30.
doi:10.1037/0893-164X.21.3.425

- Meyer, G., Roberto, A. J., & Atkin, C. K. (2003). A radio-based approach to promoting gun safety : Process and outcome evaluation implications and insights, *Health Communication, 15*(3) 299-318. doi:10.1207/S15327027HC1503
- Noar, S. M. (2006). A 10-year retrospective of research in health mass media campaigns: Where do we go from here? *Journal of Health Communication, 11*(1), 21-42.
- Parker, D., Manstead, A. S. R., Stradling, S. G., Reason, J. T., & Baxter, J. S. (1992). Intention to commit driving violations : An application of the theory of planned behavior, *77*(1), 94–101.
- Perkins, H. W., Linkenbach, J. W., Lewis, M. A., & Neighbors, C. (2010). Effectiveness of social norms media marketing in reducing drinking and driving: A statewide campaign. *Addictive Behaviors, 35*(10), 866–74. doi:10.1016/j.addbeh.2010.05.004
- Renger, R., Steinfeld, V., & Lazarus, S. (2002). Assessing the effectiveness of a community-based media campaign targeting physical inactivity. *Family & Community Health, 25*(3), 18-30.
- Rigotti, N. A., & Wakefield, M. (2012). Real people, real stories: A new mass media campaign that could help smokers quit. *Annals of Internal Medicine, 157*(12), 907-909.
- Tabachnick, B. G., & Linda S. Fidell. (2013). Using multivariate statistics (6th ed.). Boston: Allyn and Bacon.
- The Nielsen Company. (2012). *A comprehensive picture of digital video and tv advertising: Viewing, budget share shift* (p. 124).
- Thornton, B., Gibbons, F. X., & Gerrard, M. (2002). Risk perception and prototype perception: Independent processes predicting risk behavior. *Personality and Social Psychology Bulletin, 28*(7), 986–999. doi:10.1177/014616720202800711

- Turner, J., Perkins, H. W., & Bauerle, J. (2008). Declining negative consequences related to alcohol misuse among students exposed to a social norms marketing intervention on a college campus. *Journal of American College Health, 57*(1), 85-94.
- van den Putte, B., Yzer, M., Southwell, B. G., de Bruijn, G. J., & Willemsen, M. C. (2011). Interpersonal communication as an indirect pathway for the effect of antismoking media content on smoking cessation. *Journal of Health Communication, 16*(5), 470-485.
- Wakefield, M. A., Durkin, S., Spittal, M. J., Siahpush, M., Scollo, M., Simpson, J. A., ... & Hill, D. (2008). Impact of tobacco control policies and mass media campaigns on monthly adult smoking prevalence. *American Journal of Public Health, 98*(8), 1443-1450.
- Wakefield, M. A., Spittal, M. J., Yong, H. H., Durkin, S. J., & Borland, R. (2011). Effects of mass media campaign exposure intensity and durability on quit attempts in a population-based cohort study. *Health Education Research, 26*(6):988–97.
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132*(2), 249–68. doi:10.1037/0033-2909.132.2.249
- Wilder, D. A. (1990). Some determinants of the persuasive power of in-groups and out-groups: Organization of information and attribution of independence. *Journal of Personality and Social Psychology, 59*(6), 1202.
- Zakletskaia, L. I., Mundt, M. P., Balousek, S. L., Wilson, E. L., & Fleming, M. F. (2009). Alcohol-impaired driving behavior and sensation-seeking disposition in a college population receiving routine care at campus health services centers. *Accident; Analysis and Prevention, 41*(3), 380–6. doi:10.1016/j.aap.2008.12.006



Nevada Department of Transportation
Rudy Malfabon, P.E. Director
Ken Chambers, Research Division Chief
(775) 888-7220
kchambers@dot.state.nv.us
1263 South Stewart Street
Carson City, Nevada 89712