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Distracted Driving in Clark County, Nevada: Analysis of an Intervention on College Students

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DISTRACTED DRIVING IN CLARK COUNTY, NEVADA: ANALYSIS OF AN INTERVENTION ON COLLEGE STUDENTS

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Abstract

Distracted driving is a growing public health concern. Highlighted in the media, local and government agencies and in peer-review literature are increased associations of motor vehicle crash related injuries and fatalities with distracted driving, especially involving youth drivers. The goal of this thesis was to analyze the effects of a distracted driving intervention on college students at University of Nevada, Las Vegas. Quantitative statistical analysis was performed to compare self-reported pre and post-intervention questionnaire responses of the experimental and control groups. Between-group analysis was performed using independent t-tests and ANOVA. Within-group differences were analyzed with Repeated Measures ANOVA (RM-ANOVA) and Cochran's Q Chi-square tests. The results indicate an overall observed desired effect of change with statistical significance for the experimental group after the intervention, which was not observed for the control group. There were also statistically significant differences within the experimental group responses in all three themed components of the questionnaire: behavior, attitude, and knowledge. The most interesting finding of this analysis is that a classroom based intervention can have effects on self-reported distracted driving related behaviors, attitudes, and knowledge after two weeks of completing the intervention. These results can inform development of future evidence-based distracted driving intervention programs.

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Chapter 1: Introduction

Distracted driving is a growing public health concern. Inattention to driving and specifically, distracted driving, are not new behavioral phenomena. Within the last few decades and especially since year 2000, increased attention from the national and state government, public health professionals and academics have focused on the dangers of distracted driving (Regan & Lee, 2013). One explanation for this increased focus can partially be attributed to the ubiquity of technologically advanced mobile devices such as smart phones and their prominent role in diverting driver's attention.

In addition to use of mobile devices, our modern driving experience is fraught with other countless sources of potential driving distractions. Once such source is within the internal driving environment (inside the car) which can contain new technological innovations such as car dashboard touch screens and navigation systems. These innovations can encourage distracted driving behaviors even if they are meant to increase driving efficiency or decrease driving distraction (Regan & Lee, 2013). The external driving environment (activities outside the car, or barriers in the built environment) may also contribute to distracted driving in a number of ways such as road construction, the use of flashy digital billboards, and sign-spinner marketers on sidewalks and at intersections (Regan & Lee, 2013).

Given this, there are multiple existing behavioral and environmental factors that foster an environment where unsafe driving behaviors and habits can thrive. While there are a number of distracted driving behaviors, the riskiest can involve behaviors that fall within all four categories of driving distractions: visual, manual, auditory and cognitive impairment (GHSA, 2011). For example, behaviors such as texting and live streaming communications on mobile devices can involve all four categories of driving distractions. Therefore, it is not surprising that texting has

been a prominent focus for public safety campaigns against distracted driving (Distraction.gov, stoptextsstopwrecks.org).

While the use of cell phones and texting have increasingly become one of the most prevalent ways of communication in modern society; unfortunately for the safety of drivers, passengers, cyclists, and pedestrians alike, this behavior does not always end when a driver gets behind the wheel. While technological gadgets arguably improve our lives, the incorporation of using these gadgets while driving a motor vehicle fosters an environment of distraction and risk, as decreased attention to the road increases the risk of MVCs (Llerena et al., 2015).

While drivers of all ages are subject to being distracted while driving, younger drivers (ages 16-30) not only use more technology while driving, such as texting, talking on the cell phone and the use of music applications via their mobile devices, but they are also more likely to crash (National Center for Statistics and Analysis, 2016a, 2016b). While the literature has highlighted the higher risk of younger people driving distracted and to crash while doing so, it is not clear what types of preventions or interventions may be most effective for this age group (Caird & Horrey, 2016; Domigan, Glassman, Miller, Hug, & Diehr, 2015; Fournier, Berry, & Frisch, 2016; Lawrence, 2015; Rohl, Eriksson, & Metcalf, 2016).

A modest amount of published peer-reviewed research has emphasized the necessity for distracted driving prevention/intervention for younger drivers, however very few distracted driving intervention studies have been published (Domigan et al., 2015; Fournier et al., 2016; Joseph et al., 2016; Lawrence, 2015; Rohl et al., 2016). Given this, to date, there is very little evidence for the effectiveness of distracted driving prevention/intervention programs (Caird & Horrey, 2016). Furthermore, it is not clear if distracted driving prevention programs are better suited to be customized or directed toward specific target populations such as different age

groups and genders. While a growing amount of published research has focused on differences in distracted driving among age groups (Aksan et al., 2013; Guo et al., 2016; Harland, Carney, & McGehee, 2016; Llerena et al., 2015; Rumschlag et al., 2015) very little has focused specifically on gender differences with distracted driving (Caird & Horrey, 2016; Li, Yan, Wu, Radwan, & Zhang, 2016; Struckman-Johnson, Gaster, Struckman-Johnson, Johnson, & May-Shinagle, 2015). Evaluating demographic differences in driving behaviors and motivations for driving distracted may prove fruitful in formulating intervention material that may be more effective for the targeted population.

Despite these gaps in knowledge about distracted driving prevention/intervention programs, there is a clear urgency warranting the need for evidence based, effective, local and large scale prevention/intervention programs to be developed. To contribute to the small but growing knowledge-base regarding distracted driving intervention, the focus of this thesis is to evaluate the effects of a distracted driving intervention that was implemented at the University of Nevada, Las Vegas.

Main Statement of Purpose

The goal of this thesis project is to analyze questionnaire data and report the effects of a distracted driving intervention of college students at the University of Nevada, Las Vegas.

Specific Aims/Research Questions

1) Is there a difference in baseline/pre-intervention vs post-intervention questionnaire responses between group participants? Are there observed effects of the intervention?

2) Is there an effect within the experimental group in responses to behaviors, attitudes, and knowledge regarding distracted driving pre-versus post-intervention?

Chapter 2: Literature Review and Significance

What is Distracted Driving?

In efforts to spread awareness to the public using anti-distracted driving campaigns, public health and safety professionals have simplified the meaning of the term *distracted driving.* Discouraging the use of mobile devices, especially texting while driving has been the primary focus of ad-campaigns and presentations (distraction.gov, CDC.dov, NHTSA.gov). Descriptions on these referenced websites describe distracted driving as any activity that takes your eyes off the road, hands off the wheel, and mind away from driving. While this is true in a broad sense, research in the field of traffic safety has articulated more specific complexity to the topic of distracted driving.

Common in growing fields of research, is use of terminology that is often tied to multiple meanings which leads to inconsistencies in the literature. The field of distracted driving research is no different. Despite the public and academic surge of interest in recent years, there is not a clear definition of what 'distracted driving" is (Regan, Hallett, & Gordon, 2011; Regan & Lee, 2013). When different meanings are applied to what *distracted driving* is, it is difficult to compare findings, synthesize data, and implement effective countermeasures. Lastly, different estimates on the impact of distracted driving on crash data can impede our understanding of the individual impact of certain driving distractions or other components of driving inattention (Regan et al., 2011; Regan & Lee, 2013; Young, Regan, & Hammer, 2007).

For the purpose of this thesis, it is important to define the term '*distracted* driving' as it will be used in this analysis. Some researchers have conceptualized *distracted driving* in the literature as falling under the umbrella of *driving inattention* and others have conceptualized

distracted driving and *driving inattention* as being completely different categories of traffic research (Regan et al., 2011). Despite the differences of opinion in definition as discussed further in the literature (see Regan et al. 2011), for this thesis, *driver distraction* is categorized as one form of *driver inattention.* The definition for the term *distracted driving* used within this current thesis is as follows: "a diversion of attention away from activities critical for safe driving toward a competing activity"(Lee, Young, & Regan, 2009, p. 38). This working definition of *distracted driving*, can encompass both 'internalized mental activities' such as day dreaming, or physical feelings of pain or hunger and also 'external activities' (body movements such as reaching for a cell phone. Also further, *distracted driving* can encompass 'internal distractions' inside the car and 'external distractions' outside the car. Even more complex, distracted driving can further be categorized into 'non-driving related' such as eating and 'driving related' such as road rage (Regan et al., 2011).

If distracted driving is only one component under the umbrella of *driving inattention*, what are the other components? The term *driver inattention* as used in this thesis is as follows: "*driver inattention* is insufficient or no attention to activities critical for safe driving" (Regan et al., 2011, p. 1780). This term or umbrella, encompasses multiple categories of inattentive driving. Disagreement regarding these component categorizations are further elaborated in the literature (Lee et al., 2009; Regan et al., 2011; Regan & Lee, 2013; Young et al., 2007) however a summary of different types if *driving inattention* which have been proposed are: lack of attention, insufficient attention, cursory attention (in a hurry), selection of irrelevant information (or mis-prioritization), internalized thoughts, engagement in secondary activities, drowsiness, and eyes off the road (Regan et al., 2011, p. 1774).

Motor Vehicle Crash Statistics

For Americans, as of 2014, an unintentional injury from a MVC is the second leading cause of injury-death, the first being unintentional poisoning (drug overdose). In the overall national ranking of all leading causes of death, unintentional injury ranks fourth. Nationally, in 2015, there was a 7.2% increase in deaths due to MVC (total 35,092) from 2014 (total 32,744); the largest percentage increase since 1966 (National Center for Statistics and Analysis, 2016). Also, nationally, MVC non-fatal injuries increased by 4.5% from 2.34 million to 2.44 million from 2014-2015 (+105,000 people injured) (National Center for Statistics and Analysis, 2016). Although distracted driving behaviors may play a partial role in the overall epidemiology of non-intentional injury death due to MVC, it is likely that these observed increases in MVC statistics may be correlated with increased distractions while driving.

The leading causes of MVCs in the United States are behavioral; they include driving while under the influence of drugs or alcohol, failure to use restraints, and speeding (National Center for Statistics and Analysis, 2016). Other factors that may contribute to the events leading to a MVC such as weather, road condition, vehicle condition, traffic flow and personal driving errors (National Center for Statistics and Analysis, 2016). While not usually listed as a leading cause, distracted driving can play significant role in causing MVCs. Research conducted by the National Highway Traffic Safety Administration (NHTSA) reported nationally for 2014, 10% of fatal crashes (3,179 deaths) were due to driving distractions. For injury crashes, 18% (431,000 injured) were due to driver distractions and 16% of all police reported MVCs were distraction related (National Center for Statistics and Analysis, 2016b). While helpful in understanding the possible prevalence of distracted driving in relation to injuries and injury-related deaths from MVCs, this percentage is based from traffic reports and does not reflect crashes due to driving

distractions that were not realized or reported at the time of crash. Therefore, due to this under-reporting, distracted driving may be attributed to an even higher percent of MVC injuries and deaths (National Center for Statistics and Analysis, 2016).

To date, there are no published national or state prevalence rates of distracted driving behaviors. Accounting for frequency of distractions is difficult to discern in nationally represented data however, self-reported data from a phone survey regarding distracted driving was published by the National Highway Traffic Safety Administration (NHTSA) in 2013. This report is the most recent in a series national phone surveys regarding self-reported responses of attitudes, knowledge and self-reported behaviors in regard to distracted driving from over 6,000 drivers sampled in each of the fifty states in the U.S (Schroeder, Myers, & Kostyniuk, 2013; Tison, Chaudhary, & Cosgrove, 2011). While this survey focused mostly on distracted cell-phone behavior while driving, respondents were also asked to report how often they engaged in other distracted driving behaviors (Schroeder et al., 2013; Tison et al., 2011). Almost half (48%) of respondents at least sometimes answer their phone while driving and 58% of them continued conversations while driving. A larger percentage of respondents reported to at least sometimes read emails and text messages (14%) than sending text messages or emails (10%). Approximately 80% of respondents reported to at least sometimes talk to others in the car and 47% at least sometimes eat or drink in the car (Schroeder et al., 2013). An updated version of this report is needed to compare current trends in these distracted driving behaviors since distracted driving laws have been implemented and smart phone ownership and use has increased.

Cost

An important but sometimes overlooked consequence of MVCs is the impact on economic costs and quality of life. Not only do drivers suffer financial costs and poorer quality of life (injury, pain, depression) from MVCs due to distracted driving, but so do passengers, cyclists, motorcyclists, pedestrians, and their friends and family. In 2012, the CDC assessed the costs of MVCs, showing that during that year, 2.5 million people were sent to the emergency department due to MVCs and each crash cost individuals $57,000 over their lifetime (CDC, 2014). Based on this data, the economic impact upon individuals and communities may affect their quality of life in regard to financial burden, personal stress, and community well-being.

When reviewing public policy initiatives on both state and national levels, research shows that the societal cost of MVCs due to distraction while operating a motor vehicle are high. MVCs in which at least one driver was identified as being distracted cost the United States forty billion dollars in 2010 (Blincoe, Miller, Zaloshnja, & Lawrence, 2015). According to NDOT's Nevada Traffic Crashes "Crash Book" (a multi-year publication solely produced from data extracted from NDOT's Crash Data Warehouse) the "total estimated economic loss (based on national figures) resulting from traffic crashes in Nevada for the year 2010 [was] $1.809 billion" (NDOT, 2010).

Direct and Indirect Costs of Distracted Driving for Nevadans

While people can be ticketed for driving distractions such as eating or grooming themselves, the focus of distracted driving law implementation has been on cell phone or mobile device use while driving. There are now only a few states in this country where texting while operating a vehicle will not affect your driving record. As of December 2016, 14 states have primary enforcement laws prohibiting hand-held cell phone use while driving and 46 states and

Washington D.C. have prohibited texting while driving (GHSA.org). As of 2016, Arizona and Montana are the only states without any texting laws, while Texas and Missouri have texting law limitations only for drivers 21 and under (GHSA.org).

Quality of life for Nevadans can be assessed by costs directly and indirectly associated with distracted driving. For drivers in Nevada, if ticketed for using a hand-held device, this can be costly in terms of ticket fines and demerit points accruing on their driving record. During the 2011 Nevada Legislative session, Senate Bill 140 was approved, and a law enacting a ban on the use of hand-held cell phone devices while driving went into full effect on January 1st, 2012. In the 2015 Nevada Legislative session, legislators approved Senate Bill 144 which allows fines to be doubled for various vehicular offenses, including distracted driving behaviors; this bill went into effect October 1, 2015 ("Nevada: Cell phone laws, legislation", 2015; Rules of the Road, 2016).

The Nevada Department of Motor Vehicles (DMV) has an extensive demerit point system for their driver improvement program. When an individual receives, a conviction notice from a court, the offense is entered on the individual's driving record and demerit points are assigned. According to the Nevada DMV's Traffic Laws website, an individual who is ticketed for using their hand-held cell phone and texting while operating a motor vehicle will receive a fine of $50 for the first offense in seven years, $100 for the second, and $250 for the third and subsequent offenses (Nevada DMV, 2016). The first offense of hand-held cell phone use is not treated as a moving violation; the driver only receives the $50 fine with no demerit points added to their driving record (Nevada DMV, 2016). For the second and subsequent offenses of hand-held cell phone use, four demerit points, per offense, are added to the driving record (Nevada DMV, 2016). If an individual receives more than twelve points on their record within a period of

twelve months, their license will be automatically suspended for six months (Nevada DMV, 2016). For drivers in Nevada, these fines and demerits given for each offense can affect the quality of life for that individual if they get their license suspended or have to pay fines that they cannot afford.

Given the ubiquity of motor vehicles in the lives of Nevadans, and particularly Clark County where the majority (72%) of our state's population resides, distracted driving related MVCs have an impact on infrastructure of our local and state economy in regard to crash analysis cost, emergency response, and medical costs. Statewide data reported by Nevada's Office of Traffic Safety, Fatal Analysis Reporting System (FARS), MVCs and fatalities increased from 2014 to 2015. There was an 11% increase in MVC overall and a 12% increase MVC fatalities from 2014 to 2015 (http://ots.nv.gov/). Furthermore, as of November 30, 2016, there was already a reported 8.9% increase in MVCs (23 more incidents) in comparison to the same date the previous year (November 30th, 2015). Additionally, there is a 5.6% increase (n=16) in fatalities for 2016 compared to the same date in 2015 (http://ots.nv.gov/). In Clark County, the statistics are starker. As of November 30, 2016, there was a reported 12.8% increase in MVCs in comparison to the same date the previous year (November 30th, 2015), and a 10.11% increase in fatalities for 2016 compared to the same date in 2015 (http://ots.nv.gov/).

Youth Drivers

Given this local data, there is a current growing trend of rising MVCs and fatalities on Nevada's roadways, however it is not clear what the causes are. Given the reported issues of possible underreporting of distracted driving being the cause, it is possible that more Nevada non-injury crashes, as well as injury crashes and fatal crashes may be attributed to driving

distractions. A query utilizing the Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS) for motor vehicle-caused deaths in Nevada showed that the crude rate for those aged 15-19 was 13.58 per 100,000 in 2014. During this period of time, the only other age group with a higher crude rate was those aged 20-24 (20.07 per 100,000) (Centers for Disease Control and Prevention, 2016).

While all drivers can drive distracted, younger drivers are overrepresented in distracted driving academic literature. This is due to the high proportion of young distracted drivers involved in crashes: in 2014, 10% of all crashes among 15-19-year-old drivers were attributed to distracted driving. Comparing across age groups, teens have the highest within-in group percentage of distracted driving related crashes (National Center for Statistics and Analysis, 2016). Younger drivers may be at a higher risk given their more frequent use of mobile devices and talking on hand-held phones, they tend to be riskier drivers, and may have a higher risk of crash due to the lack of perception of how dangerous their behavior is (Rowe et al., 2016; Shope, 2006; Watters & Beck, 2016) This underestimation of the risk of distracted driving may be due to their inexperience with driving (Wright, 2017). For Nevada, teens make up 4% of the population and 18% of traffic fatalities (RTC, 2015). This over-representation of teens in fatal crashes justifies Nevada's Office of Traffic Safety's focus of targeting 'Drivers age 20 or Younger in Fatal Crashes' as a performance measure for Nevada's annual Highway Safety Performance Plan.

The majority of Nevada traffic crashes (66% as of 11/30/16) happen in Clark County (http://ots.nv.gov/).For 2015, Clark County ranked the highest (65%) in total crashes and total fatality-crashes (64%) in Nevada (http://ots.nv.gov/). Data from the Southern Nevada Transportation Safety Plan, also focus on *young road users* as a Critical Emphasis Area (CEA)

(RTC, 2015). This Southern Nevada Transportation Safety plan defines their grouping of *young road users* as drivers under the age of 25. The *young road users* are the group with the highest percentage (24%) of all the serious injury/fatality crashes in Southern Nevada. For the years 2008-2012, for overall crashes involving *young road users*, 'distracted driving/inattention' ranks third in factors leading to the crash, whereas in serious injury/fatality crashes involving *young road users* in Southern Nevada, 'distracted driving/inattention' ranks fourth (RTC, 2015). For Clark County, within the *young road users* age group (<25), ages 19-21 rank the highest for serious injury/fatality crashes in Clark County (37.2 %), with age group 22-24 ranking second highest for injury/fatality crashes (36.5%). The age group of 16-18 ranks third (24.6 %), and ages of less than 16 rank fourth (1.8%) (RTC, 2015).

Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is useful in predicting health behaviors such as distracted driving because it assumes that intention and action is motivated by attitudes and perceived social norms (Buckley, Chapman, & Sheehan, 2014; Montano & Kasprzyk, 2015). The intention to perform a behavior, such as use of a cellular device while driving, is influenced directly by perceived norms, as well as attitudes and perceived control over the behavior (Atchley, Hadlock, & Lane, 2012). Using the TPB's concepts on predictive behavioral intentions, we can better understand why drivers engage in distracted driving even though it is dangerous and illegal.

In addition to using a person's attitude or perceived social norms to predict behavior, TPB incorporates a perceived control over the particular behavior, taking into account situations where one may not have complete volitional control over a behavior (Montano et al., 2008). This is helpful in explaining why attitudes do not always predict behaviors. This is illustrated in

research wherein distracted driving (e.g., talking on a cell phone, and texting, etc.) was rated by younger adults as dangerous, however this perceived response of risk had little to no impact on driving behavior (Nelson, Atchley, & Little, 2009). One study focused on the intentions to call or text across a variety of scenarios which loosely covered a range of risk (from 'driving fast and in a hurry', to 'stopping and not in a hurry'). Researchers found that TPB constructs only accounted for 11–14% of intentions to text message while driving, across all scenarios. The perceived risk of crashing did not influence the decision to text message while driving (Walsh, White, Hyde, & Watson, 2008). Although the TPB can play an important role in explaining factors of distracted driving behavior, there are additional variables that can influence behavior, yet may not be captured by a single theoretical model.

Distracted Driving as a Behavioral Risk

While not directly causal, national data shows that there are some behavioral risks that are associated with MVCs: not wearing seatbelts, car or booster seats; speeding; and drunk driving (CDC, 2016). The same holds true for Nevada, with speed, restraint status, and drug/alcohol use contributing to worse health outcomes as assessed via crash and trauma data from 2005-2013. NDOT crash and Nevada trauma center data reveal that traveling at speeds exceeding 75 mph on Nevada roads resulted in statistically significant higher New Injury Severity Scores (NISS) as well as higher hospital charges compared to those traveling 56-74 mph at the time of the crash (Center for Traffic Saftey Research, 2016). Nevada teen drivers involved in MVCs between 2005 and 2012 who were admitted to Nevada trauma centers and suspected of exceeding posted speed limits, spent more days in the ICU than those not suspected of speeding (Center for Traffic Saftey Research, 2015b). Nevada 2005-2011 crash-trauma data also shows that drivers involved in drug-alcohol impaired driving crashes were significantly more likely to

die in the hospital than those not involved in an impaired driving crash (Center for Traffic Saftey Research, 2015a).

Although, distracted driving has been shown to be a behavioral risk for its role in crashes it has not been previously assessed with the crash-trauma data as described above. However, we can still assess risk of distracted driving behaviors based on poor driving outcomes. One study by Jane Stutts and colleagues completed in North Carolina and in Pennsylvania investigated how many distractions were in a natural driving environment. Research participant's cars had cameras installed inside the vehicle to track the types of distractions and driving behaviors (Stutts et al., 2005). The distractions with the highest frequency were internal distractions such as cell phone use, eating, drinking, reaching and looking for objects. These distractions were found to be associated with poorer driving performance with steering out of lanes, swerving, hands off the wheel and eyes off the road (Stutts et al., 2005). This behavior can negatively impact the individual at risk (the distracted driver) as well as others in the vicinity of that person. As was the case with cost, described previously, passengers, occupants of other motor vehicles, motorcyclists, bicyclists, and pedestrians may experience injury/trauma, short or long term disability, and even death.

How can distracted driving behavioral risk be assessed for Clark County youth drivers? There is some evidence that Clark County youths engage in risky behaviors that contribute to distracted driving. For example, the nationally administered Youth Risk Behavior Survey (YRBS), administered to high school students utilizing cluster sampling, asked students a single distracted driving related question: "During the past 30 days, on how many days did you text or e-mail while driving a car or other vehicle?" (Lensch, Gay, Zhang, Clements-Noelle, & Yang, 2015). For this survey, 37.1% of Clark County high school students responded that they texted

or emailed while driving, showing that the safety of over one third of Clark County high school students is at risk (Lensch et al., 2015). While there is very little evidence of risk assessment of youth drivers in Clark County, given the overall statistical data on MVCs involving youth drivers in Clark County, primary and secondary prevention programs focusing on Nevada youth drivers and distracted driving is warranted.

Chapter 3: Methods

Intervention Study Design

The distracted driving intervention study was a quasi-experimental study design where research participants were enrolled in either the experimental (intervention) group or the control group. This study was approved by the UNLV Institutional Review Board and funded by the Nevada Department of Public Safety, Office of Traffic Safety. The data that analyzed in this thesis was collected during semesters Fall 2015 and Spring 2016. This data consists of self-reported responses from a questionnaire that was administered to research participants before a six-week distracted driving intervention was implemented, and 2 weeks after the intervention was completed. The two questionnaires (pre and post-intervention) collected for each study participant were matched according to the anonymous code that was created by the student per instructions on the questionnaire (See Appendix).

Recruitment

The target population for the intervention study were college students who were enrolled in and attending an introductory undergraduate class on public health issues, (PBH 205) in the School of Community Health Sciences at University of Nevada, Las Vegas. The study population was asked to participate in the intervention study if they had a valid driver license, and were ages 18-30 years. The PBH 205 classes that participated in the study were recruited through convenience sampling based on the availability and discretion of the professor teaching the class. Prior to the start of each semester (Fall 2015, Spring 2016), the researchers sent a

request to professors teaching PBH 205 asking for their participation in allowing their students to be recruited and enrolled in either the experimental or control group.

Questionnaire Design

The questionnaire that was administered to the experimental and control groups was designed to test knowledge of Nevada distracted driving related laws, and their attitudes and behaviors regarding distracted driving (See Appendix). The questionnaire had a total of twenty-seven questions. Three questions asked demographic information such as age, gender, and driver license status. Eleven questions regarding behaviors while driving (in the past two weeks) required the participant to answer using binary yes/no answers. Also, five questions tested knowledge about Nevada state distracted driving laws which required the participant to answer in binary true/false answers. Seven questions regarding driving attitudes required the participant to answer using a 1-5 Likert scale (1=strongly disagree-5=strongly agree).

Experimental Group

The experimental group participants were in enrolled in classes that were selected to receive the distracted driving intervention. On the first week of the scheduled intervention study, the researcher came to the class and introduced the study, recruited participants through an informed consent form and a pre-intervention questionnaire was administered. The questionnaires were anonymous and no identifying information was placed on the questionnaire except for a code created by the participant so that their first and second questionnaires could be matched by the researcher. During weeks 2-7 the researcher arrived at the starting time of each class and delivered the distracted driving intervention for 15-20 minutes though the use of PowerPoint instruction, You-Tube videos, and class discussions. Different lectures, videos and

discussions were presented to the participants each week based on a variety topics regarding distracted driving. The intervention schedule and topics are as follows:

Week 1- Recruitment, consent, and pre-intervention questionnaire collected

Week 2- What is distracted driving?

Week 3- Special topic- Dangers of distracted youth drivers

Week 4- Brainstorming ways to not drive distracted

Week 5- Special topic- Nevada State Laws

Week 6- Review intervention material and tips for drivers to help decrease driving distractions

After the six-week intervention was completed, a two-week period elapsed before the researcher came back to the experimental group classes for the last time to administer the post-intervention questionnaire. The post-intervention questionnaire was the exact same questionnaire as the pre-intervention questionnaire that the participants completed at the prior to the receiving the intervention.

Control Group

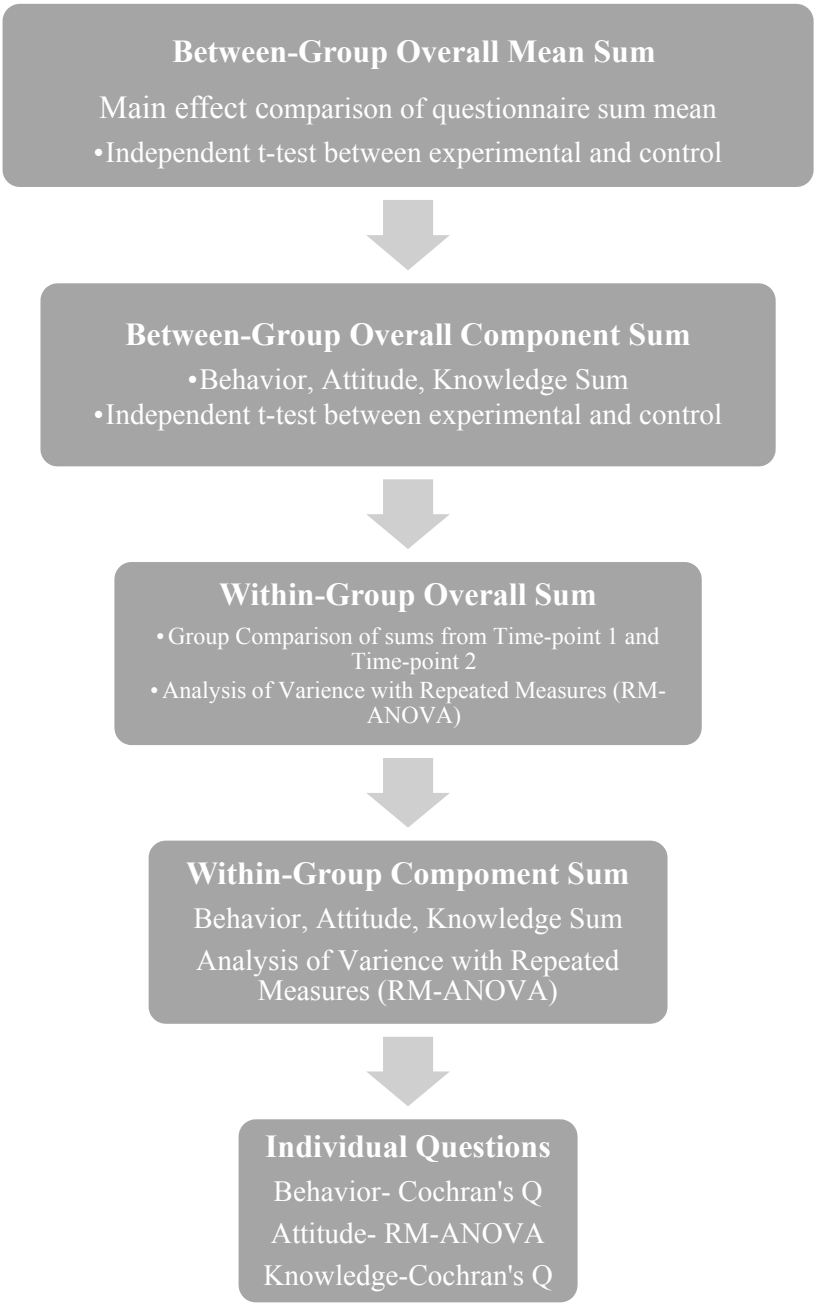
In the same week that the experimental group received their pre-intervention questionnaire, the control group was also introduced to the study, informed that they were selected as control group participants and recruited through informed consent forms. After consent was given to participate in the study, the distracted driving questionnaire was administered (this was the same questionnaire as the experimental group's 'pre-intervention' questionnaire'). The questionnaires were anonymous and no identifying information was placed on the questionnaire except for a code created by the participant so that their first and second

questionnaires could be matched by the researcher. The control group did not receive any type of intervention; however, they did receive the intervention lecture slides after the study was completed. Lastly, the researcher came back to the control group classes eight weeks later (during the same week that the experimental group completed their post-intervention questionnaire), and administered the second and final questionnaire (the exact same questionnaire as the previous one administered to the control group and the intervention group).

Chapter 4: Results

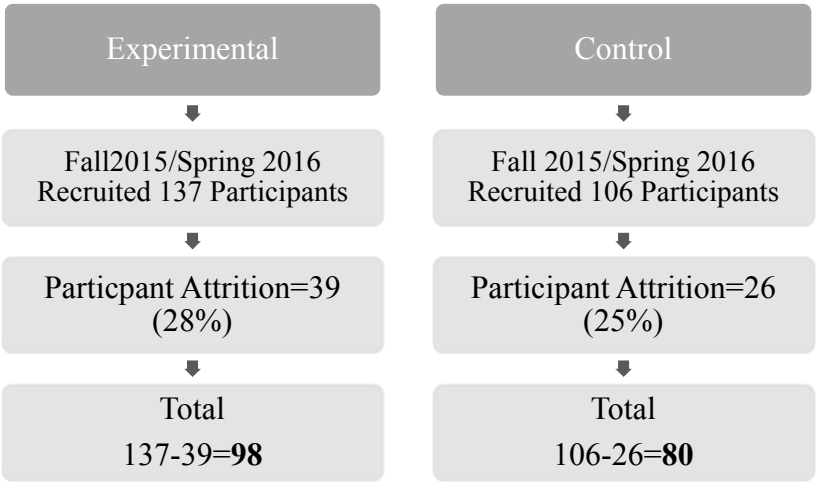
Quantitative analysis of the pre-post intervention questionnaire was completed using IBM SPSS Statistics Software, Version 23. Tests of normality were completed and parametric statistical tests were performed for the overall main effect of the intervention for between-group and within-group differences. Main effect tests of overall questionnaire score mean between the experimental and control group were completed using independent t-tests and one-way analysis of variance (ANOVA). Within-group differences were tested using repeated measures ANOVA (RM-ANOVA). Non-parametric tests for within-group repeated measures of individual line items of binary data were completed using Cochran's Q Chi-square tests. (See Figure 1 for the statistical procedure workflow).

Figure 1. Statistical Procedure Workflow



The participants of the study (N=178) were placed into the experimental group (n=98) or control group (n=80) based on study design recruitment as described in Chapter 3. Of the total number of participants recruited, the proportion of attrition was 28% for the experimental group and 25% for the control group (See Figure 2). The attrition outcome can be explained by participants dropping from the study before the intervention was completed or have unmatched codes between the first time-point of data (pre-intervention) and second time-point (post-intervention). Participants who did not have matching data from pre and post-intervention time-points were not included in the analysis as the researchers could not verify if the participant completed the entire intervention.

Figure 2. Sample Population



Demographics

As illustrated in Table 1, the majority of participants in the experimental (75.5%) and control (63.7%) groups were female. There was no significant difference in proportion of gender between the experimental and control group (X^2 (1) =2.913, p<.089).

Table 1. Gender

Gender	Experimental Frequency (%)	Control Frequency (%)	Total Frequency (%)	X^2	p .05
Males	24 (24)	29 (36)	**53 (30)**	2.913	.089
Females	74 (76)	51 (64)	**125 (70)**		
Total	**98**	**80**	**178**		

The target population for the study was licensed drivers 18-30 years of age however, the actual age range of the study population was 18-27 with a mean of 20.19 (SD=1.66). There were no statistical differences in mean age between the experimental (mean= 20.27, SD=1.73) and control (mean= 20.10, SD=1.58) groups (t (176) =.660, p= .510). This difference of mean=.165, was tested with 95% CI [-.329-.660]. See Table 2 for elaboration of age frequencies for the overall study population and for the experimental and control groups.

Table 2. Age

Overall Study Sample Population				
Age	**Frequency**	**Percent**	**Mean**	**SD**
18	11	6.2	20.19	1.66
19	57	32		
20	58	32.6		
21	28	15.7		
22	10	5.6		
23	4	2.2		
24	1	0.7		
25	7	3.9		
26	0	0		
27	2	1.1		
Total	**178**	**100**		
Experimental Group				
Age	**Frequency**	**Percent**	**Mean**	**SD**
18	8	8.3	20.27	1.73
19	25	25.5		
20	35	35.7		
21	16	16.3		
22	6	6.1		
23	1	1		
24	1	1		
25	5	5.1		
26	0	0		
27	1	1		
Total	**98**	**100**		
Control Group				
Age	**Frequency**	**Percent**	**Mean**	SD
18	3	3.8	20.1	1.58
19	32	40		
20	23	28.8		
21	12	15		
22	4	5		
23	3	3.8		
24	0	0		
25	2	2.5		
26	0	0		
27	1	1.1		
Total	**80**	**100**		

Overall Intervention Effect: Between-Group Comparison

The study questionnaire is divided into three themed components: 1) distracted driving behavior, 2) driver's attitude about distracted driving behavior, and 3) knowledge of distracted driving laws. For this analysis, the name of each component has been simplified into the following: 1) 'behavior', 2) 'attitude' 3) 'knowledge'. Since the exact same questionnaire was administered for the experimental and control groups at the pre- and post-intervention time points, in this analysis, the "pre-intervention questionnaire" will be referenced as 'time-point one' and the post-intervention questionnaire will be referred to as, 'time-point two'.

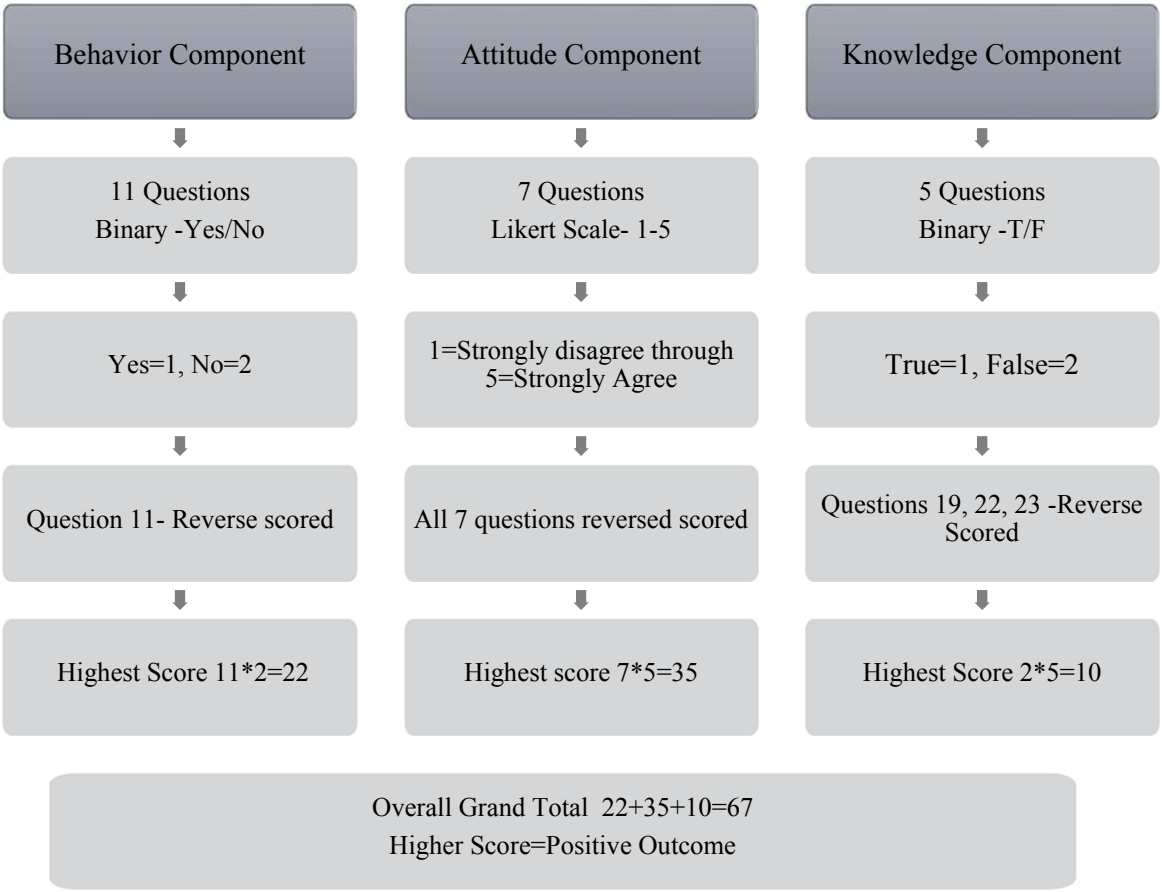
An analysis of the mean overall score of the questionnaire was completed to verify overall main effects of the intervention (See Figure 3). The responses in each component: behavior, attitude, and knowledge were scored with the highest score representing the most positive outcome against distracted driving. For example, for the binary 'yes/no' responses in the behavior section, the response that represented a distracted driving behavior was coded with the number '1', and the response that represented a non-distracted driving behavior was be coded as a '2'. Given the eleven questions requiring a binary response, the highest score possible for the behavior component is a score of twenty-two.

For the attitude component of the questionnaire, there were seven questions requiring a 1-5 Likert scale response, 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree and 5=strongly agree. In keeping with the overall scoring pattern where the highest scores reflect a more positive anti-distraction outcome, all seven questions were reversed scored for the analysis so that a participant response of five would represent a more positive score against distracted driving and a response of one would represent the least positive score for each

question (See Appendix for questionnaire). Given the seven questions, the highest score possible for the attitude component is thirty-five.

For the knowledge component, there are five questions requiring a binary true/false response. Incorrect responses were scored with a '1' and correct responses were scored with a '2'. Given this, the highest score possible for the knowledge component is ten. The sub-totals of each of the three components of the questionnaire were then added together for an overall questionnaire grand total of sixty-seven (See Figure 3).

Figure 3. Overall Questionnaire Scoring



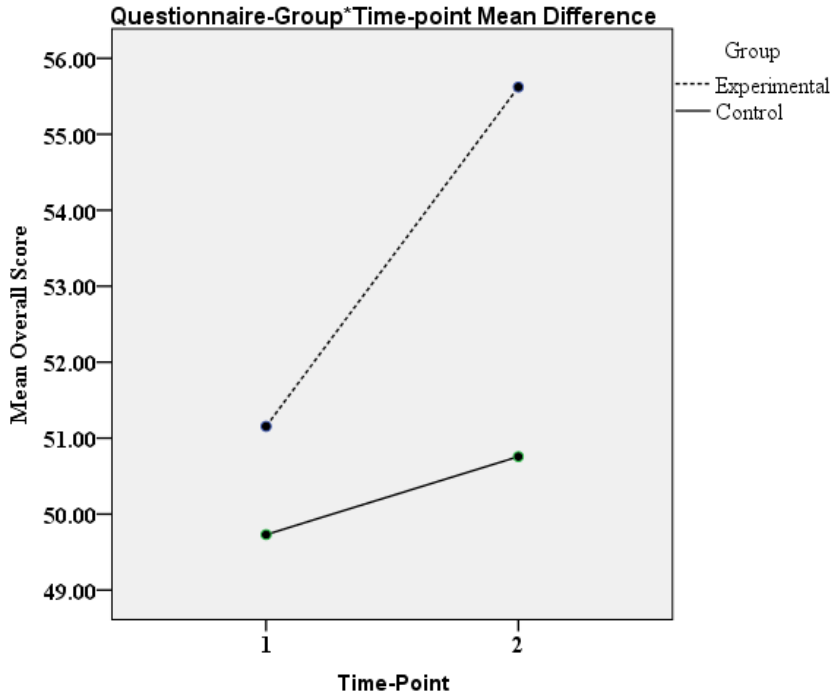
Independent t-tests were completed to analyze the main effects of the intervention by comparing the overall mean scores of the time-point one and time-point two questionnaires between the experimental and control group. Missing cases were deleted list-wise as pair-wise deletion would result in a penalized score for the individual overall score. The results indicate no statistically significant differences between the time-point one mean scores of the experimental and control groups (See Table 3). However, for time-point two, there is statistically significant differences in overall mean scores (t=5.42 (162), p=<.001, CI 3.09-6.64). Based on these results, the experimental and control group responses to the time-point one

questionnaire were similar by overall mean score. However, post-intervention, for the experimental group, the time-point two mean score of 55.62/67 was a statistically significantly higher positive outcome score of reported responses as compared to the control group mean score 50.76/67 (See Table 3 and Figure 4). This result represents the desired effect of the distracted driving intervention.

Table 3. Overall Scores Between-Groups

	N	**Mean**	**SD**	**t**	**df**	**p .05**	**d**	**CI**
Time-point 1				1.46	162	.147	.231	-.508-3.60
Experimental	90	51.16	6.57					
Control	74	49.73	5.81					
Time-point 2				**5.42**	**162**	**<.001**	**.850**	**3.09-6.64**
Experimental	90	55.62	5.85					
Control	74	50.76	5.57					

Figure 4. Between and Within-Group Time-point Mean Difference



Since the main effect of the intervention was associated with statistically significant higher overall mean scores for the experimental group compared to the control group in the time-point two results, further tests of comparisons were completed within each component level to better understand where the differences between-group mean scores lie. Independent t-tests were completed to compare experimental and control group component means for time-point one and time-point two at the component level. As demonstrated on Table 4, no statistically significant differences are observed for mean scores between the experimental and control group for the time-point one questionnaire responses for any of the three components, behavior, attitude, or knowledge. However, for time-point two, in all three components, the experimental group had statistically significant higher mean scores (See Table 4). Based on these results, the higher mean scores (positive outcome) for the experimental group in the behavior, attitude and knowledge

components all contribute to explaining the higher overall mean scores of the experimental group after intervention compared to the controls.

Table 4. Between-Group Component Comparisons

Behavior	**N**	**Mean**	**SD**	**t**	**df**	**p .05**	**d**	**CI**
Time-point 1				1.757	162	.081	.278	.072-1.24
Experimental	90	17.17	2.10					
Control	74	16.58	2.15					
Time-point 2				4.826	162	**<.001**	.763	.882-2.10
Experimental	90	18.47	2.02					
Control	74	16.97	1.90					
Attitude	**N**	**Mean**		**t**	**df**	**p .05**		**CI**
Time-point 1				0.962	162	.338	.152	0.799-2.32
Experimental	**90**	26.37	5.34					
Control	74	25.61	4.62					
Time-point 2				4.3	162	**<.001**	.674	1.65-4.44
Experimental	90	29.11	4.50					
Control	74	26.07	4.52					
Knowledge	**N**	**Mean**		**t**	**df**	**p .05**	**.091**	**CI**
Time-point 1				0.596	162	.552		0.189-0.35
Experimental	90	7.62	0.83					
Control	74	7.54	0.92					
Time-point 2				2.655	131.34	**.009***	.414	.091-.566
Experimental	90	8.04	0.65					
Control	74	7.72	0.88					

*Equal variances not assumed

Within-Group Comparison

Since statistically significant mean differences in the time-point two questionnaires between the experimental and control group were demonstrated in the overall score sum and in each of the three components, repeated measure ANOVA (RM-ANOVA) tests were completed to compare within-group differences between time-point one and time-point two questionnaire responses. As demonstrated in Table 5, the overall mean scores of the experimental group increased from 51.16 (SD= 6.57) in time-point one to 55.62 (SD=5.85) in time-point two and this difference of mean scores was statistically significant ($F(1,89) = 51.02$, $p = <.001$, $\eta_p^2 = .364$). However, for the control group, the mean score difference of 49.73 (SD= 5.87) in time-point one to 50.75 (SD=5.57) in time-point two was not statistically significant ($F(1,73) = 3.33$, $p = .072$, $\eta_p^2 = .044$). Table 6 further demonstrates within-group differences where the control group had higher mean scores in time-point two indicating an association of intervention effect that were statistically significant within each component. Figures, 4, 5, 6 also illustrate the combined differences in mean scores between and within groups for each component.

Table 5. Within-group Comparison of Overall Questionnaire Score Means

Time1*Time2	**N**	**Mean**	**SD**	**F**	**df**	**p .05**	**η_p^2**
Experimental				51.02	1 (89)	**<.001**	.364
Time-point 1	90	51.16	6.57				
Time-point 2	90	55.62	5.85				
Control				3.33	1(73)	.072	.044
Time-point 1	74	49.73	5.81				
Time-point 2	74	50.75	5.57				

Table 6. Within-Group Repeated Measure Component Comparison

Component	N	Mean	SD	F	df	p .05	ηp2
Behavior							
Experimental	90			51.102	1,89	**<.001**	.37
Time-point 1		17.17	2.10				
Time-point 2		18.47	2.02				
Control	74			4.29	1,74	.075	.04
Time-point 1		16.58	2.15				
Time-point 2		16.97	1.91				
Attitude							
Experimental	90			26.658	1,89	**<.001**	.23
Time-point 1		26.37	5.34				
Time-point 2		29.11	4.50				
Control	74			.941	1,73	0.335	.01
Time-point 1		25.61	4.62				
Time-point 2		26.07	4.52				
Knowledge							
Experimental	90			16.235	1,89	**<.001**	.15
Time-point 1		7.62	.924				
Time-point 2		8.04					
Control	74		.652	1.838	1, 73	.179	.03
Time-point 1		7.54					
Time-point 2		7.72					

Figure 5. Behavior Component Comparison

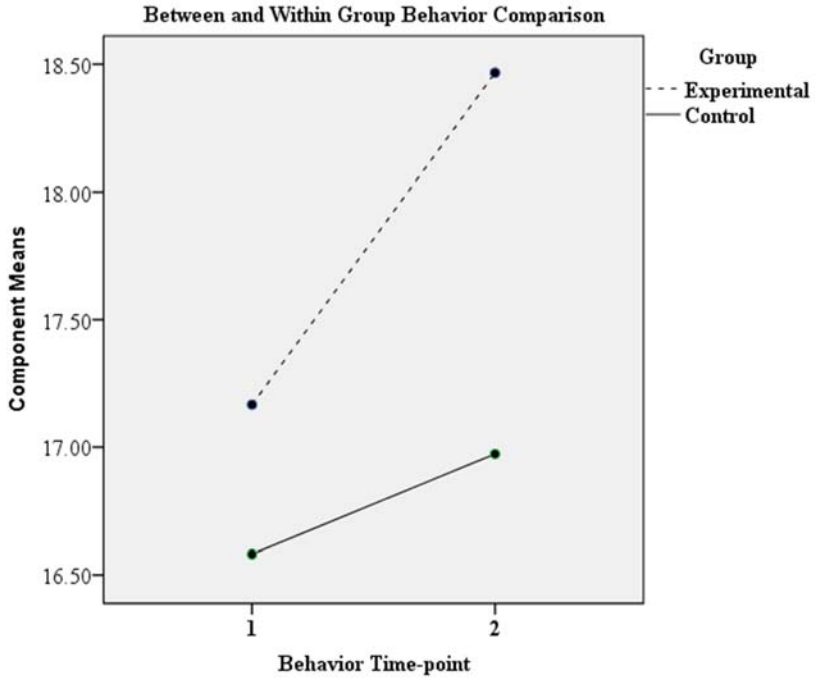


Figure 6. Attitude Component Comparison

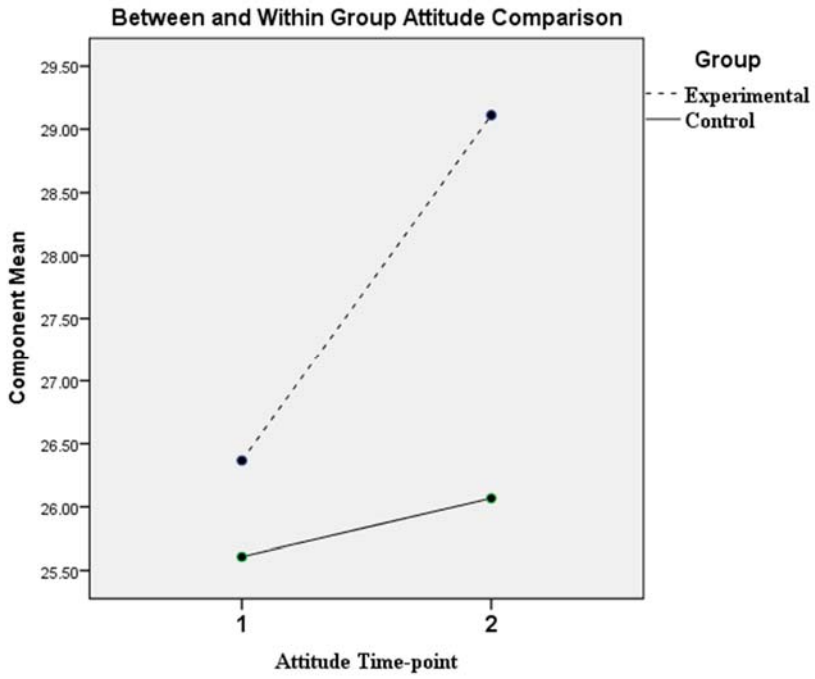
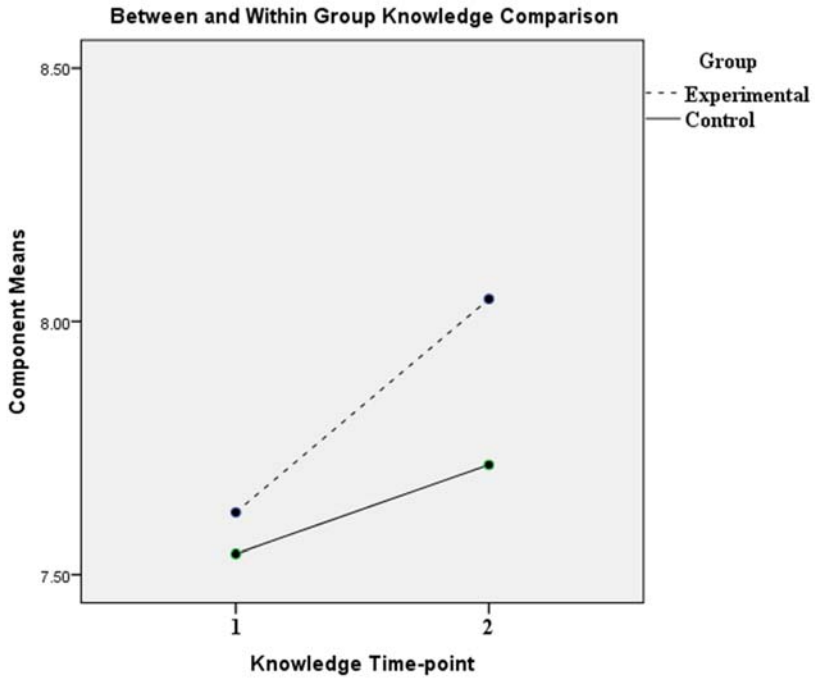


Figure 7. Knowledge Component Comparison



Experimental Group

Based on the statistical significance of overall mean difference of the in the between-group and within-group comparisons for the experimental group, further analyses of specific questions within each component were completed to better understand which questions may have been most effective in capturing effect of the intervention within the experimental group.

Behavior

Eleven questions on the questionnaire required respondents to answer either yes or no regarding specific distracted driving behaviors. Each question started with, "In the past two weeks, while driving, have you…" and then each question ended by asking a different specific question focused on certain behaviors as demonstrated in Table 7. Cochran's Q Chi-square tests were completed to test for differences in repeated measure response from time-point one and

time-point two questionnaires within the experimental group. As illustrated in Table 6, eight out of the eleven questions had statistically significant differences in responses from time-point one and time-point two.

While all questions in the behavior component resulted in an increase in positive outcome of reported distracted driving behaviors in time-point two compared to time-point one for the experimental group, a couple of the statistically significant questions are highlighted here. For the third question, "In the past two weeks, while driving, have you sent a text?, there was a 19% or (n=19) decrease in respondents reporting yes in time-point two and this difference was statistically significant ($X^2(1) = 14.44$, $p = <.001$). Secondly, the last question in the behavior component, "In the past two weeks, while driving, did you put your cell phone on silent or out of reach?", was reversed scored where the answer yes reflected a higher score of '2' as opposed to no which was scored with '1'. For this question, there was a 22% (or N=22) increase in respondents who said yes in time-point two as oppose to time-point one.

Table 7. Experimental Within-group Comparisons Behavior Questions

		Frequency Yes	Frequency No	X^2	P .05
Talked on a cell	Time 1	68	29	7.258	**.007**
	Time 2	53	44		
Read a text	Time 1	76	22	5.143	**.023**
	Time 2	64	34		
Sent a text	Time 1	63	35	14.440	**<.001**
	Time 2	44	54		
Text for work	Time 1	14	84	0.286	0.593
	Time 2	12	86		
Wore Headphones	Time 1	17	81	1.923	0.166
	Time 2	12	86		
Cell for navigation	Time 1	66	32	9.323	**.002**
	Time 2	49	49		
Cell for reading/sending email	Time 1	34	64	6.760	**.009**
	Time 2	21	77		
Dashboard Navigation	Time 1	13	85	0.333	0.564
	Time 2	11	87		

Read map, book, newspaper	Time 1	18	79	11.267	**.001**
	Time 2	5	92		
Groomed	Time 1	48	48	3.857	**.050**
	Time 2	39	57		
Silent or out of reach	Time 1	36	62	15.125	**<.001**
	Time 2	58	40		

Attitude

The attitude component consists of seven questions (statements) focused on the respondent's attitude about some of the same behaviors that were also asked in the behavior component. In summary of the previous description, each of the seven questions required the respondent to answer in a five-point Likert scale to what level they either disagree or agree with each statement. These questions were reversed scored in this analysis so a response of five would represent the highest score possible (most positive outcome against distracted driving). Each of the seven statements started with, "I believe that it is…, then ended regarding a specific behavior as illustrated in Table 8. For the experimental group, the mean score for time-point two had increased, indicating a more positive outcome for all seven statements. The differences in time-point one and time-point two means were statistically significant for six out of the seven statements (See Table 8).

A few of the questions in this component stand out in regard to talking and texting on the cell phone while driving. When asked in time-point one if the participants thought that it was

alright to talk on a cell phone their mean was on the closer end of saying neither agree-nor-disagree (m=3.43) and by time-point two the mean moved closer in the direction of disagree (m==3.94). In asking if the participant thought it was alright to send a text in time point one, the group mean was in the 'disagree' category of the Likert scale, (m=4.31) and by time-point two, the group mean moved more toward the 'totally disagree' category (m=4.61). Similarly, for statement, "It is alright to read a text", the time-point 1 mean was 4.07 and by time-point two, the mean moved to 4.38. These are noted in the context of comparison with the behavior component were even though in time-point one where attitudes may not directly reflect behaviors. Although the majority of participants may not agree that the listed behaviors of mobile device use is alright to do while driving, they may still do it.

Table 8. Experimental Within-group Comparisons Attitude Questions

		N	Mean	SD	F	df	p .05	η_p^2
Alright to talk on a cell phone		98			24.14	1(97)	**<.001**	.199
	Time 1		3.43	1.025				
	Time 2		3.94	1.024				
Alright to send a text		98			12.58	1(97)	.001	.115
	Time 1		4.31	0.842				
	Time 2		4.61	0.62				
Alright to read a text		98			11.60	1(97)	**.001**	.107
	Time 1		4.07	0.955				
	Time 2		4.38	0.806				
Alright to groom		98			2.196	1(97)	.142	.022
	Time 1		3.95	1.078				
	Time 2		4.11	0.884				
Alright to program navigation on cell phone		98			15.35	1(97)	**<.001**	.137
	Time 1		3.23	1.174				
	Time 2		3.70	1.096				
Alright to program navigation on dashboard		98			13.99	1(97)	**<.001**	.126
	Time 1		3.04	1.31				
	Time 2		3.59	1.23				
Alright to read a map, book, or newspaper		98			11.30	1(97)	**.001**	.104
	Time 1		4.38	0.903				
	Time 2		4.68	0.636				

Knowledge

A total of five questions in the knowledge component required the respondent to answer in a binary response of either true or false (See Appendix for complete questions). To test for differences in the experimental group responses, Cochran's Q Chi-Square tests were completed for repeated measure analysis of the binary responses. As demonstrated in Table 9, three out of the five questions had significant differences in answer response from time-point 1 and time-point 2 for the experimental group. The most significant result from the knowledge component is for the forth question (statement), "You can be ticketed for distracted driving, including putting on make-up, in Nevada while stopped at a red light or stop sign". The number of respondents who answered this statement correctly increased by 23% (n=22) from time-point 1 to time-point 2 and this was statistically significant ($X^2(1) = 17.286$, $p = <.001$).

The two remaining questions in the knowledge component that were not statistically significant in that the higher proportion of the experimental group answered these questions incorrectly in time-point one and even more so in time-point two. This is counter to the expected results of increases in the positive direction even if not statistically significant (See Table 9). The second question in the knowledge component stated, "First offenses for distracted driving in Nevada are considered to be moving violations". For the pre-intervention survey, most responses for the experimental group (84.5%) reported this answer as true; however, the correct answer is false. The results for the post-intervention survey responses to this answer demonstrate a 5.5% increase in the proportion of participants in the experimental group who answered this question incorrectly.

The next question in the knowledge component that was not statistically significant was the third one that stated, "All drivers in Nevada are prohibited from using handheld cell phones".

This statement is incorrect, in that although most drivers in Nevada are prohibited from using a handheld device or cellphone, there are exceptions based on emergency or work related such as utility workers, police officers, or emergency technicians. Again, as the question before it, in the time-point one, the majority of the experimental group (88%) answered it incorrectly and in time-point two the incorrect responses increased by 6%.

Table 9. Experimental Within-Group Comparisons Knowledge Questions

		Frequency Yes	Frequency No	X^2	P .05
Distracted driving as a primary moving violation	Time 1	83	14	8.333	**0.004**
	Time 2	93	4		
First offenses of distracted driving are moving violations	Time 1	76	20	1.087	0.297
	Time 2	81	15		
All drivers are prohibited from hand-held cell use	Time 1	85	12	3.769	0.052
	Time 2	92	5		
Can be ticketed for distracted driving behaviors at stop/light	Time 1	65	32	17.286	**<.001**
	Time 2	87	10		
If under 18, parents can be sued for your distracted driving	Time 1	72	23	14.44	**<.001**
	Time 2	91	4		

Chapter 5: Discussion

Overall Between-group

The goal of this thesis was to quantitatively analyze questionnaire data and report the effects of a distracted driving intervention of college students at the University of Nevada, Las Vegas. The primary research question was to test the overall effects of the intervention. The most interesting finding of this analysis is that a classroom-based intervention can have effects on self-reported distracted driving related behaviors, attitudes, and knowledge after two weeks of completing the intervention. This is important because these results can inform development of future evidence-based distracted driving intervention programs.

The results of the statistical analysis indicate an overall observed desired effect of change with statistical significance for the experimental group after the intervention which was not observed for the control group. This result is demonstrated with the between-group comparison at the baseline, or time-point one, where there was no significant difference in overall mean scores for the questionnaires, however, there was statistically significant differences in between-group analyses of overall mean questionnaire scores for the post intervention, or time-point two (See Figure 3). This difference is illustrated by higher mean scores representing a more positive reported outcome against distracted driving for the experimental group.

When examining the individual themed components of behavior, attitude, and knowledge, each component statistically significantly differed in time-point two; where the experimental group reported, higher positive outcome mean scores against distracted driving. Again, there was no significant difference between groups in time-point one as demonstrated in in Table 4. These results indicate a statistically significant effect of the intervention for each component and all three components contributed to the overall desired effect of the intervention

for the experimental group. These findings are important when considering what aspects of a person's behavior or attitude may be influenced to change by a distracted driving intervention and also if knowledge and awareness of laws may be helpful in decreasing distracted driving.

Overall Within-group

The secondary research questions for this thesis was to 1) test the effect of change for within-group responses from time-point one and time-point two while also 2) observing the effects of the intervention on each of the component outcomes. The effect of the intervention for with-in group differences is helpful in further exemplifying the effect of the intervention based on participant responses in time-point two. As demonstrated in Table 5, there was a statistically significant overall mean score increase of 4.46 for the experimental group in time-point two, whereas the control group had an overall score mean increase of 1.02 that was not statistically significant. While both groups demonstrated increased scores within each questionnaire component at time-point two, this difference within-groups was only statistically significant for the experimental group (See Table 6). The increase of mean score in time-point two for the controls may be an artifact of test-retest bias or due to chance alone. Whereas the experimental group scores may have also been influenced by the intervention. For an illustration of between and within-group differences by component see Figure 4 for behavior, Figure 5 for attitude, and Figure 6 for knowledge. These results of the experimental group are useful in informing future distracted driving study designs on the themes of behavior, attitude, and knowledge. These results for the control group are useful in determining how much change may be reported from re-testing bias and how this may impact future studies.

Further statistical analysis of each individual question within the components was helpful in further explaining the within-group effects of the intervention for the experimental group.

Given that the first time-point data collection occurred a week before the intervention and time-point two occurred two weeks after the intervention, it is interesting that the participants self-reported more positive outcome against distracted driving (Table 6, Figure 4). Specifically, the behaviors involving using a cell-phone while driving to talk, read a text, send a text, reading or sending email, and for navigation, all had statistically significant differences in the positive outcome direction at time-point two for the experimental group. Also, a good sign of a positive effect of the intervention was the 22% increase of respondents who placed their cell phone on silent or out of reach while driving. These results aid in underscoring a possible effect of the distracted driving intervention to influence behavior change within a two-week period after completion of the intervention.

The success in reported behavior change for the experimental group as discussed above may in part be attributed to attitude changes regarding those specific behaviors or about distracted driving behaviors in general. This interpretation is supported by the statistically significant difference in the direction of positive outcome of the overall mean of the attitude component (Table 6, Figure 5). Furthermore, when comparing within-group results of the individual questions in the attitude component with the responses of the behavior component, an observed increase in reported responses in the positive outcome direction for both components. This may signify some association between attitude change and behavior change. However, attitudes that may be reported about certain distracted driving behaviors may be based on 'injunctive norms' (what is commonly regarded in society as good or bad) and reported behaviors may be based on 'descriptive norms' (or what is actually done) (Lawrence, 2015). This result was observed in this current study, especially with using a cell phone to talk and read/or

send text messages; although the participant may disagree with a certain distracted driving behavior, they may still do it.

Lastly, there was statistically significant changes in the positive outcome direction within the knowledge component for the experimental group where the overall mean component score increased between time-point one and time-point two (Table 6, Figure 6). This is the smallest component in terms of the number of questions (statements) (5) dedicated to it and it is also the component with the smallest overall mean increase where the mean score in time-point one was 7.62 and in time-point 2 was 8.04. In review of the individual questions (statements) within the knowledge component (Table 9), three out of the five questions were correctly answered by the majority in the time-point one and this number of participants increased in time-point two.

However, there were also some interesting results in the remaining two questions that were not statistically significant (See Table 9). For both of these questions, the majority of the experimental group answered them incorrectly in time-point one and an increased number of participants answered them incorrectly in time-point two. This was counter to the expectation that the proportion of participants in the experimental group would have increased in answering the statement correctly in time-point two. This result can be interpreted, that although the experimental group received this information during the intervention, the information presented may not have been clear enough or substantial for the participants to retain and report the correct response in the post intervention survey or there was a misunderstanding in what the question was asking. The participants may have thought that the exceptions to the law as previously stated in the results section was not meant to be included in the question, or they just may not have known the exceptions to the law.

Another possibility is that the correct answers to these two questions were reversed where the correct answer was 'false' whereas with the other three statements the correct answer was 'true'. The reverse of correct answers may have confused the participants, or because the correct answers were reversed and the majority of participants answered them wrong, this may be an indication that they may have guessed their answers. These surprising negative results with these two questions in the knowledge category contribute to a lower overall mean increase for the component.

Limitations

One of the largest limitations to this distracted driving intervention study is that the data was collected as self- reported responses. While this type of data collection is often used to collect numerous data points or variables in a short time, the self-report biases such as memory loss or recall bias, and acquiesces, or telling the research what they want to hear can lead to inaccurate results. Also, history bias can also play a role in how one may respond to questions about distracted driving. For example, if a person has been involved in a distracted driving related crash, or participated in a distracted driving intervention before, they may answer differently. This type of historical information was not obtained from the current study research population. Another limitation is the convenience sampling recruitment where the classes that were enrolled into the experimental or control group was based on the professor's discretion of their classes involvement in the study.

Other limitations include issues with generalizability where participants were undergraduate college students enrolled in an introductory course of public health in Las Vegas, Nevada. Given this, the results of the data analysis cannot be generalized to the entire population of licensed drivers. Also, minimal demographic information was collected and this limits the

types of analysis that can be completed on the data and therefore a full view of variables that may play a role in effects of the intervention are less clear. This point also leads to the limitation that there is a deficiency of male participants in the study which is likely a result of less males being enrolled in classes. Because of this limitation, it is difficult to fully assess gender differences of intervention effects. Lastly, the length of the study by only collecting data at two time-points may have been a limitation. Although results were observed at a two-week post intervention time-point, an additional time-point of data collection at a later date from the post intervention time-point would aid in better understanding long-term effects of the distracted driving intervention of change of driving habits that minimize distracted driving.

Directions for Future Research

Repeated intervention studies need to be completed to compare and develop future evidence-based distracted driving prevention and intervention programs. Also, research that focus on effects of interventions on gender differences and age groups could prove fruitful in tailoring distracted driving programs toward a specific audience. Other types of intervention strategies and techniques could be tested and published such as virtual reality distracted driving interventions, and programs that focus on different types of driving distractions. The need for prevention and intervention of distracted driving is urgently warranted and an increase in published research and data on interventions will aid in developing programs that may effect change in decreasing distracted driving and quite possibly the risks of motor vehicle crashes.

Appendix

NV-DTS Survey Date _____ Code _ _ / _ _ / _ _

Code: Day of the month you were born in / first two letters of your favorite color / 1st two letters of the city you were born in)

Example: Born November 2 (write 02); favorite color purple (write PU); born in Denver (write DE)

Code 02/PU/DE

Please answer the following questions as accurately as you can.

1. In the past two weeks, while driving a vehicle, have you talked on any type of cell phone?

   Yes No

2. In the past two weeks, while driving a vehicle, have you read a text message?

   Yes No

3. In the past two weeks, while driving a vehicle, have you sent a text message?

   Yes No

4. In the past two weeks, while driving a vehicle, have you been required or expected to send or receive a text message because of work?

   Yes No

5. In the past two weeks, while driving a vehicle, have you used your cell phone for other activities such as reading or sending an email?

   Yes No

6. In the past two weeks, while driving a vehicle, have you worn head phones?

   Yes No

7. In the past two weeks, while driving a vehicle, have you programmed cell-phone navigation system?

   Yes No

8. In the past two weeks, while driving a vehicle, have you programmed dashboard-attached navigation system?

Yes No

9. In the past two weeks, while driving a vehicle, have you read a map, book or newspaper?

Yes No

10. In the past two weeks, while driving a vehicle, have you groomed yourself (combed hair, looked in the mirror at yourself, shaved, applied make-up, etc.)?

Yes No

11. In the past two weeks, before starting your car, have you put your cell phone on silent or placed it out of your reach to avoid being tempted to answer it?

Yes No

12. I believe that it is alright to talk on a cell phone while driving.

1 2 3 4 5

Strongly disagree Strongly agree

13. I believe that it is alright to send a text while driving.

1 2 3 4 5

Strongly disagree Strongly agree

14. I believe that it is alright to read a text while driving.

1 2 3 4 5

Strongly disagree Strongly agree

15. I believe that it is alright to groom yourself (comb hair, apply make-up, look at self in mirror, shaved, etc.) while driving.

1 2 3 4 5

Strongly disagree Strongly agree

16. I believe that it is alright to program a navigation system on your cell phone while driving.

1 2 3 4 5

Strongly disagree Strongly agree

17. I believe that it is alright to program a navigation system that is attached to your dashboard while driving.

1 2 3 4 5

Strongly disagree Strongly agree

18. I believe that it is alright to read a map, book or newspaper while driving.

1 2 3 4 5

Strongly disagree Strongly agree

19. Distracted driving is a primary (can be ticketed for without first being observed performing another moving violation) violation as defined by Nevada law?

True / False

20. True / False First offenses for distracted driving in Nevada are considered to be moving violations.

21. True / False All drivers in Nevada are prohibited from using handheld cell phones.

22. True / False You can be ticketed for distracted driving, including putting on make-up, in Nevada while stopped at a red light or stop sign.

23. If you are under 18 years of age and on your parent's auto insurance they can be sued for your distracted driving.

Yes No

24. Do you have a valid driver's license?

Yes No

25. My age is _____ years.

26. I am _____.

Male Female

Instructor of this class _____

Class meeting time _____ and day(s) of week _____.

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Curriculum Vitae

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EDUCATION

2017 Master of Public Health
School of Community Health Sciences, University of Nevada, Las Vegas
2011 Master of Arts
Department of Anthropology, University of Nevada, Las Vegas
2008 Bachelor of Arts
Department of Anthropology, University of Nevada, Las Vegas

PROFESSIONAL EXPERIENCE

Spring 2015-Spring 2017
Graduate Assistantship, Department of Public Health
Research Assistant-Duties include management of distracted driving intervention research, development and implementation of intervention material, data collection, data analysis

Summer 2013-Fall 2015
Associate Instructor (Online), Ashford University, Department of Anthropology
Introduction to Cultural Anthropology

Spring 2013-Fall 2015
Part-time Instructor, Nevada State College, Department of Social Science,
Anth 101 Introduction to Cultural Anthropology

Spring 2013-Fall 2014
Part-time Instructor (Online), Surry Community College, Social Science Division
Ant 210- General anthropology, Ant 220- Cultural Anthropology
Online faculty

Fall 2011-Spring 2014 (Including, summer 2012, and 2014)
Adjunct Instructor, College of Southern Nevada, Department of Human Behavior Anthropology 101- Introduction to Cultural Anthropology

Fall 2012-Spring 2014
Adjunct Instructor, University of Nevada, Las Vegas, Department of Anthropology, Anth. 420, Magic, Witchcraft, and Religion and Anthropology 101 Introduction to cultural anthropology.

Summer 2012 Teaching Assistant, University of Nevada Las Vegas, Division of Education Outreach, SAGE Program, Health Sciences and Public Policy, Aiding in lecture prep, daily in-class assistance, and grading.

Summer 2009

Instructor for Anth. Lab 110L- UNLV Anthropology Department
Instructing, lab preparation, and grading

Fall 2008-Fall 2010

Graduate Assistantship, UNLV Department of Anthropology
Instructor for Anth. Lab 110L – Instructing, lab preparation, grading
T/A – class preparation, grading, and lecturer, student co-editor for Ethnoarchaeology: Journal of Archaeological, Ethnographic, and Experimental Studies.

PUBLICATIONS

Escasa-Dorne, M.J., Manlove, H., and Gray, P.B. (2017). Women express a preference for feminized male faces after giving birth. *Adaptive Human Behavior and Psychology, 3 (1), 30-42.*

Guillermo, C. J., Manlove, H. A., Gray, P. B., Zava, D. T., & Marrs, C. R. (2010). Female social and sexual interest across the menstrual cycle: the roles of pain, sleep and hormones. *BMC women's health*, *10*(1), 1.

Manlove, H.A, Guillermo, C., & Gray, P. B. (2008). Do women with polycystic ovary syndrome (PCOS) report differences in sex-typed behavior as children and adolescents?: Results of a pilot study. *Annals of human biology*, *35*(6), 584-595.

GRADUATE THESES

2017 Distracted Driving in Clark County, Nevada: Analyses of an Intervention on College Students, University of Nevada, Las Vegas, School of Community Health Sciences

2011 Polycystic Ovary Syndrome in Urban India, University of Nevada, Las Vegas Department of Anthropology

HONORS AND AWARDS

2011 Nominated for the Most Outstanding Graduate Student Award for Spring Commencement by the Anthropology Department at UNLV

2010 Certificate of Recognition: The College of Liberal Arts Honors Convocation
For receiving grants and scholarships to complete thesis research

2007 UNLV Libraries Award for Undergraduate Research
$1,000 Award for research paper: Hyperandrogenemia, Obesity and PCOS: Consequential Health, Reproductive Success and Behaviors from their Fetal Environment to their Granddaughter

2007 Spring/Fall Dean's Honor List

2006 Spring/Fall Dean's Honor List

SCHOLARSHIPS AND GRANTS

2010- Spring $900.00 UNLV International Programs Grant for Graduate Research
2010- Spring $750.00 Spring Term GPSA Grant
Graduate and Professional Student Association award for written proposal on travel plans for masters thesis in India
2009-Summer $350.00 2009 Summer Term GPSA Grant
Graduate and Professional Student Association award for written proposal on travel plans for masters thesis in India
2009- Fall $1200.00 Edwards and Olswang Scholarship
Award for written proposal on travel plans for masters Thesis in Delhi, India
2009- Fall $750.00 2009 Fall Term GPSA Grant
Graduate and Professional Student Association award for written proposal on travel plans for masters Thesis in Delhi, India.
2009- Fall $1000.00 James F. Adams/GPSA Graduate Student Scholarship
Award for written proposal on masters Thesis research in Delhi, India.
2009- Spring UNLV Graduate Access Grant for $1000.00
2009- Spring $150.00 Future Anthropologist Fund for Travel Funds
UNLV Anthropology Society
Award for written essay on travel plans for masters Thesis in Delhi, India
2008-Fall UNLV Graduate Access Grant for $1000.00
2008-Spring $100.00 Margaret Lyneis Undergraduate Scholarship for Travel Funds
UNLV Anthropology Society
Award for written essay on travel plans to present at the Western Psychological Conference poster session in Irvine, California.

RESEARCH EXPERIENCE

2015-2017 Distracted Driving Intervention Research
Research Assistant, developed intervention lectures and given lectures to intervention group, collected data
2015 Long Term Care Research
Research Assistant, qualitative research duties included coding data in ATLAS-TI, analyzing data, and writing manuscript
2011-2012 Post-partum Sexual Behavior Research
Co-researcher and co-author- My research duties include survey creator and administrator, data analysis, and Co-authorship of written results.
Collaboration with colleagues at Department of Anthropology, University of Nevada Las Vegas
2008-2011 Polycystic Ovary Syndrome in Urban India
Masters thesis
I designed the research, traveled to India for four months, collaborated with clinicians in Delhi, administered questionnaires to participants; completed semi-structured interviews and conducted participant observation of key participants and Delhi culture.
2007-2008 PCOS, Hormones and Behaviors

I designed the research, recruited the participants, administered questionnaires via mail, data collection, entered the data into spreadsheet, analyzed that data and am the first author of the manuscript.
The primary investigator and advisor was Dr. Peter Gray, Department of Anthropology and Ethnic Studies, University of Nevada, Las Vegas

2007-2008 Hormones, Mood, and Cognition
As a research assistant, I administered cognitive tests and mood questionnaires, recruited participants and collected biological samples, as well as a co-author of the manuscript
Dr. Douglas Ferraro (Department of Psychology) and Dr. Peter Gray (Department of Anthropology and Ethnic Studies) of University of Nevada Las Vegas are the co-primary investigators and advisors.
Dr. Chandler Marrs and Chrisalbeth Guillermo are co-secondary investigators

CONFERENCE PRESENTATIONS

2011 The "New Indian Woman" with Polycystic Ovary Syndrome (PCOS): The Biopsychosocial Experience.

Presented at the 82nd Annual Southwestern Anthropological Association Meeting, Reno NV, Organized Session, May.

2011 Polycystic Ovary Syndrome in Urban India

Presented at the annual Graduate and Professional Student Association Research Forum, Las Vegas, NV, March.

2009 Avoiding the Mind-Body Dichotomy: Investigation of the Psychosocial and Psychosexual Behaviors of Women with Polycystic Ovary Syndrome (PCOS). Presented at the annual Human Behavioral and Evolution Society meeting, Fullerton, CA, Poster session, May.

2009 Viewing Polycystic Ovary Syndrome Through a Cross-Cultural Lens: New Health Implications for Developing Nations. Presented at the 38th annual Meeting for Cross-Cultural Society Research, Las Vegas, NV. February.

2007 Does Human Female Sociosexual Behavior Change Across the Menstrual Cycle?, Guillermo, Chrisalbeth J.; Gray, Peter B.; Marrs, Chandler R.; Manlove, Heidi A., Ferraro, Douglas P. Presented at the 88th Annual Western Psychological Association Convention, Irvine, CA, Poster session, April.

PROFESSIONAL SERVICE

2015-2017 Graduate Professional Student Association (GPSA) Council Member

Department of Public Health Representative, Election Committee Chair, Awards committee member

2012-2014 Co-editor, Adjunct Faculty Newsletter, *Adjunct Voice,* College of Southern Nevada, Department of Human Behavior

2013 Communications Assistant, Nevada Faculty Alliance/AAUP