Mann-Kendall test for Monotonic Trend Analysis of Driving Under Intoxicated (DUI) Arrests in the United States: 1995-2013

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ABSTRACT

Drinking under the Influence (DUI) remains to be a public health issue as there has still been a significant number of traffic deaths and injuries due to DUI. Despite the laws enacted and the impacts of DUI highly publicized, the high percentage of people still perceiving DUI as a major personal safety threat furthers the need to review the status of DUIs in this country. There are various agencies in this country that has gathered DUI data in one way or the other. However, making sense of these available information for policy planning purposes on a comprehensive manner remains to be a challenge. It is to this purpose that this study endeavors to review the trends on DUI utilizing existing data gathered by various agencies. Specifically, the objective is to determine whether there has been a statistically significant decrease in the number of DUI arrests from 1995 to 2013. Data on Driving under the Influence (DUI) arrests were drawn from information provided to the Federal Bureau of Investigations' (FBI) Uniform Crime Reporting Program (UCR) from 1995 to 2013. The FBI's UCR Program is a nationwide, cooperative statistical effort of more than 16,000 in 1995 and in 2013, 18,415 city, university and college, county, state, tribal, and federal law enforcement agencies voluntarily reporting data on crimes brought to their attention (Federal Bureau of Investigation, Uniform Crime Reporting Program (UCR), 1995). From 1995 to 2013, the average number of individuals arrested for DUI accounted for 10 percent (14,107,840) of the total arrests in the US. Results revealed during this period; the number of DUI arrests has decreased by 9 percent with an average yearly rate change of 1 percent. The highest increase of the DUI arrests during this period was observed in 1999 with 8 percent, while the highest decrease was observed in 2011 with 14 percent. The year that had the highest number of DUI arrests was in 1999 while the lowest was in 2013. The analysis also revealed that there was a decrease in the total number of DUI arrests from 1995 to 2013 as pointed out by the negative value of the computed Z (Z (S > 0) = -1.77, p = .076). However, there was no statistically significant trend as the normalized test statistic (Z) was less than the critical value (Zα/2 = 1.96) at the level of significance (0.05). The paper concludes that in order to gauge the effectiveness of prevention measures, there is a need to regularly monitor trends in alcohol-impaired driving. There are several approaches adopted by previous studies to examine these trends, which includes onsite surveys of drivers, examination of crash reports and driver's records. However, developing an approach that utilizes existing sources of data would be the most efficient and effective in terms of time and monetary resources.

Keywords: DUI; traffic violation; trend analysis; time-series; arrests

INTRODUCTION

Driving under the Influence (DUI) is an offense defined by the US Department of Justice to be driving or operating a motor vehicle or common carrier while mentally or physically impaired as the result of consuming an alcoholic beverage or using a drug or narcotic. The level of intoxication renders the driver incapable of safely operating a motor vehicle. A field sobriety test establishes probable cause for a law enforcement officer to arrest someone for driving under the influence, which is preceded by a measurement of blood alcohol content (BAC). Although differing in specific laws and penalties, all states define driving with a blood alcohol concentration (BAC) at or above 0.08 percent as a crime (GHSA, 2015).

In the United Sates, both the federal and state levels have adopted laws that would prevent the recurrence of the DUI. On the first offense, 42 states, the District of Columbia, the Northern Mariana Islands and the Virgin Islands have administrative license suspension (ALS). Law enforcement through ALS has the authority to confiscate a driver's license for a period of time upon the individual's failure on a chemical test. In addition, some type of ignition interlock law has been adopted by all states that requires some convicted drunk driver by order of a judge to install interlocks in their cars to analyze their breath and disable the engine if alcohol is detected.

Ignition interlocks have been mandatory in 20 states for all convicted drunk drivers, even first-time offenders. Furthermore, at stake of having a portion of the state's surface transportation funding transferred to the state DOT or State Highway Safety Office, federal law mandates states to adopt open container and repeat offender laws that meets specific requirements.

Preventing the very real danger of underage drinking has been the intention of the laws adopted by a majority of the states. All 50 states plus the District of Columbia have also enforced a Zero Tolerance stance on underage DUI offenses stemming from the fact that it is already illegal for people under the age of 21 to purchase and possess alcohol. For drivers under the age of 21 under the Zero-tolerance laws make driving with even a small amount of alcohol in their system, ranging from 0.00 to 0.02 percent BAC, depending on the state, a criminal DUI offense.

DUI have both short- and long-term impacts to the individual driver and to the community at large. Foremost and the most serious of these impacts would be the deaths and injuries in alcohol related vehicular crashes. In 2013, data from the National Highway and Transportation Administration (NTSA) revealed that of the 30,057 fatal crashes in 2013, 30% were due to alcohol-impaired driving. Fatalities from these crashes accounted 32,719 persons killed, of which were 50% vehicle drivers and 17% pedestrians and pedal cyclist.

Some other immediate as well as long-term consequences of a DUI conviction include financial repercussions for an individual. The penalties for DUI arrests function as a deterrent for this type of offense as such, they would be set at a higher value. The cost that an offender would have to be liable, including bail, fines, fees and insurance, would average to about $10,000 (Solomon, 2011). Resulting future loss of income would also be an adverse consequence for this offense. In the short term, the amount of time that would have to be allocated to court appearances, resulting jail time or community services hours would significantly impact on current work schedules. On the long term, prospective employment opportunities would also be diminished as convictions listed in the background checks could result in an outright rejection. In addition, a conviction would influence one's housing options, loan and auto insurance rates. Inter-personal relationships would also be impacted by this offense. Subsequent revocation of driver's license following an arrest would limit mobility for the individual, which would restrict participation in social activities including family visits. Notwithstanding, the stigma of a DUI arrest may cause an estrangement from co-worker, friends and family.

These impacts have been widely been covered by numerous Public Service Announcements (PSA), which aims at decreasing the incidence of DUI. Forefront in this campaign is the Ad Council, a private non-profit organization that produces and distributes advertisements to raise awareness and action on various social issues including DUI.

In the 2008 National Survey of Drinking and Driving Attitudes and Behaviors, which monitors the public's attitudes, knowledge, and self-reported behavior regarding drinking and driving, more than four out of five persons (81%) saw drinking and driving by others as a major threat to their personal safety and that of their families. This perception was higher for women (85%) than males (76%).

Despite the laws enacted and the impacts of DUI highly publicized, the high percentage of people still perceiving DUI as a major personal safety threat furthers the need to review the status of DUIs in this country. There are various agencies in this country that has gathered DUI data in one way or the other. However, making sense of these available information for policy planning purposes on a comprehensive manner remains to be a challenge. It is to this purpose that this study endeavors to review the trends on DUI utilizing existing data gathered by various agencies.

LITERATURE REVIEW

Due to strong concerns from the public, political and scientific communities research on drinking and its consequences has been the subject matter of careful scientific study, which has unfortunately come in torrents and as a result generated somewhat trivial knowledge (Moore and Gerstein, 1981).

According to Substance Abuse and Mental Health Services Administration (SAMHSA, 2014) based on their survey interview, 52.2 percent of Americans aged 12 or older reported in 2013 being current drinkers of alcohol, which was similar to the rate in 2012 (52.1 percent). In effect, there were an estimated 136.9 million current drinkers in 2013. Of this population, an estimated 10.9 percent drove under the influence of alcohol at least once in the past year, which was lower than in 2002 (14.2 percent), but it was similar to the rate in 2012 (11.2 percent). At 20.7 percent, persons aged 26 to 29 had the highest rate followed by persons aged 21 to 25 a 19.7 percent. These rates were lower in 2013 among persons aged 12 to 20 and those aged 21 to 25 (4.7 and 19.7 percent, respectively) than in 2012 (5.7 and 21.9 percent, respectively).

Charlton, S. G., & Starkey, N. J. (2015) in looking into the effects of alcohol on drivers' performance found it to differ depending on whether blood alcohol concentrations are increasing or decreasing. Their research determined whether the same pattern of driver impairment would occur when drinking happened in social groups over a longer period of time by utilizing a more ecologically representative alcohol consumption procedure. They found that the ratings of subjective intoxication were significantly affected by placebo. Meanwhile, dose-dependent alcohol impairment had a strong influence on driving and cognitive performance that also showed acute protracted error on some measures. Results of their experiments also offer substantial confirmation of expectancy effects in contributing to self-perceptions of intoxication.

Williams (2006) noted that major decreases occurred in alcohol-impaired driving and its consequences in the 1980s and continuing into the early 1990s. He pointed out the 35-40% reduction in fatal crashes that was contributed to alcohol impairment. The emergence of citizen activist groups that mobilized public support and attention to the problem and the proliferation of effective law were the two principal reasons cited by Williams (2006) for the said decline. However, he stated that there still was a relatively high level of alcohol-impaired driving problem even though it has stabilized.

Addressing the gap in public health knowledge on the prevalence of driving after drinking Chou et al (2005) examined changes in prevalence rate between 1991–1992 and 2001–2002 utilizing two large nationally representative surveys of the U.S. population. Findings of their study reflected a 2.9% incidence of driving after drinking in 2001 – 2001, which was a 22% decrease from the 3.7% rate observed in 1991 – 1992. Their analysis also pointed out to a decrease in the difference in the driving after drinking incidence between the male and female population. However, the examination reflected in the past decade a growing sex ratio significantly observed among the under-aged group, which showed a distinct decline in the prevalence of driving after drinking among the 18 – 20-year-old women. Whites, Native Americans, males, under aged young adults and 21–25-year-olds were the constant and emerging subgroups identified by the study to be at high risk for drinking and driving.

Similarly, Quinlan (2005) looked into the trends in alcohol-impaired driving among U.S. adults from 1993 through 2002. The study analyzed the results of The Behavioral Risk Factor Surveillance System, a random-digit telephone survey of adults aged ≥18 years in all states (and the District of Columbia). Outcomes of the survey pointed out that the percentage of respondents who reported alcohol-impaired driving (AID) in the U.S. declined from 123 million in 1993 to 116 million in 1997. However, these numbers increased to 159 million both in 1999 and 2002. This increase was observed in the study at differing scale among most subgroups of the population. The study furthered that over 80% of total AID episodes in each study year was reported by people who also reported binge drinking (more than five drinks on a single occasion).

The extent of driver-based and passenger-based drinking and driving were examined by Chou, et al (2006) by utilizing major socio-economic characteristics as variables to identify the significant determinants of the said behavior. Their study utilized data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC, n = 43,093). Findings revealed that there were 23.4 million, or 11.3%, of American adults who reported engaging in at least one of the four driver- or passenger-based drinking and driving behaviors in 2001–2002. The study found that passenger-based drinking and driving behaviors were generally prevailed more than those of the driver-based measures. Age was found to be inversely associated the risk for all four drinking and driving behaviors and males were at greater risk with the related male-to-female ratios of approximately 3.0. Their analysis pointed a greater risk of all drinking and driving behaviors amongst individuals who were widowed/separated/divorced or never married and those with greater than a high school education.

In analyzing the gender differences in young drivers with its relation to substance use and high-risk driving behavior Elliott et al (2006) found evidence to suggest that during the first 4 years of licensure high risk behaviors as shown in driver's records of offenses and crashes were associated with 12th - grade self-reported substance use/ environmental influences. Outcomes of the study point out that there were generally stronger associations among women than among men to high-risk driving and substance use/environmental influences. Although, it was noted that women had fewer risky-driving incidents than men when matched by substance-use profiles. The study notes that this result suggests that there was more deviation among young women who exhibit high-risk driving behavior from the general population of young women with respect to alcohol use, alcohol misuse, and marijuana use compared to difference amongst the high-risk-driving young men from other young men. The results furthered that women would likely retain their lower-risk driving profiles even if young men and women were to eventually have equal levels of substance use.

The 2006 Behavioral Risk Factor Surveillance System (BRFSS) was analyzed by Flowers, et al (2008) to examine alcohol consumption and self-reported alcohol impaired driving among U.S. adults aged 18 years for all states. The results of the study noted that among persons aged 18–24 years, men, the never married, those with low incomes (<$20,000), and those who did not complete high school was the highest prevalence of binge/ heavy drinking. It was also observed that the occurrence of binge/ non-heavy drinking was highest among those aged <40 years (35.9%, 18–24; 29.5%, 25–39), decreasing gradually with increasing age thereafter. Among Hispanics, men, and persons who had never married had a higher incidence of binge/ non-heavy drinking as pointed out by the results of the study. The non-binge/ heavy pattern, on the other hand, was seen to be most common among those aged 55 years or more, white people, women, and those previously married, but varied little by education or income.

In the study conducted by Voas and Lacey (2011), they noted that Asians and Cubans were less involved in impaired driving than the average citizen (4.6), and females (4.8.2) are less frequently involved in alcohol-related crashes than men. Their research furthered that motor vehicle crashes were the primary cause of death among youth ages 15 to 20 in the United States and that this age group was overrepresented in traffic fatalities and injuries, particularly in alcohol-related crashes and at lower

BAC levels. Amongst college students, those that were at an increased risk for driving while impaired were students attending school full-time and who were from ages 17 to 24. Also, those more involved in drinking and driving were college men than college women. Data from the study pointed out that approximately 45% of the drinking drivers with the Blood Alcohol Content (BAC) level of 0.08 g/dl or higher were drivers ages 21 to 34. In examining the relation of age and gender to driving and crash involvement, the study pointed out that men drink more than women and consumption levels declined with age. However, they observed a variation in crash involvements by age and gender, and a distinct difference in the pattern for alcohol-involved crashes compared to non-alcohol-related crashes. Results of their study furthered that vulnerability to impaired driving differs between racial and ethnic group despite the absence of a consensus on the definition and constitution of a race and an ethnic group. The study additionally noted that despite the smaller incidence of alcohol related crashes amongst drivers 70 yrs. and older, the interactions of alcohol with the physical and mental health, and medications taken could exacerbate driving impairment.

In the survey conducted by Scott-Parker, et al (2014), socio-demographic characteristics of the drivers and their self-reported driving behaviors that counted in crashes, offenses, police avoidance and driving intentions were examined to explore the relationships between substance-impaired driving and other risky driving behaviors. Findings of the study revealed that those who reported driving after taking drugs and drinking alcohol was a relatively small proportion of the entire sample. The study noted that avoiding police, speeding, risky driving intentions and self-reported crashes and offenses were related to substance-impaired driving. It was also pointed out in the study that forty-three percent (43%) of those who reported driving after taking drugs also admitted to alcohol-impaired driving.

Shults, et al. (2001) noted in their study that 0.08 blood alcohol concentration laws, minimum legal drinking age laws, and sobriety checkpoints have been effective measures of interventions to prevent impaired driving especially amongst the young and inexperienced drivers. The research utilized the evidence approach outlined in the Guide to Community Preventive Services: Systematic Reviews and Evidence-Based Recommendations (the Guide), which evaluates and make recommendations on population-based and public health interventions (Briss et al, 2000). Existing research on the effectiveness of the intervention measures were analyzed by the study in terms of changes in the reported fatal and nonfatal injuries resulting from alcohol-related motor vehicle crashes.

Relative to these intervention measures, Carpenter (2005) observed that the age structure of arrests for driving under the influence has been altered by the Zero Tolerance laws. He noted that there was a 4 percent difference in the DUI arrests of 18 – 20-year-old males compared to those of older males.

Outcomes of the study also pointed out that alcohol related offenses such as public drunkenness and disorderly including vandalism decreased among young men age 21 and younger due to the ZT laws. The study concluded that the results substantiate the effects of heavy alcohol use in the committing nuisance offense by youths.

Another intervention measure to curb DUI were the Minimum legal drinking age (MLDA) laws, which were studied by McCartt, et al (2010). In the study, it was noted that the MLDA laws went through many changes during the 20th century in the United States and that there have been 21 states adopting the law since 1988. It was pointed out that there has been a decline in the alcohol consumption of high school students and adults since 1970s and the most in 1990s when MLDA-21were being introduced or restored by different states. The percentage of fatally injured drivers ages 16 - 20 with positive BACs was noted in the study to have declined in 1982 from 61% to 31% in 1995. This decline was observed in the study to be bigger compared to the older age groups and that the decrease occurred among the ages directly affected by raising MLDAs (ages 18 – 20) and those ages 18 – 20, which were indirectly affected. The research found that MLDA-21 reduced drinking, problematic drinking, drinking and driving, and alcohol-related crashes among young people as revealed by the majority of the studies intended to measure the effects of drinking age. However, the research perceived that despite the decrease there is still a prevalence of drinking and driving among underage people and that alcohol is still a significant risk factor in serious crashes among young drivers. The study suggests a further reduction of underage drinking through intensified enforcement of MLDA and other drinking and driving laws. It was also indicated in the study that the effect of MLDA-21 could not be substituted even partially with alcohol education.

The effect of MLDA evasion across states with different alcohol restrictions was examined by Lovenheim and Slemrod (2010) by utilizing GIS software and micro-data on fatal vehicle accidents from 1977 to 2002. The results of the study indicate that a legal restriction on drinking does not reduce youth involvement in a fatal accident in counties within 25 miles of a lower-MLDA jurisdiction, where fatal accident involvement actually increases for 18 and 19-year-old drivers. Results consistent with the previous literature that MLDA restrictions are effective in reducing accident fatalities were observed in the study to occur farther from the 25-mile border. The study infers from the results that due to the equalization of state MLDAs at 21 in the 1970 and 1980s the total teenager-involved fatalities were reduced, for 18-year olds between a quarter and a third percent and for 19-year olds over 15 percent. Furthermore, results of the study suggested that the effects of lowering the MLDA in some states would lead to significant increase in teenage involvement in fatal accidents due to evasion of local alcohol restrictions.

Focusing on the rate of proactive DUI arrests, Dula (2007) presented a formula generating a metric for assessing aspects of the DUI prosecutorial chain. Although precaution was advised due to limitations of the data sources, the results of the assessment noted that there is no relationship between the level of DUI arrest activity and DUI-related crashes. The results of the study raised the issue of the effectiveness of targeted DUI enforcement currently being implemented, which costs a substantive amount of money.

Meanwhile, the differences in subjective beliefs on driving while intoxicated (DWI) between race and gender was investigated by Sloan, et al (2013) by surveying drinkers on their beliefs of police/ judicial fairness on DWI. The drinkers surveyed in the study were from four states with actual arrest, conviction, and fine rates from court data in the same cities. The study used the state arrest data as a point of reference. Results of the study revealed that there was significant pessimism amongst Black males about being stopped regardless of actual drinking occurred, which was associated with higher jail penalties to DWI conviction. The study reported that disparities in judicial outcomes following DWI were not revealed by arrest data. The subjective beliefs of Black about DWI consequences, the study concluded may reflect social experiences, which are not jurisdiction- or crime-specific.

In the study conducted by Sloan (2014), the difference of drinker-drivers from other drinkers in cognitive ability and ignorance of DWI laws. The data from the study points out that drinker-drivers were relatively knowledgeable about DWI laws and do not differ on two of three study measures of cognitive ability from other drinkers. Results of the study also revealed that drinker-drivers were less prone to pan events involving drinking and are more impulsive. Outcomes of the study suggest hyperbolic discounting as non-drinker-drivers differ from drinker-drivers as the difference between short- and long-term discount rates were significantly higher amongst the latter group. The inconsistency in an individual's choices about the same thing at different points in time defines Hyperbolic discounting or also called dynamic inconsistency.

Macleod (2015) examined the relationship of an objective environmental-level measure (proportion of alcohol-involved driving crashes in one's residential city) with individual-level perceptions and behavior. The study utilized data from a 2012 cross-sectional roadside survey of 1147 weekend nighttime drivers in California, individual-level self-reported acceptance of drinking and driving and past-year drinking and driving, which were merged with traffic crash data using respondent ZIP codes. Outcomes of the analysis revealed that city-level alcohol-involved traffic crashes had a non-linear relationship with individual-level acceptance of drinking and driving. The study noted that there was a low acceptance of drinking and driving amongst communities with both low and high proportions of alcohol-involved traffic crashes.

METHODOLOGY

Data on Driving under the Influence (DUI) arrests were drawn from information provided by the Federal Bureau of Investigations' (FBI) Uniform Crime Reporting Program (UCR) from 1995 – 2013. The FBI's UCR Program is a nationwide, cooperative statistical effort of more than 16,000 in 1995 and in 2013, 18,415 city, university and college, county, state, tribal, and federal law enforcement agencies voluntarily reporting data on crimes brought to their attention (Federal Bureau of Investigation, Uniform Crime Reporting Program (UCR), 1995). The number of persons arrested for all violations, except traffic offenses, are submitted by contributing agencies on monthly returns to their state Program or directly to the FBI. Arrest trends and volume were computed based on the agencies' recording of the age, sex, and race of both adult and juvenile arrestees. The UCR defines DUI as driving or operating any vehicle or common carrier while drunk or under the influence of liquor or narcotics. The DUI offense was classified under the Part II Offenses, which law enforcement agencies report to the FBI only as an arrest data. The law enforcement agencies reporting these data follow the UCR Program jurisdiction guideline to be certain that data (offense or arrest) are not reported more than once by overlapping jurisdictions.

The arrest totals presented in the UCR reports were national estimates based on the arrest statistics of all law enforcement agencies submitting 12 months of arrest data to the UCR Program. The FBI bases percent cleared statistics on aggregated offense and clearance totals. The arrest data for each of the individual offenses was the sum of the estimated volume of arrests for that offense within each of the eight population groups. The FBI calculated each of the eight population group's arrest estimates by dividing the reported 12-month volume figures by the contributing agencies' jurisdictional populations. The resulting figure was then multiplied by the total population for each population group as estimated by the UCR Program.

Analyses were conducted utilizing Mann-Kendall Test for Monotonic Trend to determine an underlying pattern in a time series which would otherwise be partly or nearly completely hidden by noise. This study would like to determine if the number of DUI arrests has generally increased or decreased (getting "better" or "worse"). A simple description of these techniques is trend estimation, which can be undertaken within a formal regression analysis. The probability distribution from which the trend arises has changed over time is determined. The amount or rate of change with regards to some central value of the distribution such as a mean or median would also be described.

It is hypothesized that there is no significant trend in the number of DUI arrests from 1995 – 2013 (H0). Failure to reject H0 would not exactly indicate no trend but rather that the evidence available is not sufficient to conclude that there is a trend (Hill, 2006)

$H0: |Z| \leq Z_{\alpha/2}$

$H1: |Z| \geq Z_{\alpha/2}$, (2-sided test)

where

$F_N (Z_{\alpha/2}) = \alpha/2$, F_N being the standard normal cumulative distribution function, and

$\alpha = .05$ significance level

RESULTS

From 1995 to 2013, the average number of individuals arrested for DUI accounted for 10 percent (14,107,840) of the total arrests in the US. During this period, the number of DUI arrests has decreased by 9 percent with an average yearly rate change of 1 percent. The highest increase of the DUI arrests during this period was observed in 1999 with 8 percent while the highest decrease was observed in 2011 with 14 percent. The year that had the highest number of DUI arrests was in 1999 while the lowest was in 2013.

The Mann-Kendall test for Monotonic Trend was conducted to determine whether there has been a statistically significant decrease in the number of DUI arrests from 1995 – 2013. Results revealed that there was a decrease in the total number of DUI arrests from 1995 – 2013 as pointed out by the negative value of the computed Z (Z (S > 0) = -1.77, p = .076). However, there was no statistically significant trend as the as the normalized test statistic (Z) was less than the critical value (Zα/2 = 1.96) at the level of significance (0.05).

Examining the number of DUI arrests by sex, there was an observed decrease amongst male individuals with a total decrease of 20 percent. The decrease had an annual average of 1 percent in the DUI arrest amongst the male during the examined period. The highest decrease of 16 percent was observed from 2010 to 2011and the highest decrease of 7 percent was from 2001 to 2002. In contrast, amongst female individuals, there was an increase in arrests with a total of 46 percent. The average change in the arrests within the period examined was 3 percent yearly. The highest increase of 13 percent in the DUI arrests amongst females occurred from 2001 to 2002.

There was a 319 percent difference in the average number of DUI arrests amongst males than the females (Table 1). From 1995 – 2013 the difference in this average has been decreasing at 5 percent annually. The highest difference was observed to be in 1999 and the lowest was in 2013. Homogeneity of variance was met as assessed by Levene's Test for Equality of Variances (p = 0.416). An independent-samples t-test revealed a statistically reliable difference between the mean number of DUI arrests amongst males (M = 810,295, SD = 53,961, n = 19) and females (M = 193,551, SD = 39,696, n = 19), t(36) = 40, p = .000, α = .05.

Analysis of the trend of DUI arrests between females and males from 1995 – 2013 was conducted utilizing also the Mann Kendall Test for Monotonic Trend. Results showed that the DUI arrests amongst males had a decline from 1995 – 2013 as indicated by the

negative value of the computed Z (Z (S < 0) = -0.8, p = .40) but was not statistically significant as the as the normalized test statistic (Z) was less than the critical value (Zα/2 = 1.96) at level of significance (0.05). For females, there has been a statistically significant increasing trend as indicated by a positive value of the computed Z (Z (S > 0) = 3.2, p = .002) and as the normalized test statistic (Z) was greater than the critical value (Zα/2 = 1.96) at level of significance (0.05).

**TABLE 1:** Descriptive Statistics for the DUI arrest from 1995 - 2013 by Sex (N = 38)

	n	M	SD
Female	19	19,3551.21	39,696.693
Male	19	810,295.05	53,961.143

The number of DUI arrests by age was examined utilizing 7 age groupings (less than 14 yrs. old, 15 – 24, 25 – 34, 35 – 44, 45 – 54, 55 – 64, and 65 and over). Amongst these age groups, DUI for the age group 35 to 40 had the most total decrease from 1995 to 2013 at 40 percent with an annual decrease of 2.2 percent. The highest decrease in DUI arrests was observed from 2010 to 2011 and the highest increase was observed the following year 2011 to 2012. Meanwhile, the 65 and over age group had the most total increase of 111 percent from 1995 – 2013 with an annual increase of 6.2 percent. From 2000 to 2001 was when this age group had the highest increase in DUI arrests at 16 percent and the highest decrease was observed the following year from 2001 to 2002 at 60 percent.

A One-way ANOVA was conducted to evaluate the number of arrests of the different age groups where an alpha level of 0.05 was used for all analyses. Comparing the mean number of arrests amongst the age groups (Table 2), the highest mean number of arrests was observed from the 25 to 34 age group (M = 309,865, SD = 28,537, n = 19) while the lowest was from the less than 14 yrs. old age group (M = 308, SD = 130, n = 19). As assessed by Levene's Test for Equality of Variances (p = 0.00) there was a violation of the homogeneity of variance assumption, so the Welch F test was considered in determining the significant difference between group means and the Games Howell post hoc test in identifying specific groups that differed. Results revealed that there was a statistically significant difference between mean DUI arrests amongst the age groups as determined by the one-way ANOVA (F (6, 126) = 959, p = 0.000). Post hoc comparison using Games-Howell test revealed that all of the age groups had a statistically significant mean difference in the number of arrests at the 0.05 level. The age groups (1) less than 14 and (2) 65 and over had statistically significant lower mean difference compared to the other age groups. Meanwhile, the age group 25 – 34 had a statistically significant higher mean difference compared to all the other age groups (Figure 1).

TABLE 2: Descriptive Statistics for the DUI arrest from 1995 - 2013 by Age (N = 133)

	n	M	SD
Less than 14	19	308.21	129.854
15 – 24	19	267376.66	34503.807
25 – 34	19	309865.32	28537.514
35 – 44	19	230226.47	28623.059
45 – 54	19	136152.74	19224.918
55 – 64	19	46000.00	10111.853
65 and over	19	13916.61	4013.193
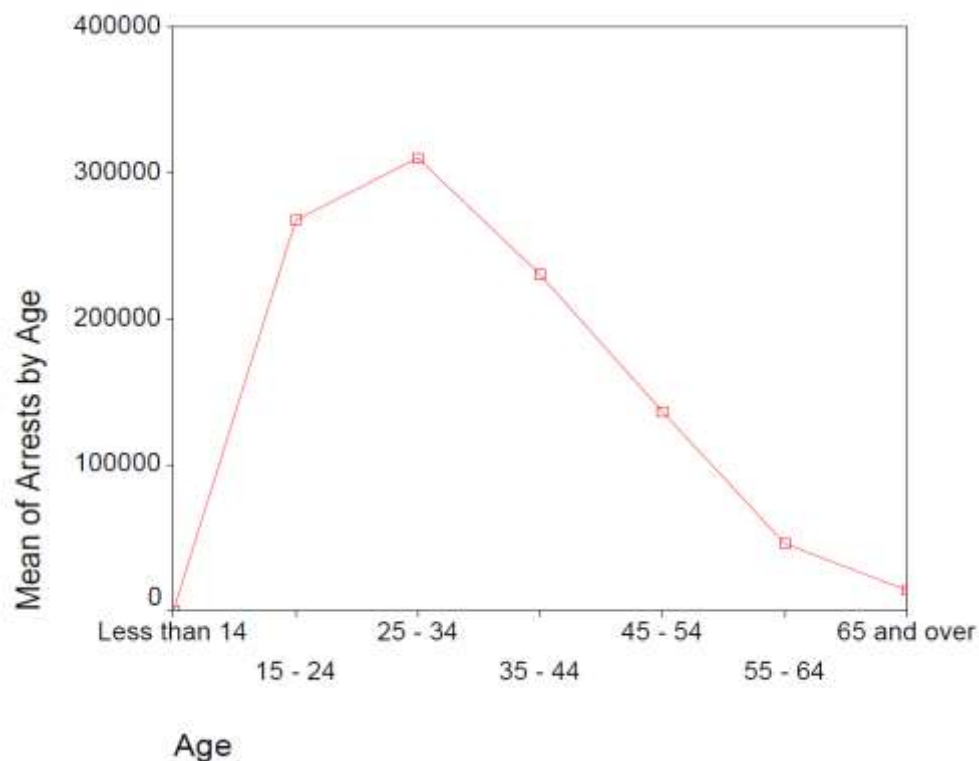
FIGURE 1: Means Plot – Number of DUI Arrests from 1995 – 2013 by age

In order to determine whether there had been significant changes in the number of DUI arrests for each of the age groups, the Mann-Kendall test for Monotonic Trend was also conducted where an alpha level of 0.05 was used for all analyses. There was a decrease in the DUI arrests in the less than 14 age group as the computed Z (Z (S < 0) = -2.0, p = .045) value was negative, which was statistically significant as the normalized test statistic (Z) was greater than the critical value ($Z_{\alpha/2}$ = 1.96) at level of significance (0.05). This was similar for the 35 – 44 age group (Z (S < 0) = -3.54, p = .0004). In contrast the age groups 45 – 54 (Z (S > 0) = 2.94, p = .003), and 55 – 64 (Z (S > 0) = 0.88, p = .002) had a statistically significant increasing trends. The age groups 15 – 24 (Z (S > 0) = 1.5, p = .12), 25 – 34 (Z (S > 0) = 0.23, p = .82), and 65 & over (Z (S > 0) = 0.89, p = .38) also had an increasing trend but were not statistically significant as its normalized test statistic (Z) was less than the critical value ($Z_{\alpha/2}$ = 1.96) at level of significance (0.05).

Examining the number of DUI arrests amongst the race groups, the White American population had the highest total number of DUI arrests from 1995 – 2013 followed by the African American, Native American, and American Asian, respectively. In the White American population, the highest number of DUI arrests was observed to be from 2007 to 2008 and the lowest number was in 2012 to 2013. For the African American population, the highest number of DUI arrests was from 2009 to 2010 and the lowest number was from 1999 to 2000. The highest number of arrests was from 1995 to 1996 for the Native American population while for the American Asian population it was from 2011 to 2012. The Native American population had the lowest number of DUI arrests from 1999 to 2000 and the American Asian population was from 1999 to 2000.

Analysis of the number of arrests of the different racial groups entailed a One-way ANOVA where an alpha level of 0.05 was used for all analyses.

Comparing the mean number of arrests amongst the age groups (Table 3), the highest mean number of arrests was observed from the White American population (⯑ = 865,455, SD = 58,023, n = 19) while the lowest was from the Asian American population (⯑ = 12,076, SD = 2,909, n = 19). As assessed by Levene's Test for Equality of Variances (p = 0.00) there was a violation of the homogeneity of variance assumption, so the Welch F test was considered in determining the significant difference between group means and the Games Howell post hoc test in identifying specific groups that differed.

Results revealed that there was a statistically significant difference between mean DUI arrests amongst the age groups as determined by the one-way ANOVA (F (3, 75) = 1693, p = 0.000). Post hoc comparison using Games-Howell test revealed that the White American population had a statistically significant higher mean difference in the number of arrests against all the other racial groups. There was no statistically significant difference between the Native American and Asian American populations, which both had statistically significant lower difference against the African American population (Figure 2).

TABLE 3: Descriptive Statistics for the DUI arrest from 1995 - 2013 by Race (N = 76)

	n	M	SD
White American	19	865454.79	58022.54
African American	19	103502.32	11269.66
Native American	19	14042.11	1211.667
Asian American	19	12075.89	2908.98
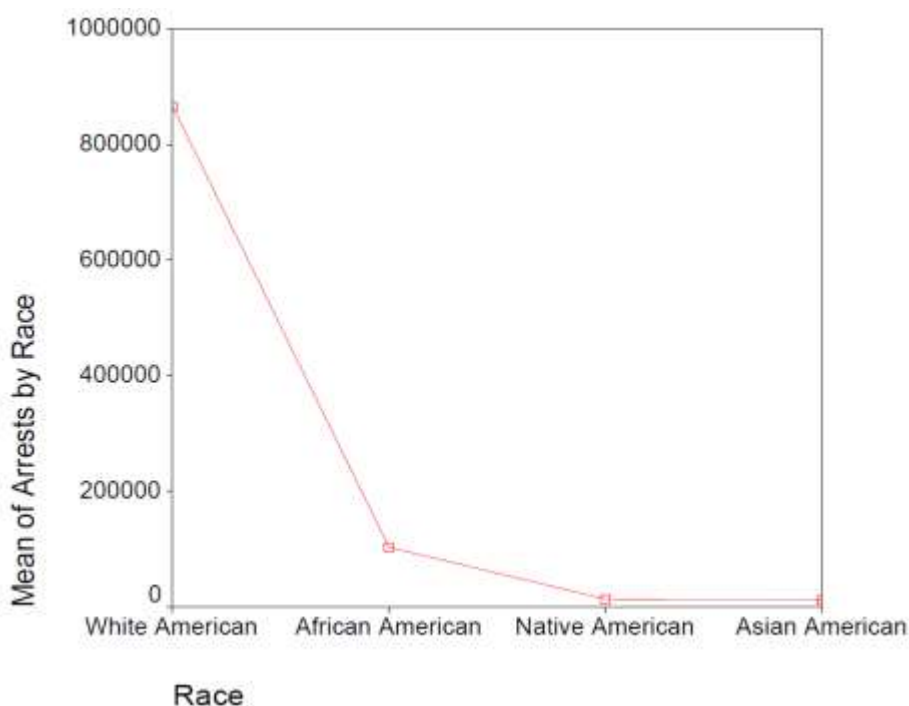
FIGURE 2: Means Plot – Number of DUI Arrests from 1995 – 2013 by race

The presence of significant changes in the number of DUI arrests for each of the racial groups was investigated by also employing the Mann-Kendall test for Monotonic Trend where an alpha level of 0.05 was used for all analyses. There were trends of increase in the DUI arrests amongst the White American population (Z (S > 0) = 0.37, p = .71), African American (Z (S > 0) = 0.98, p = .33) and Asian American (Z (S > 0) = 1.4, p = .18) populations but were not statistically significant as the normalized test statistic (Z) was less than the critical value (Z$_{\alpha/2}$ = 1.96) at level of significance (0.05). In contrast, the Native American group had a trend of decline in DUI arrests with a negative computed Z (Z (S < 0) = -0.84, p = .40) but was also not statistically significant.

DISCUSSIONS
The results of this study regarding the trends of DUI arrests from 1995 – 2013 are comparable with the results of other studies, which conducted surveys of actual drivers. Foremost, there has been a decrease in the number of drinking and driving from 1995 – 2013 that would also be supported by other studies (Chou et al 2005; Quinlan 2005). Outcome of the analysis also validates previous studies indicating a decline in the difference in driving after drinking between male and female (Chou et al, 2005). Although more states have adopted MLDA and Zero Tolerance laws as a deterrence, the significant increasing rate of DUI arrests among the 15 – 24 age group could be attributable to the stricter

enforcement of the law (Carpenter 2005; McCartt et al 2010; Lovenheim and Slemrod 2010). Meanwhile, the results that the age group 25 – 34 have an increasing number of DUI arrests could be substantiated by the previous study that drinking drivers involved in crashes and with higher BAC levels were mostly aged 21 – 34 (Voas and Lacey 2011). The increasing trend of DUI arrests among White American could also be validated by the previous studies that suggest that white males were the constant subgroup at high risk for drinking and driving (Chou et al 2005; Quinlan 2005).

CONCLUSIONS

In order to gauge the effectiveness of prevention measures, there is a need to regularly monitor trends in alcohol-impaired driving. There are several approaches adopted by previous studies to examine these trends, which includes onsite surveys of drivers, examination of crash reports and driver's records. However, developing an approach that utilizes existing sources of data would be the most efficient and effective in terms of time and monetary resources. This study presents an approach in examining existing DUI arrests as an indicator of the efficacy of current preventive measures and to identify specific areas where these measures should be focused on. This approach could also be instrumental in validating results of other studies, which utilizes the approaches aforementioned.

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