An examination of preventative factors used to reduce vehicular deaths in adult drivers

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Introduction

One of the most prevalent non-illness related causes of death that plagues countries on every continent is deaths occurring due to motor vehicle accidents. Globally, roughly 1.3 million people lose their lives in motor vehicle accidents each year, and 20 to 50 million people are severely injured, requiring treatment for the rest of their lives (Goniewicz et al., 2016).

Every year, 13,000 to 18,000 people die in motor vehicle accidents that involve an alcohol or drug impaired drive, accounting for close to 40% of all motor vehicle driving related fatalities (Vearrier et al., 2016). Driving impaired is one of the main causes of vehicular deaths, and according to Healthy People 2030, (2020), the incidence rate of impaired driving is increasing. This rate of incidence of alcohol impairment involvement in motor vehicle deaths is equal to roughly three deaths every two hours, or one death every 51 minutes, that are caused by motor vehicle collisions that involve an alcohol impaired driver (Vearrier et al., 2016).

According to Spivey Law Firm (2020), alcohol impairment begins with just the first drink that a person consumes, and even if they do not feel impaired, they are in regards to the law. This is because alcohol is not immediately absorbed into the bloodstream, so the person may continue to get more drunk even if they have not had any more alcohol. The legal limit for blood alcohol levels in adults over the drinking age of 21 is currently 0.08 BAC. Drug impairment, however, can vary between drugs, since those such as ibuprofen most likely will not cause impairment, but a drug like heroin will (Spivey, 2020). Depressants, a category of drug including alcohol, heroin, Z-hypnotics, etc., have acute side effects that include slowed reaction time, poor judgment, impaired vision, and poor coordination, among other things. Chronic effects of depressant abuse can include permanently slowed reflexes, information processing, and loss of cognitive functions (Marillier, 2019). Depressants slow down the functioning of the body's central nervous system, which in turn slows these necessary skills for safely operating a vehicle. The combination of these effects can cause perception and balance issues. Alcohol especially, at very low BAC levels can severely diminish reaction time (Marillier, 2019). Stimulants, a category of drugs including methamphetamine, amphetamine, and cocaine, can cause lack of coordination, disorientation, increased risk taking, etc. They

can also increase the driver's impulsivity, making it more difficult to react in a safe manner to control a vehicle (Marillier, 2019). A final classification of drugs that this study outlined was hallucinogens, which include LSD and cannabinoids, which can cause both visual and auditory hallucinations, feelings of being disconnected from reality, and loss of control. All of these effects are extremely dangerous when it comes to operating a motor vehicle on public roads due to having false views of the environment one is in (Marillier, 2019).

The prevalence of drug or alcohol impaired drivers varies between studies and regions within the United States. A study conducted in Los Angeles County California during the late 1980's found that, of the impaired drivers, 43% of the drivers had a positive blood alcohol test, 8.8% tested positive for illicit drugs, and 4.7% tested positive for prescribed medicinal drugs. 25% of the alcohol impaired drivers also tested positive for one or more drugs that are commonly abused, including cocaine and marijuana (Vearrier et al., 2016). According to a French study, prescription medications also are associated with impairment while driving, and are also responsible for increasing the risk of a motor vehicle collision. However, it is possible that some of these collisions could be related to the condition that the drugs were prescribed for instead of the actual drug itself (Vearrier et al., 2016). This study also mentions that commercial drivers are at high risk of developing a dependency on stimulant drugs in order to stay awake during long drives, causing impairment not only from drug abuse, but also from sleep deprivation (Vearrier et al., 2016). According to a study done on 12 hour nursing shifts, sleep deprivation can cause significant impairment on the mental and physical state, decreasing safe driving abilities (James & James, 2023). This study shows that nurses who had just completed a 12 hour day shift had a 0% near collision rate, whereas those who had finished a 12 hour overnight shift had a 37.5% near collision rate, which is a significant difference. They found that night shift workers were more likely to accidentally deviate from their lane than those who worked day shifts, meaning that they were less likely to drive in a straight line, and more likely to swerve around a lane (James & James, 2023). Also, as people age, they lose many of their abilities that are necessary for driving such as decreasing reaction time, eyesight, perception, etc. (Fields et al., 2023). According to Fields et al. (2023), elderly people tend to outlive their

ability to drive by around 7 years, but many times do not acknowledge this and opt to continue driving, increasing the danger on roads (Fields et al., 2023).

<div align="center">**Theory**</div>

Theory of Planned Behavior

According to Mostafavi et al. (2021), traffic accidents relating to unsafe driving is one of the most serious causes of death among today's population. They attempt to use the constructs of the theory of planned behavior to change how the subjects of the study view certain safe and unsafe driving practices in order to reduce unsafe driving habits (Mostafavi et al. 2021). The theory of planned behavior focuses on the prediction of an individual's behavior by said individual's intention whether or not to perform a certain action or behavior. This intention is rooted in a person's personal beliefs about a behavior, whether they be positive or negative, due to norms of the social groups that they surround themselves with (Earle et al., 2020).

In the study conducted by Mostafavi et al. (2021), they used five educational sessions, each teaching safe driving practices to the participants in a different way with the intention of changing the beliefs of the participants regarding risky behaviors while driving. In the first session, a poster was designed by the World Health Organization that outlined traffic accidents across the globe and how the prevalence of these accidents. The second session focused on changing the attitudes of the participants by educating them on what can happen if they were to continue to practice risky driving behaviors by showing photos, talking about the dangers of risky driving, and training them how to partake in safe driving behaviors (Mostafavi et al. 2021). The third session was "educated in the cognitive domain" where pamphlets educate drivers about how to maintain their vehicles and how to use seatbelts on populations such as pregnant women where it might not be self explanatory. The fourth and fifth sessions were focused on hands-on learning for situations that the driver might not be able to control such as dangerous weather conditions or what to do if they are in an accident in order to reduce injury or chance of death (Mostafavi et al. 2021). These interventions were not universally successful across the 5 cities that the experiment was performed in, however some interventions worked in one city whereas another was successful in a different city. After intervention, surveys of the participants showed that behavioral

intention to participate in safe driving practices (in some cities) was increased, but changes to the subjective social norms were relatively unchanged (Mostafavi et al. 2021).

Social Cognitive Theory

The social cognitive theory suggests that individuals' behaviors are shaped by multiple factors including, individual and environmental factors (Fields et al., 2023). One of the main problems when it comes to unsafe driving practices is transportation self efficacy. This is the belief of an individual that they have the ability to get to where they need to go on their own without help from others (Fields et al., 2023). In regards to the elderly or disabled population in which Fields et al. (2023) focuses on, those with higher self efficacy may be more inclined to use public transportation techniques such as taking the bus or walking, because they know that they can. Those who have never used public transportation and do not understand how to navigate it are more likely to hold on to driving themselves places, even with a deteriorated physical ability to safely operate their own vehicle due to factors such as decreased reaction time or poor eyesight (Fields et al., 2023).

Environmental factors that are discussed as helpful in increasing transportation self efficacy include those such as making sure there is flat ground so that there is less chance of tripping, ramps for accessibility, more lighting for a sense of increased safety, and sidewalks and street crossings in high traffic areas where it would be extremely difficult to navigate. These interventions would increase the amount of people that would cease driving themselves once they begin to lose their ability to drive safely (Fields et al., 2023).

Health Belief Model

The Health Belief Model explains that an individual's behavior is influenced, and can be predicted by their perceptions of the threat that an action could potentially cause. This model also focuses on "cues to action" which is what will drive a person to modify their behaviors based on the perceived severity of consequences following certain behaviors (Cao et al., 2014). This theory can be used in practice to reduce the prevalence of risky driving behaviors by attempting to change overall public perception of the risks and severity of consequences that often follow risky driving behaviors. This

is often done by creating education programs for younger age groups so that their perceptions of certain behaviors are that of what was intended by the program (Cao et al., 2014).

A survey study was conducted where surveyors asked high school students how they perceived certain injury causing behaviors. These behaviors included a wide range of dangerous activity, but also included driving related behaviors such as riding in a vehicle with an impaired driver, wearing a seatbelt, and the risks that the students would associate with motor vehicle accidents. Cao et al. (2014) then intervened with risk education programs that included traffic safety lectures from first responders to explain the possible physical consequences that accompany motor vehicle accidents. The students were taught about how risky driving behaviors could lead to serious injury that could result not only in minor injuries (scratches, muscle injury, concussion), but also long term injuries that could greatly impact their quality of life (paralysis, permanent brain injury, disability). A survey taken post-intervention shows great improvement in the perception of injury of the high school students, which in turn reduces the likelihood of participation in risky driving behaviors.

Intrapersonal Factors

In order to assess risky behaviors such as alcohol and drug impairment while driving, it is important to first look at the factors behind the drug and alcohol impairment without the aspect of driving. College students are at a huge risk of driving while impaired due to the culture surrounding drinking or doing drugs in a college environment. According to Mallett et al. (2009), one of the main intrapersonal factors that affects alcohol consumption in college students is how much alcohol the person thinks they are able to consume before feeling intoxicated, regardless of what their body can actually handle. This study also includes that an individual's intentions while drinking play a big role in if they drink and how much they drink if they do. For example, one person may not drink or drink lightly in order to have fun, whereas another individual may drink to the point of extreme intoxication because their intention was to get drunk (Mallett et al., 2009)

Martinussen et al. (2018) mention how implicit attitudes towards driving under the influence are largely negative across the population. However, these attitudes are not in

correlation with what the actual prevalence rates of driving under the influence actually are. Many programs and campaigns are targeted towards changing the attitudes towards risky behavior and drunk driving however these attempts are largely unsuccessful as they primarily target explicit attitudes, which are already largely negative (Martinussen et al., 2018). It is also worth mentioning that those who drive under the influence generally are more aware of the potential consequences of these actions than those who do not become drunk drivers, which seems to be in direct opposition to what would be expected from an increased knowledge base. The study outlined in this article found that even though most people had negative explicit attitudes towards impaired driving, their implicit attitudes were not in sync (Martinussen et al., 2018). Most current programs that attempt to reduce drunk driving are aimed at changing these explicit beliefs, which do not, for the most part, need to be changed. It is suggested that more research should be done on the implicit attitudes towards impaired driving, with the intention to create more effective intervention methods that target these implicit attitudes, since they become dominant in a state of intoxication (Martinussen et al., 2018).

Another intrapersonal factor that correlates with impaired driving is socioeconomic status and education level. Levels of impaired driving across gender and age groups remained relatively the same, however, it was found in a study conducted by Impinen et al. (2011), that certain factors contributed to an increased rate of impaired driving. These factors include those such as low education levels, unemployment, and living alone, all of which had extremely high odds for impaired driving (Impinen et al., 2011).

Interpersonal Factors

Speeding is a risky driving behavior that many young adult male drivers between the ages of 18 and 28 usually partake in. Male drivers have an increased risk of accidents due to voluntarily exhibiting extremely risky behaviors when driving such as speeding. They also usually have less regard for traffic safety rules than their female counterparts (Møller et al., 2014). Møller et al. (2014) explain how young males are influenced by other young males to conform to their gender stereotype of exhibiting risky behaviors, leading to their increased rate of accidents compared to young adult

female drivers. Male drivers also prove to be more in danger of conforming to social influences than female drivers, which can be explained by understanding how male relationships are often more competitive with the need to show off, usually requiring some level of risky behavior to be involved (Møller et al., 2014).

Risky driving behaviors can also be influenced simply by if there is a passenger, and who the passenger is. Young drivers of any gender are more likely to speed if the passenger is a young male peer, giving in to either the aforementioned competitiveness of male relationships, or to seem cool (Cestac et al., 2016). In contrast, if an older adult or parent is the passenger, drivers tend to drive more slowly and pay more attention to the traffic around them with increased awareness and caution. Cestac et al. (2016) also mention that an individual's alcohol consumption is related to that of their peers, and if their peers are willing to drive while under the influence of drugs or alcohol, the individual will also be more likely to agree with this behavior.

Organizational, Community, Environment, and Policy Factors

Jobs and careers that are centered around driving pose an increased risk of risky driving, since people with those jobs can be more inclined to get too tired to continue driving, or fall victim to "highway hypnosis", which is when drivers zone out while driving, making them more susceptible to accidents. Support within these organizations has shown to be effective in improving safe driving habits among professional drivers (Delhomme & Gheorghui, 2021). An increase in training offered to the drivers has had a positive impact on stress levels, which in turn lowers the prevalence of risky driving behaviors. This extra training also helps the drivers to increase their knowledge of what to do if an accident were to occur, increasing their perceived preparedness levels and encouraging safe driving techniques as well as increased attention to the task (Delhomme & Gheorghui, 2021). Organizational factors can also have a negative impact on professional drivers. Pressure from a driver's supervisor can increase stress levels in the individual, which has shown to increase transgressive behaviors, which then leads to a decline in safety for the professional driver and other drivers around them. Truck drivers have also reported poor working conditions such as extremely long hours, which goes against set regulations that determine how many hours can be driven

at one time (Delhomme & Gheorghui, 2021). As previously mentioned, long hours and over-tiredness can be detrimental to road safety.

According to Akbari et al. (2021), studies have shown that driver education has not been effective in reducing the amount of motor vehicle crash deaths in recent years. The intent of these organizations is to teach and train new drivers how to safely become a driver on the roads. Many of these organizations require one-on-one training as well as classroom training on the rules and regulations of the roads and how to deal with certain situations. However, due to, most likely, errors in the approach and teaching method, drivers education programs have done little to improve overall road safety (Akbari et al., 2021). Insurance organizations do play a role in effectively reducing risky driving behaviors (Tselentis et al., 2017). Many insurance companies use a pay-how-you-drive method of payment. This means that the consumer pays a fixed premium based on their driving habits, so if they are more inclined to risky driving behaviors or have previously been involved in a motor vehicle accident, they will have to pay more. This incentivizes safe driving behaviors (Tselentis et al., 2017).

Culture is an important interpersonal factor that can influence risky driving behaviors because it influences how one views a certain behavior. Culture is shared with the collective members of a person's community, and their beliefs will most likely align with those who share the same culture (Cestac et al., 2016). Cultures that value the community are less likely to have a high incidence rate of fatalities involving car accidents because it is frowned upon to partake in a type of behavior that may cause harm to other members of the community. In contrast, cultures that value self independence would therefore have a higher motor vehicle related fatality rate (Cestac et al., 2016).

Drivers can also be affected by the physical environment and conditions of the roads that are being utilized by a driver. For example, driving on roads with low visibility or an above average amount of potholes will create a more complex task for the driver, increasing their susceptibility to an accident while trying to avoid the road imperfections (Onate-Vega et al., 2020). Other possible environmental imperfections that could cause more difficult driving scenarios include narrow and crowded roads, such as those in a downtown city area, road work zones, constantly changing signage (speed limits, exits,

etc.), and winding roads. Drivers that are in these sorts of environments are more likely to lose control of their vehicle and get into an accident (Onate-Vega et al., 2020). However, these worsened conditions often make the driver more cautious leading to safer behaviors. For example in an urban setting with other vehicles parked on the side of the roads and increased congestion of the roads, drivers are more likely to reduce their speed in an attempt to avoid hitting other vehicles or objects (Onate-Vega et al., 2020). Increased visual complexity of the driver's environment can also have a negative impact on the driver. Large advertisements and billboards have shown to distract drivers and increase the rate of incidents, especially the digital billboards that constantly change the advertisement shown every few seconds. A simple environment, however, then increases the amount of time that drivers spend using a cellular device while also actively driving (Onate-Vega et al., 2020). This is because the driver has an increased self efficacy, and confidence in their ability to safely use their phone while driving, opening up the possibility of an accident due to not seeing a change in the environment (Onate-Vega et al., 2020).

There are many federal and state policies within the United States that aim to reduce the prevalence of unsafe driving habits among americans. For example, all 50 states conform to the minimum age of alcohol consumption being 21, in an attempt to allow drivers to mature and fully learn how to drive before adding possible impairment. This has shown to have correlated with a 16% decline in motor vehicle crashes averaged among all states (CDC, 2022). There have also been regulations enacted in the United States that set limits for how many hours truck drivers are allowed to drive per day and week in order to combat driving burnout and tiredness. The regulations have changed many times over the last century, but the latest rules state that a truck driver cannot drive for more than 11 hours in a 24 hour period, and cannot have on-duty status for more than 14 hours in a 24 hour period. They must also have at least 10 hours of off-duty time (Heaton, 2005).

Suggestions for Intervention

Those who abuse alcohol and frequently become intoxicated are at a much higher risk of driving while impaired than those who occasionally get intoxicated. Programs such as Alcoholics or Narcotics Anonymous have demonstrated to be one of

the only effective treatments for alcohol abuse (Kelly et al., 2020). The goal of this program is to increase an individual's interpersonal skills as well as their ability to cope with things such as stress and anxiety that might be causing their substance abuse. AA and NA also aim to set up a support system for those who may not have one, increasing their self efficacy and confidence in their ability to become sober (Kelly et al., 2020). Often, if a person is charged with driving under the influence of drugs or alcohol, a judge will mandate attendance to an alcoholics anonymous group for a certain duration of time in an attempt to change the root behavior (Hansen, 2015). However, this is not always successful as those who participate must make the choice to get sober (Kelly et al., 2020).

There remains a low transportation self efficacy level among elderly drivers that have *recently* developed disabilities or conditions that prevent them from continued safe driving practices. Especially those in rural areas are susceptible to this low self efficacy due to a lack of infrastructure and modes of transportation (Fields et al., 2023). It is imperative to improve features that could increase transportation self efficacy among the elderly and disabled so as to encourage driving cessation. Such interventions include improvements to the infrastructure like covered areas to protect from the elements, and other factors that could prevent falling and injury such as level ground, adequate lighting, and street crossing lights that decrease danger of crossing busy intersections (Fields et al., 2023). Programs through organizations such as the church that offer free transportation can also be helpful in reducing the rate of elderly driving (Fields et al., 2023).

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