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AGGRESSIVE DRIVING BEHAVIOUR – A REVIEW OF THE LITERATURE

Muhammad Asyraf Mohd Kassim[1]
Suhaila Abdul Hanan[2]
Ahmad Bashir Aziz[3]

[1]*School of Business Innovation and Technoprenuership, Universiti Malaysia Perlis, 01000 Kangar Perlis Malaysia*
[2]*School of Technology Management and Logistics, Universiti Utara Malaysia, 06010 Sintok Kedah*
[3]*Islamic Business School, Universiti Utara Malaysia, 06010 Sintok Kedah Malaysia*
muhammadasyraf@unimap.edu.my, suhai@uum.edu.my, bashir@uum.edu.my

INTRODUCTION

Road accidents in Malaysia keep increasing every year and most of the accidents ended with deaths, serious injuries and total loss of the vehicles. National Highway Safety Traffic Administration (NHSTA) (2017) defined road accidents as an event that occurs on a road open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. The phenomena of road accidents have been haunting the public as it can cause permanent disability and post-traumatic stress disorder to the drivers.

Malaysia had experienced huge numbers of registered motor vehicles from 22,702,221 in 2013 to 26,904,539 in 2017. It shows about 15.62% growth for the last five years. Remarkably, in year 2017, the total number of motor vehicles in Malaysia is almost equal to the total population in that year. Increasing volume of motor vehicles will cause increasing number of interactions between road users' and road accidents risk is getting higher (Ibrahim, Ismail, Halim & Amit, 2016)

This could be seen from Bukit Aman Traffic Investigation and Enforcement Department (2017) reported that about 3.3 million car accidents and 34,195 fatalities were recorded from year 2013 to 2017. Worst, in 2017, there were 667,275 car accidents and 6,983 fatalities of drivers and occupants. Table 5.1 shows in detail numbers of cars involved in road accidents last 5 years.

Table 5.1

Total cars involved in road accidents year 2013 to 2017.

Year	Cars
2013	659,813
2014	662,602
2015	663,578
2016	665,758
2017	667,275
Total	**3,319,026**

The Malaysian Institute of Road Safety Research (MIROS) (2017) discovered that more than 80% of road accidents in Malaysia are caused by driver's violation or aggressive driving. Previous studies have consistently discovered that aggressive driving such as speeding, tailgating, failing to observe signs and regulations, and seeking confrontations with other drivers are prone to road accidents (Fai, 2015; Plankermann, 2014). Manan and Varhelyi (2012) discovered that the prime factors of aggressive driving is human's behavioural factors such as driver's personality, driving anger and risky driving behaviour. This can be supported by a study conducted by Al-Reesi, Ganguly, Al-Adawi, Lalamme, Hasselberg and Al-Maniri (2013) that examined responses to the Driving Behaviour Questionnaire among car drivers in Oman and found that human's behavioural factors as main contributory factors of aggressive driving that lead to road accidents. While there are many research about aggressive driver in other part of the world (Chraif, Dumitru, Aniţei, Burtaverde & Mihaila, 2016; Simons-Morton, Li, Ehsani & Vaca, 2016; Kovacsova, Lajunen & Roskova, 2016; Deffenbacher, Stephens & Sullman, 2016). However, there are minimal researches had been done to examine the behavioural factors that contribute to aggressive driving among drivers in Malaysia. Therefore, the purpose of this paper is to provide a review of literature on (1) concept of aggressive driving among Malaysian drivers (2) behavioural factors that influence aggressive driving behaviour among Malaysian drivers (3) types of aggressive driving among Malaysian drivers. Recommendations to minimize road accidents among Malaysian drivers are provided in the discussion section of this paper.

LITERATURE REVIEW

Aggressive driving behaviour

Aggressive driving has been the major contributor of road accidents as this has become a growing problem in Malaysia. King and Parker (2008) defined aggressive behaviour as a response that delivers harmful stimuli with the purpose to give a danger or injury to other living who is encouraged to avoid such behaviour. Generally, these definitions are referred to people. The concept of aggressive behaviour has the similar characteristics with aggressive driving. In terms of driving,

aggressive driving was defined as any form of behaviour that is intended to injure or harm other road users physically or psychologically (Özkan & Lajunen, 2005). Chraif, Dumitru, Aniței, Burtaverde and Mihaila (2016) reviewed aggressive driving behaviour as operating a vehicle with more aggressive that threatens road users or property. Simons-Morton, Li, Ehsani and Vaca (2016) indicated aggressive driving behaviour as any undesirable, dangerous or risky action on the road, such as weaving through lanes, running red lights, tailgating, and using the shoulder to pass.

Even though this concept has been studied for years, but there are still ambiguities in determining the critical factors that influence some drivers to be aggressive on the road. Thus, this paper will discuss the factors that are associated with aggressive driving from the available literature.

Factors influencing aggressive driving

Driving Anger
According to Berkowitz (1993), a person's aggression depends on the amount of anger that they express when confronting with frustrating situation. In terms of driving, the concept of driving anger was defined as the tendency to become angry behind the wheel (Deffenbacher, Stephens & Sullman, 2016). According to Kovacsova, Lajunen and Roskova (2016), young drivers are potentially to get angry easily compared to old drivers especially when they were provoked or challenged by other drivers. For example, the drivers will express their anger when they face with several frustrating situations such as slow traffic, blocked traffic, being honked, or being tailgated by others.

These angry drivers will impose their aggressiveness when driving towards others without paying any attention to others intentions and rights in road and results in a higher risk for accidents and a greater number of road accidents with fatalities. In addition, young male drivers are at a greater risk of involving in road accidents compared to older drivers (Stephens & Sullman, 2015). Deffenbacher, Oetting and Lynch (1994) had developed the Driving Anger Scale (DAS), an instrument to measure driving anger.

This instrument has been developed such that it could be related to the frequency and intensity of angry thoughts and feelings as well as aggressive driving. Moreover, the relationship of driving anger and aggressive driving could predict aggressive driving outcomes such as road accidents and property damages. Table 5.2 summarizes the reviews of anger in influencing aggressive driving behaviour.

Table 5.2

Summary of reviews on driving anger.

Authors	Findings
Berkowitz (1993)	A person's aggression depends on the amount of anger that they express when confronting with frustrating situation.
Deffenbacher, Stephens and Sullman (2016)	The concept of driving anger was defined as the tendency to become angry behind the wheel
Kovacsova, Lajunen and Roskova (2016)	Young drivers are potentially to get angry easily compared to old drivers especially when they were provoked or challenged by other drivers.
Stephens and Sullman (2015)	Young male drivers are at a greater risk of involving in road accidents compared to older drivers

Personality Traits

Besides the influence of anger on aggressive driving behaviour, a driver's personality traits are discovered to have connection with aggressive driving behaviour. Costa Jr. and McCrae (1992) defined personality traits as dimensions of individual differences that have a consistent pattern of thoughts, feelings, and behaviour. In detail, there are five big personality traits (Big 5 traits) that related to young drivers such as neuroticism, extraversion, openness, agreeableness, and conscientiousness (Costa Jr. & McCrae, 1992). Neuroticism is a personality trait that is defined as an inclination to experience negative emotions and difficulty in dealing with problems (Ibrahim et al., 2015). People with a high score on the neuroticism scale are often impatient, anxious, tense and irritated and tend to act aggressive when driving.

Meanwhile, extraversion is a personality trait that reflects social relations, the need for stimulation and the capacity to experience positive emotions (Baptiste, 2018). People with a high score on the extraversion scale are active, talkative, optimistic, cheerful, enjoy excitement and stimulation, and are full of energy. Therefore, those who violated traffic regulations were much more extraverted than were those in a control group. Extraversion has also been shown to be connected with physical aggression toward other drivers that might cause road accidents (Fang & Zhang, 2014). On the other hand, openness towards an experience is defined as an active need for a novel experience and a tolerance of things that are unknown and novel (Judge & Zapata, 2014). People who have the personality trait of openness are curious, non-traditional, unconventional, and prone to seek out novel experiences and reconsideration of authorities, although not necessarily unprincipled or lacking a system of values.

Next, agreeableness is a personality trait that reflects an individual's relationships with and attitudes about other people (Gowda, Rangaswamy & Rudresh, 2016). Individuals with a high score on the agreeableness scale tend to be altruistic, empathetic and willing to help others, believing that they will receive same treatment from others in return. Antagonistic people tend to be hostile and

irritating and have the need to confront, attack or punish others. Although this dimension can be connected with aggressive behaviour in general, and with driving-related aggression specifically, based solely on its definition, only few studies that have confirmed this relationship empirically.

Last but not least, conscientiousness is defined as the extent of a motivation behaviour directed towards a goal (Qu, Ge, Jiang, Du & Zhang, 2014). People with high scores on the conscientiousness scale are precise, punctual, reliable, scrupulous, and thoughtful and have strong feelings of order, duty and self-discipline. Such persons could be expected to observe traffic regulations and laws and to act thoughtfully in traffic. In conclusion, based on the reviews, it is expected that all of these traits will influence driver's aggressive driving behaviour on the road. Table 5.3 summarizes the reviews of personality traits on aggressive driving behaviour.

Table 5.3
Summary of reviews on personality traits.

Authors	Findings
Costa Jr. and McCrae (1992)	Dimensions of individual differences that have a consistent pattern of thoughts, feelings, and behaviour. Five big personality traits (Big 5 traits) that related to aggressive driving such as neuroticism, extraversion, openness, agreeableness, and conscientiousness.
Ibrahim, Ismail, Halim and Amit (2015)	Neuroticism is a personality trait that is defined as an inclination to experience negative emotions and difficulty in dealing with problems.
Baptiste (2018)	Extraversion is a personality trait that reflects social relations, the need for stimulation and the capacity to experience positive emotions.
Fang and Zhang (2014)	Extraversion has also been shown to be connected with physical aggression toward other drivers that might cause road accidents.
Judge and Zapata (2014)	Openness towards an experience is defined as an active need for a novel experience and a tolerance of things that are unknown and novel
Gowda, Rangaswamy and Rudresh (2016)	Agreeableness is a personality trait that reflects an individual's relationships with and attitudes about other people
Qu, Ge, Jiang, Du and Zhang (2014)	Conscientiousness is defined as the extent of a motivation behavior directed towards a goal

Sensation Seeking
Zuckerman (1990) defined sensation seeking as a personality trait involving the degree to which one desires novel and intense stimuli as it is another factor that has received considerable attention for its role in driving behavior. Holmes, Hollinshead, Roffman, Smoller and Buckner (2016) had revealed the extended

definition of sensation seeking which is seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences. As a result, those high in sensation seeking are assumed to engage in aggressive driving to provide the type of stimulation that they find pleasurable. High sensation seeking might have been related to some aggressive driving acts such as speeding, passing in no-passing zones, and a variety of other unsafe driving behaviours (Rahemi, Ajorpaz, Esfahani & Aghajani, 2017). Table 5.4 summarizes the reviews of sensation seeking towards aggressive driving behavior.

Table 5.4
Summary of reviews on sensation seeking.

Authors	Findings
Zuckerman (1990)	Personality trait involving the degree to which one desires novel and intense stimuli as it is another factor that has received considerable attention for its role in driving behaviour.
Holmes, Hollinshead, Roffman, Smoller and Buckner (2016)	Seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences.
Rahemi, Ajorpaz, Esfahani and Aghajani (2017)	High sensation seeking might have been related to some aggressive driving acts such as speeding, passing in no-passing zones, and a variety of other unsafe driving behaviours.

Types of aggressive driving

Speeding
Speeding is the most common driving offence and contributed in many crashes among young drivers. Speeding is defined as a driver was offending the speed limit, exceeding or driving too fast for conditions contributed to the crash (NTSHA, 2017). A study from Yildirim-Yenier, Vingilis, Wiesenthal, Mann and Seeley (2016) showed that 39 percent of male driver age between 15 and 20 were involved in fatal crashes while speeding at the time of crash. They always drive at high speed lead to lose control over the vehicles. On top of that, speeding is the third contributor to traffic accidents.

Researchers have indicated that speeding is a very dangerous driving behaviour and should be considered one of the most important contributors to specific kinds of accidents such as right of way violations, active shunts or reversing, and loss of control (Rusu, Sarbescu, Moz & Stancu, 2017). In particular, Fai (2015) and Plankermann (2014) discovered that majority of young male drivers were involved in excessive speeding behaviours because of running late, not paying attention to the speed, keeping up with the flow of traffic, and enjoying the thrill of driving fast.

Red-Light Running (RLR)
Red-light running (RLR) is one of the most aggressive driving behaviours and occurs frequently in urban areas. Based on RTD of Malaysia (2018), RLR was defined in two ways. The first one was under a "permissive yellow" rule that a driver could legally enter the intersection during the entire yellow interval. In this case, RLR refers to a violation when a driver entered an intersection after the onset of a red light. The other rule was "restrictive yellow" that a driver could neither enter nor be in the intersection on a red light. Under this situation, RLR refers to a violation when a driver had not cleared intersection after the onset of a red light. Researchers have conducted many studies to investigate the habit of RLR among young drivers. For example, Jahangiri, Rakha and Dingus (2016) found that the red-light runners were always young drivers aged below 25 years old. Furthermore, Yan, Li, Zhang and Hu (2016). indicated that red-light runners were more likely to be young males with invalid driver's licenses and had alcohol consumptions; in particular, those who were deviant and driving after drinking were more likely to run red-light at night. In a later study, Zhang, Wang, Wang, Feng and Du (2016). argued that RLR rates were related to the size of the intersection, traffic volume, time of day, safety belt use, and ethnicity. Also, Huang, Chiu, Tsai, Kuo, Lee and Wang (2016) demonstrated that violators were more likely to drive alone and in a hurry. They also found that a driver's characteristics, attitudes, and the presence of passengers were important predictors of RLR behaviour. Recently, Elmitiny, Yan, Radwan, Russo and Nashar (2016) also showed that moving speed, vehicle's distance from the intersection, and positions in the traffic flow were significantly associated with RLR.

DISCUSSION

The literature regarding the concept of aggressive driving behaviour in the context of Malaysian drivers was reviewed. A synthesis of the reviews in the previous researches have identified three factors that influence aggressive driving, such as driving anger, driver's personality and sensation seeking. However, it should be noted that there may be combination of several other factors that could lead to driver aggressiveness on the road. The three main factors are driving anger, driver's personality and driver's sensation seeking. Some of the literatures reviewed young drivers have the greater sensitivity to become angry easily when they confront with annoying situations on the road (Deffenbacher, Stephens & Sullman, 2016; Kovacsova, Lajunen & Roskova, 2016). Young drivers will express their anger towards the other driver by conducting aggressive driving actions such as honking, tailgating or overtaking dangerously in order to get rid from annoying situations. In addition, literatures also reviewed that young drivers are more prone to road accidents rather than old drivers (Stephens & Sullman, 2015). Furthermore, the well-known instrument to measure driving anger, the Driving Anger Scale (DAS) that was developed by Deffenbacher, Oetting and Lynch (1994). In deep, DAS is used to measure physically driving anger expression, verbally driving anger expression and use of the vehicle to express anger.

Regarding the driver's personality traits, literatures discovered that of the five personality traits, agreeableness, extraversion and conscientiousness are strong predictors of aggressive driving outcomes. Individual with low levels of agreeableness shows have high levels of aggressive driving outcomes such as speeding and red light running (Chraif, Anitei, Burtaverde & Mihaila, 2016). In addition, it is known that young people are tend to have less driving experience that will lead to low agreeableness while driving and more prone to accidents and receive more fines than people from other age groups. On the other hand, extraversion has been predicted to have positive relationship with aggressive driving (Dahlen, Edwards, Tubre, Zyphur & Warren, 2012). For instance, individuals characterized by high extraversion are prone to behave aggressively when driving, increasing the risk that they will be involved in accidents, frequently receive summons or have their licenses suspended. In busy traffic, conditions and situations that induce stress are generated. Due to low tolerance to stress, people with high extraversion choose to behave aggressively. Of the Big 5 traits, conscientiousness also could be a predictor of aggressive driving as individuals characterized by low conscientiousness manifested increased aggression when driving (Chraif et al., 2016). These people generally do not follow the rules and are characterized by an erratic lifestyle which transposes into their driving behavior. When driving, these people are rebellious and disorganized, and have an aggressive driving style, which often leads to the occurrence of accidents or violations of traffic rules. Meanwhile, neuroticism and openness will be not predicting aggressive behaviour among young drivers.

Finally, the literature regarding sensation seeking was reviewed. Rahemi, Ajorpaz, Esfahani and Aghajani (2017) found that most of the sensation seekers are young drivers aged 18 to 25 years old and was initiated to be associated with a range of aggressive driving behaviours including speeding or passing in no-passing zones. This is consistent with the findings of Oppenheim Oron-Gilad, Parmet and Shinar (2016) in which a statistically significant relationship between sensation seeking and aggressive driving behaviour.

CONCLUSION

As a conclusion, this paper provides an extensive knowledge on factors that influenced the driving behaviour in Malaysia. The literature indicated three factors that can influence a driver to be aggressive while driving such as driving anger, driver's personality traits and sensation seeking. Although, these three factors have been shown significantly influence aggressive behaviour, there are still considerable questions regarding the extend to which each of the factors interrelated with other factors that have not been studied yet such as lifestyle or economic background. As such, investigating these new factors is a promising research area.

Considering the review on research on aggressive driving and the limitations outlined above, it is expected that this paper will enhance understanding of the factors underpinning the aggressive driving behaviour. Furthermore, it is expected that the extensive literature review will enable to highlight the aspect to which

intervention could be done to reduce the road accidents involving aggressive drivers.

REFERENCES

Al-Reesi, H., Ganguly, S.S., Al-Adawi, S., Laflamme, L., Hasselberg, M., Al-Maniri, A., (2012). Economic growth, motorization and road traffic injuries in the Sultanate of Oman, *Traffic Injury Prevention.* http://dx.doi.org/10.1080/15389588.2012.694088. Available: http://www.nhtsa.gov/Aggressive.

Baptiste, B. A. M. (2018). The Relationship Between the Big Five Personality Traits and Authentic Leadership. (Doctoral Dissertation).

Berkowitz, L. (1993). Aggression: Its Causes, Consequences, and Control. *Aggressive Behavior, 20*(6), 464–466.

Bukit Aman Traffic Investigation and Enforcement Department. (2016). *Statistics of road accidents for motorcycle vehicles in Malaysia.* Polis DiRaja Malaysia.

Chraif, M., Dumitru, D., Aniței, M., Burtăverde, V., & Mihăilă, T. (2016). Developing of an English Version of the Aggressive Driving Behavior Test (AVIS). Improving the Construct Validity of Aggressive Driving. *Current Psychology*, *35*(1), 29-38.

Costa Jr. P. T., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO–PI-R) and NEO five factor inventory (NEO–FF-I) professional manual.* Odessa, FL: Psychological Assessment Resources.

Dahlen, E. R., B. D. Edwards, T. Tubré, M. J. Zyphur, and C. R. Warren. 2012. "Taking a driving." Accident Analysis and Prevention 45: 1–9.

Deffenbacher, J. L., Oetting, E. R., & Lynch, R. S. (1994). Development of a driving anger scale. *Psychological Reports, 74*, 83–91.

Deffenbacher, J. L., Stephens, A. N., & Sullman, M. J. M. (2016). Driving anger as a psychological construct: Twenty years of research using the Driving Anger Scale. *Transportation Research Part F: Traffic Psychology and Behaviour, 42* (2), 236 – 247.

Elmitiny, N., Yan, X., Radwan, E., Russo, C., & Nashar, D. (2016). Classification analysis of driver's stop/go decision and red-light running violation. *Accident Analysis and Prevention*, *42*, 101–111.

Fai, L. C. (2015, May 25). Miros statistics say human error causes 80% of traffic accidents. *theSun Daily*. Retrieved from http://www.thesundaily.my/news/1333889.

Fang, H., & Zhang, S. (2014). A structural model of enterprise managers' tacit knowledge and personality trait. *Social Behaviour and Personality, 42*(5), 783-798. doi:10.2224/sbp.2014.42.5.783.

Gowda, S., Rangaswamy, N., & Rudresh, H. B. Personality correlates of accident proneness in truck drivers passing by one of the state highway of India. International Journal of Community Medical Public Health, 3, 1841 - 1846.

Holmes, A. J., Hollinshead, M. O., Roffman, J. L., Smoller, J. W., & Buckner, R. L. (2016). Individual differences in cognitive control circuit anatomy link sensation seeking, impulsivity, and substance use. *Journal of neuroscience*, *36*(14), 4038-4049.

Huang, K. S., Chiu, P. J., Tsai, H. M., Kuo, C. C., Lee, H. Y., & Wang, Y. C. F. (2016). Redeye: preventing collisions caused by red-light running scooters with smartphones. *IEEE Transactions on Intelligent Transportation Systems*, *17*(5), 1243-1257.

Ibrahim, N., Ismail, R., Halim, M. R. T. A., & Amit, N. (2015). Personality, high-risk activities and aggressive behaviour among illegal street racers. *Mediterranean Journal of Social Sciences*, 6 (5), 527-535.

Jahangiri, A., Rakha, H., & Dingus, T. A. (2016). Red-light running violation prediction using observational and simulator data. *Accident Analysis & Prevention*, 96, 316-328.

Judge, T. A., & Zapata, C. P. (2014). The person-situation debate revisited: Effect of situation strength and trait activation on the validity of the Big Five personality traits in predicting job performance. *Academy of Management Journal, 58*(4), 1149-1179. doi:10.5465/amj.2010.0837.

King, Y., & Parker, D. (2008). Driving violations, aggression and perceived consensus. *Revue Europeenne De Psychologie Appliquée 58*, 43–49.

Kovacsova, N., Lajunen, T., & Roskova, E. (2016). Aggression on the road: Relationships between dysfunctional impulsivity, forgiveness, negative emotions, and aggressive driving. *Transportation Research Part F*, 42, 286 – 298.

Manan, M. M. A., & Várhelyi, A. (2012). Motorcycle fatalities in Malaysia. *IATSS Research, 36* (1), 30–39. http://dx.doi.org/10.1016/j.iatssr.2012.02.005.

National Highway Traffic Safety Administration (NHTSA). 2017. "*Aggressive driving.*"

Oppenheim, I., Oron-Gilad, T., Parmet, Y., & Shinar, D. (2016). Can traffic violations be traced to gender-role, sensation seeking, demographics and driving exposure?. *Transportation research part F: traffic psychology and behaviour, 43*, 387-395.

Ozkan, T., & Lajunen, T. (2005). Why are there sex differences in risky driving? The relationship between sex and gender-role on aggressive driving, traffic offences, and accident involvement among young Turkish drivers. Aggressive Behavior, 31, 547–558.

Plankermann, K. (2014). *Human factors as causes for road traffic accidents in the Sultanate of Oman under consideration of road construction designs*. PhD Thesis. University of Regensburg.

Qu, W., Ge, Y., Jiang, C., Du, F., & Zhang, K., (2014). The Dula Dangerous Driving Index in China: An investigation of reliability and validity. *Accident Analysis Prevention, 64* (0), 62 - 68.

Rahemi, Z., Ajorpaz, N. M., Esfahani, M. S., & Aghajani, M. (2017). Sensation-seeking and factors related to dangerous driving behaviors among Iranian drivers. *Personality and Individual Differences, 116*, 314-318.

Road Transportation Department of Malaysia (2018). *Transport Statistic Malaysia.*

Rusu, A., Sârbescu, P., Moza, D., & Stancu, A. (2017). Implicit attitudes towards risky driving: Development and validation of an affect misattribution procedure for speeding. *Accident Analysis & Prevention*, *100*, 15-22.

Simons-Morton, B., Li, K., Ehsani, J., & Vaca, F. E. (2016). Covariability in three dimensions of teenage driving risk behavior: Impaired driving, risky and unsafe driving behavior, and secondary task engagement. *Traffic injury*

prevention, *17*(5), 441-446.

Stephens, A. N., & Sullman, M. J. (2015). Trait Predictors of Aggression and Crash-Related Behaviors Across Drivers from the United Kingdom and the Irish Republic. *Risk analysis*, *35* (9), 1730-1745.

Yan, F., Li, B., Zhang, W., & Hu, G. (2016). Red-light running rates at five intersections by road user in Changsha, China: An observational study. *Accident Analysis & Prevention*, *95*, 381-386.

Yildirim-Yenier, Z., Vingilis, E., Wiesenthal, D. L., Mann, R. E., & Seeley, J. (2016). Relationships between thrill seeking, speeding attitudes, and driving violations among a sample of motorsports spectators and drivers. *Accident Analysis & Prevention*, *86*, 16-22.

Zhang, W., Wang, K., Wang, L., Feng, Z., & Du, Y. (2016). Exploring factors affecting pedestrians' red-light running behaviors at intersections in China. *Accident Analysis & Prevention*, *96*, 71-78.

Zuckerman, M., (1990). The psychophysiology of sensation seeking. *Journal of Personality, 58,* 313–345.