

Analysis of Drivers' Characteristics Concerning Speeding Behavior and Crash Involvement in Oman

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Abstract- This study aims to identify the significance of driver's socioeconomic demographics (SEDs) in the decision to speed and crash involvement. A questionnaire was designed consisting of a driver's SEDs, speeding propensity, and crash experience. This questionnaire was conducted with the students and employees of the University of Nizwa and other drivers at the selected locations. A total of 604 usable samples were obtained. Simple frequency distribution and discriminant multivariate analysis were conducted on the driver's responses. Survey results revealed that about 47.7% of the drivers have experienced a crash. The driver's gender nationality, profession, age, type of vehicle drive, driving experience, and past crash experience are significant attributes of the driver's speeding behavior. Ordered probit analysis for speeding behavior and simple probit regression analysis for crash involvement was conducted. The male drivers and those who are under the age of 30 years and have driving experience of more than 3 years have more likelihood to exceed the speed limits than other drivers. Similarly, the driver's gender, age (≤ 30 years), and those who are employees have a significant correlation with the propensity of crash involvement. Male and young drivers have more likelihood to be involved in a crash.

Index Terms-- Crashes, Drivers, Questionnaire Survey, Speeding Behavior

I. INTRODUCTION

The driver's risky driving behavior results in Road Traffic Crashes (RTCs). Almost 1.35 million people die each year in road traffic crashes [1]. More than half of the road traffic-related deaths are pedestrians, cyclists, and motorcyclists, and road crashes related injuries are the main cause of death among road users aged between 5-29 years old [1]. According to the World Health Organization (WHO) safety report 2018, there are around 16.1 deaths per 100,000 of the population in Oman [2]. Most of the deaths have accounted for drivers of four-wheeled cars and light vehicles (36%), passengers of four-wheeled cars and light vehicles (29%), (23%), and others (12%) [2]. The main reasons for RTCs in Oman include speeding, wrong overtaking, carelessness, and bad driving behaviors and the majority of those crashes happened due to collision between vehicles [3]. Risky driving behaviors include speeding, wrong overtaking, and careless driving. Despite heavy speed enforcements, still, there is an existence of drivers who exceed the speed limits. Speeding is responsible for about 70% of the traffic crashes, deaths, and injuries [4]. Most of the road crashes occur due to speeding behavior and negligence of drivers. The crashes resulted due to over speeding usually involve more fatalities and severe injuries. There is a need to develop some policy measures to consider specific characteristics of drivers to tackle the speeding behavior and improve the safety conditions on roads.

In Oman, the young people make a major share of the reported injuries and fatalities, and male young drivers dominate in this category [5], [6]. Speeding, inexperience, and nighttime driving are the main risky driving attributes of crashes and fatalities [6]. The young drivers are especially influenced by others (e.g. friends, peers, family members) with whom they have interacted and sometimes risky driving behavior is the projection of perceived social influence [7]. The result of a study revealed that errors and aggressive violation of traffic rules, and record of traffic offenses are the main risky factors of road crashes among university students [8]. Speeding is a dominant risky behavior on roads among young Omani drivers [9]. Driver's distraction is a significant predictor of driver's crash involvement in Oman [9], [10]. Gender, age, and experience have a strong effect on attitudes towards traffic violations and risky driving behavior in Oman [11].

Most of these studies in Oman focus on general risky driving behavior and the significant factors contribute to it. Speeding is one of the major risk-taking behaviors and responsible for the majority of road crashes, deaths, and severe injuries. It is required to determine the significance of the driver's personal and driving characteristics in their decision to speed and crash involvement. Therefore, this study aims to identify the underlying personal and driving characteristics of drivers concerning speeding and crash experience. A self-reported questionnaire survey was designed and conducted with the University of Nizwa students and employees and other drivers

at selected locations. The collected data were analyzed using discriminate multivariate analysis. The remaining paper has been organized in the following manner. Relevant literature has been discussed in section. Research methods have been discussed in section and survey and analysis results are presented in section 4. Key findings and their implications are summarized in the last section.

II. LITERATURE REVIEW

Several factors influence the driver's propensity to speed and being involved in a crash. The drivers who tend to speed and be involved in traffic crashes are mainly male, unbelted, unlicensed, and who drive old vehicles [12]. A study revealed that gender, single marital status, greater experience of driving, crash experience, and leisure purpose of traveling are strong predictors of drivers' decision to speed [13]. The driver's attributes such as gender, car ownership, and attitudes are significant in predicting their speeding intentions and behavior [14]. The driver's attitudes towards speeding, subjective beliefs and social pressure, control beliefs, and specific personality traits are strong predictors of their speeding behavior and crash propensity [15]–[18]. The personality traits differ across gender and influence the driving styles of students in Oman [19]. A study reported the significance of personal attributes such as age, gender, income, job type, and driving attributes such as experience, vehicle engine size, and taxi ownership in speeding behavior and crash involvement [20]. Male drivers in the high-income group and experienced drivers tend to drive at higher speeds in comparison to other drivers [21]. Drivers tend to speed more on weekdays and weekend nights, and male drivers speed more than female drivers [22].

Numerous factors contribute to the crashes of young drivers such as gender, age, driving experience, level of driving skills, and social factors [23]. Drivers' characteristics such as inexperience, poor driving skills, and risk-taking behavior are underlying factors of young drivers' involvement in road crashes [24]. A study in Tabuk city showed that drivers with higher education and higher experience are involved more in traffic crashes and young drivers of less than 30 years of age have been involved in more than 60% of the road crashes [25]. The driver's age and gender, traffic exposure, and time of the day have a strong correlation with a higher risk of a crash experience [26], [27]. There are significant differences in risk-perceptions of traffic violations among drivers of different characteristics [28]. The age of the driver, poor driving skills, speeding, and frequency of driving was significantly related to traffic violations and crashes [18]. The occupants of light-vehicles on two-way roads tend to encounter more severe injuries than those travelers who are on heavy-vehicles on one-way roads. Women tend to suffer more from serious injuries than men [29]. The driver's greater experience has a positive effect in diminishing driver crash involvement, while traffic violations, change of job, and earlier crash experience has a negative influence [30]. The likelihood of being involved in an crash is high for those drivers who are young or old, males, and drivers with speeding violations and recent

history of crash experience [31]. Non-usage of a restraint device and speeding intentions are the most significant factors influencing the severity of crashes [32].

The presented literature has shown that numerous socio-economic and driving characteristics of drivers affect their decision to speed and their likelihood to be involved in a crash. The influencing nature of significant factors may be different under different infrastructural, legal, economic, and social constraints. The drivers of different regions possess unique driving and demographic characteristics which greatly affect their risk-taking behavior. Therefore, this study attempts to identify significant demographic and driving aspects that affect their speeding behavior and crash involvement in Oman.

III. DATA COLLECTION AND ANALYSIS METHODS

A. RESEARCH FRAMEWORK

A block diagram of research workflow is shown in Fig. 1. The main research elements included questionnaire design, survey in the field, data analysis and interpretation, and conclusions and recommendations.

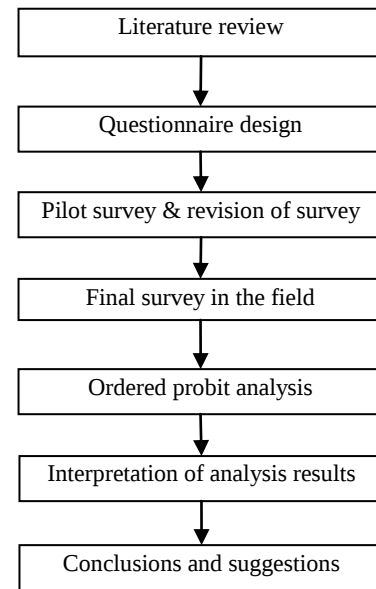


FIGURE 1: A systematic diagram of research workflow

B. QUESTIONNAIRE DESIGN AND SURVEY

An objective-oriented questionnaire was designed consisting of two parts. The first part included questions related to SEDs of drivers such as age, gender, marital status, profession, driving experience, and type of vehicle drive. Each characteristic was divided into different categories to record the responses. The second part consisted of statements related to the driver's experience of a crash in general and due to speeding and observation of other driver's crash. In this part, drivers were asked to report "how fast do you usually drive than the posted speed limit?" Drivers were supposed to show their responses on four pre-designed categories i.e. (1) at the posted speed limit,

(2) 5-10 km/hr more than of posted speed limits, (3) 10-15 km/hr more than of posted speed limits, and (4) more than 15 km/hr of posted speed limits. These ranges of exceeding the speed limits were decided considering the local practice of permissible allowance for the drivers to exceed the speed limits and consider it a speed violation by the police.

This survey was conducted with the students and staff of the University of Nizwa and at other selected locations on roads. It was hypothesized that it was easy to get desired samples of driver's population at the designated locations. The drivers were selected randomly and a convenience-based sampling strategy was adopted considering the convenience of the drivers. All the drivers were monitored carefully during the survey to ensure the reliability of the collected information. A total of 604 usable samples were obtained.

C. DATA ANALYSIS SPECIFICATIONS

The collected data were analyzed using the Ordered Probit (OP) regression analysis. The ordered regression analysis is applicable when the outcome or objective variable has been measured on an ordinal scale or categories have been organized in a specific order [33], [34]. In the present study, the driver's speeding behavior was expressed as an ordinal variable because the driver's propensity to exceed speed limits was arranged in the order of increasing speed (for example; at the posted speed limit (0), 5-10 km/hr more than of posted speed limits (1), 10-15 km/hr more than of posted speed limits (2), and more than 15 km/hr of posted speed limits (3). The objective variable of the driver's crash involvement was defined as not experience a crash (0) and experienced a crash (1). In the crash involvement model, the simple probit regression analysis is applicable as the objective variable of crash involvement has only two values or outcomes. All the explanatory or independent variables were coded as binary (0, 1) variables for modeling purposes. The ordered regression analysis provides a parameter estimate against '0'; therefore, all the explanatory variables were defined to test the correlation of a particular driver's characteristics with speeding behavior and crash involvement.

IV. ANALYSIS OF RESULTS

A. DESCRIPTION OF DRIVERS' CHARACTERISTICS

The distributions of the driver's personal and driving characteristics are presented in Table 1. This distribution shows that most of the respondents are under the age of 30 years. Around 90% of the respondents are Omanis, and male drivers account for 63.6% of the samples. The majority of the respondents have a single marital status. The employees and students made 54.2% and 30.5% share of the sample, respectively. About 75.5% are drivers of private cars and the remaining driver buses, trucks, and other kinds of vehicles. Most of the drivers have driving experience of more than 5 years. Figure 2 shows that around 288 drivers have experienced a traffic crash and 347 have observed the crash of other drivers. It shows a high number of crashes in the collected sample. Fig.

3 shows that 39% of the drivers reported driving at the posted speed limits, 35% drive at 5-10 km/hr more than of posted speed limits, 17% drive at 10-15 km/hr more than of posted speed limits, and 9% drive more than 15 km/hr of posted speed limits. These results depict that there is a high trend of exceeding the speed limits among drivers with different ranges.

TABLE I: DISTRIBUTION OF DRIVER'S CHARACTERISTICS

Characteristics	Distribution (%)
Age (years)	Age $\leq$ 20 (21.2), 21-30 (55.5), 31-40 (20.0), above 40 (3.3)
Nationality	Omani (90%), Non-Omani (10%)
Gender	Male (63.6), female (36.4)
Marital status	Single (56), married (44)
Profession	Student (30.5), employees (54.2), professional drivers (10.7), others (4.6)
Type of vehicle drive	Car (75.5), bus (11.4), truck (8.3), others (4.8)
Driving experience	Less than 1 year (14.9), 1-2 years (25.0), 3-5 years (14.6), more than 5 years (45.5)

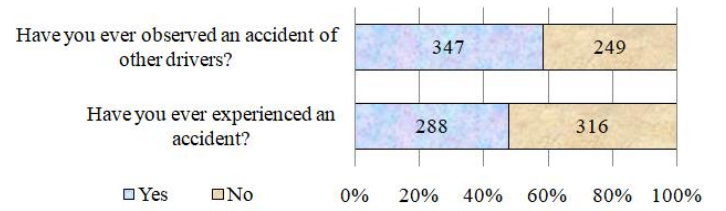


FIGURE 2. Driver's crash experience and observation

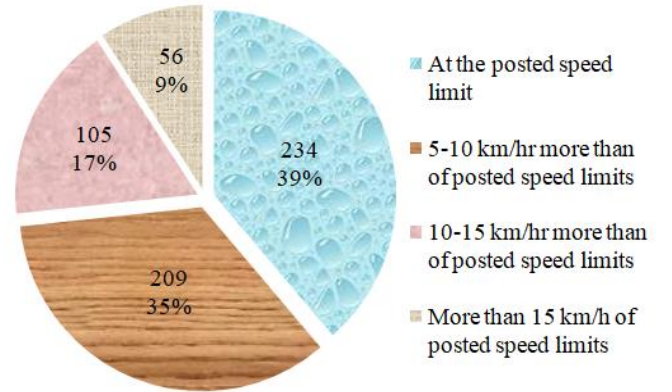


Figure 3. Driver's responses distribution on the speeding propensity

B. PROBIT REGRESSION ANALYSIS

The regression analysis was conducted using the probit function. The explanatory or independent variables were coded as binary variables. For example, gender (0 if a driver is male, otherwise is 1), nationality (0 if a driver is Omani, otherwise is 1), type of vehicle drive (0 if a driver is a driver of a car, otherwise is 1), profession (0 if a driver is an employee, otherwise is 1), age (0 if a driver is $\leq$ 30 years, otherwise is 1), experienced drivers (0 if the driving experience is more than 3 years, otherwise is 1), and crash experience (0 if a driver has experienced a crash, otherwise is 1).

a. SPEEDING BEHAVIOR MODEL

The results of the OP model of driver's speeding behavior propensity are presented in Table 2. The estimate of gender as

male drivers with speeding behavior propensity is positive and highly significant. It shows that male drivers have a high likelihood to exceed the speed limits. This result is consistent with the results of other studies in terms of traffic violations [13], [19], [35]. The Omani drivers and those who drive cars in the sample have a low probability to exceed the speed limits as the parameter coefficients are negative and significant. The variable of age (i.e. ≤ 30 years) has a positive and significant correlation with the speeding behavior. It shows that these age group drivers who are usually young tend to exceed the speed limits more in comparison to other drivers. Young drivers generally have more likelihood to speed [25], [36]. The drivers possessing experience of more than 3 years tend to exceed speed limits more as the parameter coefficient is positive and significant at a 5% level of significance. It means that as some of the drivers gain more experience they tend to become speedy drivers, and this propensity is high among male and young drivers [36]. Private vehicle drivers who work at different institutions have a negative correlation with speeding behavior, which predicts a low likelihood of speeding among employees. The drivers speeding propensity and crash experience are strongly related to each other. It shows that the likelihood of crash involvement increase when drivers exceed the speed limits.

TABLE II

ORDERED PROBIT MODEL RESULTS OF DRIVER'S SPEEDING BEHAVIOR

	Driver's speeding behavior propensity			
Explanatory variables	Estimate	Standard Error	Wald	Significance (p-values)
Gender (male drivers)	0.466	0.100	21.722	0.000
Nationality (Omani)	-0.181	0.160	3.271	0.060
Type of vehicle drive (car drivers)	-0.339	0.117	8.402	0.004
Age (≤ 30 years)	0.181	0.122	4.209	0.037
Experienced drivers (experience = 3+ years)	0.179	0.108	4.738	0.048
Profession as employees	-0.134	0.109	3.519	0.098
Crash experience	0.618	0.102	36.759	0.000
Model fitting information				
-2 Log Likelihood	Intercept	638.446		
	Final	531.447		
	Chi-Square	106.999		
	Degree of freedom	7		
	Significance	0.000		
Pseudo R-Square				
	Cox and Snell	0.232		
	Nagelkerke	0.217		
	McFadden	0.170		

The values of model fitting parameters such as likelihood ratios and Pseudo R-Square show that the estimated model results have an acceptable level of reliability [34], [37]. These results imply that the male, young and experienced drivers are more likely to exceed the speed limits and to be involved in a crash due to speeding. The traffic safety policies should focus on altering driving patterns of young age groups to control speeding culture on roads.

b. CRASH INVOLVEMENT MODEL

The probit modeling results of the driver's crash involvement are presented in Table 3. The variable of gender has a positive and highly significant correlation with the driver's likelihood of being involved in a crash. It shows that male drivers have more crash risks than female drivers. The drivers who are under 30 years of age have more likelihood of crash involvement as the parameter estimate is positive and significant. The young drivers usually tend to take more risks while driving, therefore, have more probability of being involved in a crash [9], [32]. The variable of the profession has a negative coefficient with the driver's crash involvement likelihood which depicts that the drivers who are employees have a less propensity of crash experience. These drivers are usually more educated and well aware of the negative consequences of a crash. Therefore, they tend to be more careful than other drivers, which make them safer drivers. Other studies have also reported significant correlations of driver's education and training on their crash involvement [38], [39]. It has positive implications in deriving safety policies. The indices of fitting parameters show an acceptable level of probit modeling results in predicting the driver's crash risks under the significance of selected driver's characteristics.

TABLE III

SIMPLE PROBIT MODEL RESULTS OF THE DRIVER'S CRASH INVOLVEMENT

		Driver's crash involvement			
Explanatory variables		Estimate	Standard Error	Wald	Significance (p-values)
Gender (male drivers)		0.587	0.125	22.019	0.000
Nationality (Omani)		0.223	0.201	1.224	0.269
Type of vehicle drive (car drivers)		-0.133	0.142	.879	0.348
Age (≤ 30 years)		0.279	0.156	3.208	0.073
Experienced drivers (experience = 3+ years)		-0.030	0.131	0.053	0.819
Profession as employees		-0.282	0.133	4.532	0.033
Model fitting information					
-2 Log Likelihood	Intercept	196.384			
	Final	149.309			
	Chi-Square	47.074			
	Degree of freedom	6			
	Significance	0.000			
Pseudo R-Square					
	Cox and Snell	0.175			
	Nagelkerke	0.118			
	McFadden	0.166			

V. CONCLUSIONS

This study attempted to identify the significant correlation of driver's characteristics with their likelihood to speed and be involved in a crash. Descriptive statistics revealed that there is a significant proportion of drivers who tend to exceed the speed limits, and around 47.7% of the drivers have been involved in an accident. Ordered probit analysis revealed that the driver's

gender, age, nationality, type of vehicle drive, profession, driving experience, and past crash experience are significant attributes of their speeding propensity. Past crash experience and propensity to exceed the speed limits are positively related to each other, which imply that the drivers who exceed the speed limits have more chances to be involved in a crash. Male drivers and those who are under the age of 30 years and have driving experience of more than 3 years have a high probability to exceed the speed limits. The driver's gender, age, and profession are significantly related to their likelihood to be involved in a crash, and this likelihood is more among males and drivers who are under 30 years of age. These findings implicate that there is a need to develop appropriate traffic policies to control the speedy drivers and reduce their crash risks. The main target group of policies should be young drivers as they have a more predicted probability of being involved in a crash. Traffic safety policies should focus on reducing the risks of young and male driver's involvement in road crashes. Proper awareness and training of drivers can help in changing their speeding attitudes and norms and driving culture on roads. There is also a need for heavy enforcement from the police to control the speedy drivers and reduce the rate of traffic crashes and related injuries and fatalities. The implementation of specific traffic management plans concerning to speedy is required. These plans may include installation of speed radars or cameras to monitor speedy drivers and punish the violators. An integration of soft policies with hard polices would be handy in controlling speed drivers and to change their attitudes and behaviors. For example, proper training and education of fresh and young drivers would help in developing control beliefs among driver and heavy enforcement of traffic fines through traffic police would help in controlling the speedy drivers. Through proper enforcement, the vehicles and driving license of speedy drivers may be confiscated for a specific duration. With this integrated, it would be possible to manage speedy drivers and reduce of risks of crashes. Future studies may focus on assessing the driver's specific attitudes and behavioral beliefs concerning risky driving behavior such as speeding.

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