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Determination and Analysis of Unreported Road Accidents in Riyadh, Saudi Arabia

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Abstract. The effectiveness and efficiency of any road safety policy measure depends directly on the availability and accuracy of the related data on which the safety measure is based. When a large portion of road accidents remains unreported, vital information concerning the characteristics of those accidents will also be lost. The choice of appropriate safety measures may, in turn, be adversely affected by this loss of data. This paper reports on the result of a research study undertaken to determine the extent, characteristics, and reasons for unreported road accidents in Riyadh. A stratified random sample of 2200 individuals were interviewed in person and data on their socio-economic traits as well as unreported road accidents and their costs were collected. Analysis of the data revealed that nearly 60 percent of road traffic accidents remained unreported. Individuals who frequently did not report their traffic accidents were found to be young, single, holding a driver's license and employed. People with no education reported the smallest number of their road accidents, and there existed a large variation in the distribution of unreported traffic accidents by different nationalities. The Chi-square test was applied to determine significant response variations. A methodology for the computation of unreporting accident potential is presented, and the cost characteristic of unreported accidents is analyzed. Measures to minimize the problem of unreported road accidents are discussed.

Intorduction

The tremendous growth in socio-economic activities and mobility in the Kingdom of Saudi Arabia over the last 15 years has been accompanied by an equally large increase in the number of road traffic accidents [1]. Statistics, although limited and incomplete [2], show that the number of road accidents, accident fatalities and injuries over the period 1971-1985 have increased by 700, 575 and 413 percent, respectively [3].

In the year 1984, the traffic fatality rate of nearly 30 fatalities per 100.000 population [2], was nearly 17 times higher than that of the United States [4]. The fatality

figure for the Kingdom represents only same day deaths. It does not include mortalities while receiving emergency care or during hospitalization. If the number of emergency facility and hospital deths is taken into account, the overall mortality rate would be close to double this Fig. [5].

A key ingredient for a successful road safety improvement program is the availability and the knowledge of basic facts about road accidents. In particular, certain essential pieces of information concerning the where, when, why and who of road traffic accidents are ncessary before any effective solution plan can be envisaged [6].

In the Kingdom of Saudi Arabia, the program of road traffic safety suffers not only from a substantial deficiency in the recording of reported road accidents [7,8], but also from the loss of data on a large number of traffic accidents which remains unreported. Since auto insurance remains an optional vehicle-owner decision, the majority of drivers in the Kingdom do not carry auto insurance. The claims in a large number of road accidents resulting in minor vehicle damages are therefore settled through driver agreements. Although, the traffic law in the Kingdom penalizes drivers (penalty depending on severity of accidents) for not reporting their accidents [9], the general attitude of enforcement officials with regard to this matter is rather flexible. While a general acknowledgement exists among the Kingdom's safety officials concerning the extent of unreported road accidents, no information is available on the magnitude, characteristics and reasons for not reporting the unreported traffic accidents.

The specific aims of this research study were to provide answers to the following questions:

a) What are the characteristics of Riyadh's drivers and their unreported road accidents?

b) What influences do drivers' socio-economic variables have on their reporting or not-reporting of road traffic accidents?

c) What are the reasons for unreported road accidents?

d) What is an estimate for the damage cost of unreported road accidents in Riyadh?

Data and Method of Investigation

In the absence of any reliable data on the size of the heterogeneous driver population in Riyadh, a sample size with a given desired accuracy level could not be calculated in advance for the study [10]. It was decided to select a large sample size in order to provide for a better understanding of the problem of unreported road accidents as well as to obtain a high level of sampling accuracy.

A stratified (by occupation) random sample of 2200 individuals in Riyadh were systematically selected and person-interviewed. The sample population included individuals from among the faculty/administration staff of King Saud University, college students from two universities and a technical college, sample employees from three ministries, samples from the private sector, and retail workers. In addition, a systematic random sample of individual heads of households was also person-interviewed. Individual samples were requested to fill in questionnaires. No name or identification was requested in the questionnaire and confidentiality of the reported information was emphasizaed.

Riyadh is strongly characterized as a metropolitan area with a heterogeneous driver population. Nearly 50% of drivers are Saudis and the remaining percentage includes individuals from more than 25 nationalities with varying sizes.

In order to obtain a statistically reliable sample size from among drivers in each nationality group, a significant expenditure of time and money resources would have been required for a random sample of household heads to be home-interviewed. To minimize these expenditures, it was decided to take advantage of the existence of a strong relationship between an expatriate individual's nationality and the type of occupation which he/she most likely holds in the Kingdom (*e.g.* skilled workers, male Philippinos; nurses, female Philippinos; maintenance laborers, Bangladeshis and Sri Lankans; etc.). The stratified (by occupation) random sampling technique was therefore selected to achieve these objectives.

The supplementary systematic random sample of individual heads of households (every nth house was visited), was mainly done, to ensure the representation of drivers with occupational categories not covered in the stratified random sampling plan. The zonal sample size was chosen in approximate proportion to the zonal area and its population density [11]. The systematic random sampling technique was chosen for its implementational simplicity.

A total of 2070 completed questionnaires (130 questionnaires contained missing information) was utilized and processed for analysis. The questionnaire included two categories of questions: socio-economic traits and unreported road accidents characteristics. In the first category, data on age, nationality, education, income, employment, marital status, car ownership and driver's licenses were collected. Data on unreported road accident characteristics (occurring during years of driving in Riyadh) such as time, type, cause, location and cost were addressed in the second category.

To ensure the accuracy of the interviewed data, a high degree of emphasis was applied to the anonymity of the individual sample (no name/no identification), and the confidentiality of the reported information. In addition an attempt was also made to verify the questionnaire data for its degree of accuracy. For the verification of socio-economic traits, data were compared with those of three recently performed

researches in Riyadh [1, 11, 12]. Results of these comparisons indicated that a close similarity existed among the socio-economic variables. However, no indenpendent verification of the sample's road accident data could be made due to the unavailability of comparable information and the sketchiness of the road accidents records of the enforcement officials [2, 7, 8].

The data were stored in the computer system of the College of Engineering. The Statistical Analysis Software (SAS), was utilized to process the data for the analysis.

The methodology followed for the achievement of the study objectives included formulation (work plan, objective clarification and literature search), search (sampling plan and data collection and reduction), explanation (data analysis), and evaluation of study findings.

Sampling Statistical Accuracy

Since the variances of the unreported accidents were also estimated from the sample data, the t-test was performed to determine the statistical accuracy and confidence limits of the sample interviewed data [12]. Results showed that with a sample size of N = 2070, at the 95% significance level ($\alpha = 0.05$, degrees of freedom, df = 2069 and t = 1.960), the expected error associated with the sample mean number of unreported road accidents ($\bar{X} = 1.4$) was 0.08. In other words with the sample size of 2070, we can be 95% confident that during his driving years in Riyadh an average individual did not report from 1.3 to 1.5 of his road accidents to traffic officials.

Results and Discussion

The result of the data analysis is presented under five separate headings. These include the general characteristics of the sample population, characteristics of unreported road accidents and their relationships with driver traits, the unreporting accident potential, the reasons for not reporting traffic accidents, and finally, the cost of unreported road accidents. Chi-square tests were also carried out to indicate that these relationships are not the outcome of chance. The paper concludes with a discussion on policy implications and conclusions.

General Sample Characteristics

The sample population of 2070 individuals included drivers from more than 20 nationalities, with a mean age of 29.4 years, a mean monthly income of SR 3300; 72.8 percent were employed and 89 percent possessed driver's licences. 54.5 percent of the sample population were married, 7.3 percent had no education, and on the average, sample individual had been driving for 7.4 years. The values of the characteristics of the sample driving population, followed closely those reported in three recent independent studies in Riyadh [1, 11, 12].

The sample population experienced a total of 5031 road accidents (over the average 7.4 years of driving in Riyadh), of which 2130 (42.3%) were reported to traffic officials. The remaining 2901 (57.7%) were not reported. These Figures show that an average individual in Riyadh was involved in 2.4 road accidents, 1.0 of which was reported and 1.4 remained unreported. The mean repair cost for an unreported road accident was nearly SR 650 ($ US 1 = SR 3.75). This finding also indicates that vital information concerning nearly 58 percent of road accidents which were not reported, remained absent from the files of traffic safety officials in Riyadh. Fig. 1 shows the distribution of the sample populations' road accidents and unreported accidents.

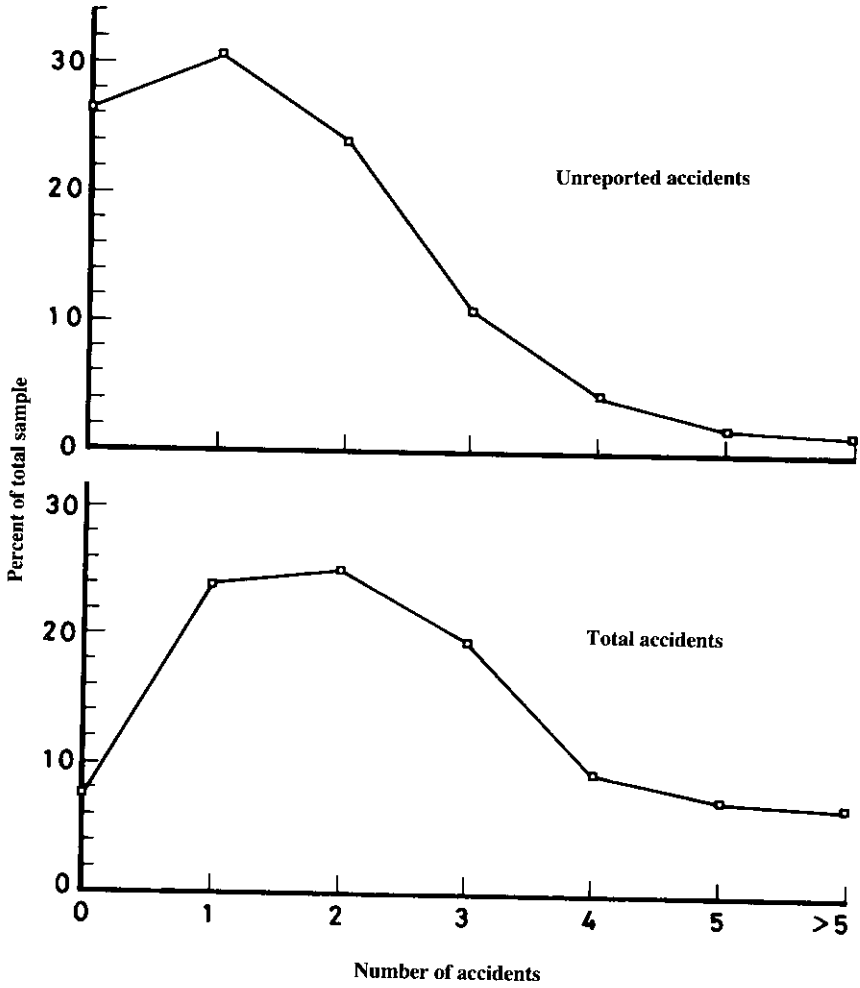

Fig. 1. Distribution of total and unreported road accidents of the sample population

Unreported Accident Characteristics and Driver Traits

The distributions of cause, time of day and location characteristics of unreported road accidents (as reported by the sample population) are given in Table 1. Also shown in the table, are the causes of reported road accidents taken from the files of traffic police officials [14].

Of particular importance with regard to the cause variable, is the large perentage of road accidents attributed to the fault of drivers (37.5%). If we also include the category of high speed, which is a direct result of a driver's neglect and disrespect for traffic rules (speed limit), plus a portion of the "combination" category, it becomes quite clear that more than 70 percent (76.7 percent as recorded by traffic police officials) of unreported accidents in Riyadh include the fault of the driver as a major contributing factor. This high contribution of drivers to the cause of road accidents undermines the importance and the necessity of a comprehensive driver education program as well as the need for increased and continuous levels of enforcement of road traffic rules in Riyadh. In spite of the continuous construction and maintenance activities performed on the street network of Riyadh over the last decade or so, the deficiencies related to the network were reported as the cause in only 10 percent of road accidents.

Another important point with regard to accident cause is the fact that in nearly 2% of unreported traffic accidents, pedestrians were involved. Since any road accident involving a vehicle and a pedestrian would most likely result in an injury for the pedestrian, it is therefore clear that some injurious traffic accidents are also not reported to enforcement officials.

Analysis of the time of unreported accidents indicated that the majority of these accidents occurred in the afternoon (Table 1). This is in conformity with the higher traffic volumes observed during afternoon peak hours [15]. The relatively low percentage of unreported night accidents, which also is in conformity with the percentage of reported accidents, highlights the important and positive role played by the strict prohibition of alcohol/drug consumption in the Kingdom on reducing the proportion of road accidents, especially at night. The night share of road accidents exceeds 50 percent in many European nations and North America [16].

Of the total number of unreported road accidents, more than 80 percent took place inside the city. Of this, more than 60 percent occurred at intersections. This high percentage of intersection accidents may be caused mainly by one or more of the following three factors: a high approach speed, non-compliance with traffic signs and signals regulations and deficiencies in geometric design standards. Improvement of sub-standard geometrics and increased presence of enforcement officials at intersections with high accident rates should improve the safety of road users in Riyadh.

Unreported accidents were also analyzed with respect to their results and repair costs. Findings, shown in Table 2, indicated that, in a surprising 7.2 percent of acci-

dents, an injury was involved. In addition to the 2 percent involving pedestrians, five percent of these unreported injurious road accidents included vehicle-occupants.

Table 1. Distribution of unreported and reported road accidents by cause, time and location

Variable	Unreported		Reported*	
	Frequency	Percent	Frequency	Percent
CAUSE				
High speed	856	29.5	11340	53.6
Driver fault	1088	37.5	4875	23.1
Vehicle fault	177	6.1	-	-
Network fault	290	10.0	-	-
Combination	264	9.1	-	-
Fixed object	168	5.8	1685	8.0
Pedestrian	47	1.6	972	4.6
Missing	11	0.4	-	-
Other	-	-	2263	10.7
TIME				
Morning	899	31.0	10798	51.0
Afternoon	1222	42.1		
Night	780	26.9	5880	27.8
Missing	-	-	4473	21.2
LOCATION				
Inside City:	2335	80.5		
Intersection	1411	60.0		
Street	924	40.0	15872	75.0
Outside City:	566	19.5	806	3.8
Missing	-	-	4473	21.2

* **Source**: Records of traffic police, reference [14].

Table 2 also shows that in nearly 50 percent of unreported road accidents, the mean damage repair cost was SR 500 or less. For another one-third of the road accidents, the repair cost ranged from SR 500 - 1000. These accidents may justifiably be grouped and classified as minor. However, the cost of repairing damages in 23 percent of the unreported accidents was more than SR 1000, with 10.5 percent of these exceeding SR 2000. These findings clearly indicated that not necessarily all the unreported road accidents were of the minor property-damage-only nature.

Table 2. Result and Cost Characteristics of Unreported Road Accidents

Variable name	Frequency	Percent
Result		
Vehicle damage	1921	92.8
Minor person injury	149	7.2
Cost (SR)		
< 200	476	23.0
200 - 500	538	26.0
501 - 700	351	17.0
701 - 1000	228	11.0
1001 - 1500	159	7.7
1501 - 2000	99	4.8
>2000	217	10.5

In order to determine the interrelationships between driver-related variables such as nationality, age, education, years of driving, marital status, the holding of driver's licenses and employment, with the number of unreported road accidents, two and three-way categorical analyses were performed on the data.

The heterogeneous driver population in Riyadh demonstrated a large variation in their rate of non-reporting road accidents. For example, Philippinos with a mean number of 1.7 road accidents - the lowest of all driver nationalities, also had the lowest rate (0.3) of unreported road accidents. Turks and Syrians on the other hand, with a mean number of 2.3 road accidents, had the highest non-reporting rate (2.3), by actually not reporting any of their road accidents to police officials. Saudi drivers, along with Indians, had the third highest rate of unreported road accidents. It should be recognized however, that a much more meaningful conclusion may be reached if the level of exposure (e.g. vehicle-mile of travel, VMT), for each nationality group was also known. It is quite possible, for example, that Philippinos may not drive as much as Syrians and therefore, may not be exposed to the same level of accident potential. Unfortunately, information on VMT in the Kingdom, is non-existent. These findings may, nevertheless assist in the development of methods and policies (in driver education programs) to improve drivers' attitudes toward the problem of not reporting road accidents. These policies may focus on individual drivers who have demonstrated a greater likelihood of not reporting their road accidents.

Analysis of data with respect to individuals' age indicated that, there was a gradual decrease in the mean rate of unreported road accidents with an increase in driver age. The maximum value was 1.7 unreported road accidents for individuals in the youngest age group (20 years or less). Drivers in the 55 years and over age group demonstrated a minimum rate of 1.4 unreported accidents per person. This finding

was also supported by the test of Chi-square ($\chi^2 = 57.1$, df = 24, significance level, $\alpha = 0.05$). This maturity-related (sense of responsibility) phenomenon is important especially when we consider the fact that involvement in more road accidents increases with an increase in age and/or years of driving (increase with time). The infrequent involvement in accidents of older individuals in Riyadh is consistent with these findings. These drivers began their driving careers only a few decades ago at a time when the trafic system in Riyadh was characterized by a small number of vehicles and limited kilometers of streets. With no traffic congestion, the likelihood for involvement in road accidents was therefore very low.

Analysis of unreported accidents involving minor person injuries showed that 14% of the minor injury accidents included drivers 20 years in age or less. 79% involved individuals ranging in age between 21-30 years. The remaining 7% included those in the 31-40 year age category. The preference of younger drivers for higher travel speed is further reinforced.

Sample individuals' years of driving experience also demonstrated a positive relationship with their mean number of unreported accidents. As years of driving increased, the mean number of unreported accidents also increased, as expected ($\chi^2 = 69.3$, df = 36, $\alpha = 0.05$). However, the rate of change in the number of unreported accidents (mean unreported accidents per driving year per driver) decreased with an increase in the years of driving, indicating as individuals became more experienced in driving (and developed greater maturity and sense of responsibility), their rate of involvement in road accidents decreased, and so did the rate of their failure to report their accidents. It is, therefore, safe to conclude that young individuals in Riyadh reported fewer road traffic accidents to enforcement officials when compared to their counterparts in older age categories.

The distribution of the sample population's mean unreported road accidents by the variables of driver's licenses, marital status, and employment indicated that while the difference in the mean unreported accidents was not substantial for the holders and non-holders of driver's licenses (1.56 vs 1.55), those for the single vs married groups (1.57 vs 1.24), were relatively large ($\chi^2 = 11.9$, df = 6, $\alpha = 0.05$).

Of particular importance was the result of a categorical analysis performed on the sample populations' education and unreported road accidents. It was found that individuals with no formal education had the highest rate of non-reporting (2.1 unreported accidents per drive) when compared with persons in other education categories. The mean number of unreported road accidents was 1.3 for individuals with elementary education, 1.1 for highschool graduates, and 1.7 for sample individuals with Junior College/College education ($\chi^2 = 52.7$, df = 18, $\alpha = 0.005$). The reason for the high rate of unreported road accidents for drivers with no formal education was thought to be a function of two factors. First, individuals with no education may be more likely to have more road accidents (and proportionally a higher number which may not be reported). This turned out to be true since their mean

number of road accidents was 3.1 - the highest of all other drivers. Second, these individuals may be less aware of the importance of the role which the reporting of road accidents plays in, among other things, the identification of accident locations, and the development of policy-measures to improve road safety. Again, in the absence of any exposure measure, this finding (the relationship between education and non-reporting) could not be further substantiated. However, a methodology for the development of unreporting accident potential, taking into account the variable "years of driving" as a measure of exposure, is presented in the subsequent section.

Analysis of correlations between individuals' socioeconomic traits and their unreported road accidents further reinforced the pattern of relationships existing among these variables. As presented in the correlation matrix (Table 3), although the correlation coefficients were small, all of the socio-economic variables of the sample individuals demonstrated appropriate relationships with the number of unreported road accidents occurring over the years of driving in Riyadh. For example, the variables age, education, employment, and marital status were all negatively correlated with the number of unreported accidents. This indicates that as age, for example, increased, the rate of unreported road accidents of an individual, decreased. As was previously discussed, drivers in the youngest age category ($\leq$20 years), had the highest rate of non-reporting.

Table 3. Correlation matrix between the socio-economic variables and unreported road accidents

Variable	Age	Education	Employment	Driver's licenses	Marital status	Income	Total road accidents	Unreported road acc.
Age	1.000	–0.241	0.353	0.097	0.636	0.511	0.335	–0.249
Education		1.000	–0.159	0.221	–0.228	0.156	–0.244	–0.116
Employment			1.000	0.071	0.498	0.477	–0.036	–0.159
Driver's licenses				1.000	0.063	0.136	0.004	0.021
Marital status					1.000	0.437	–0.125	0.267
Income						1.000	–0.006	–0.002
Total road accidents							1.000	0.563
Unreported road acc.								1.000

It is also interesting to note that of these variables, the factor of marital status had the highest correlation (negative) with non-reporting road accidents (married individuals reported more). This was followed by factors of age, employment and education. The variables of drivers' licenses and income, demonstrated little cause-

and-effect with an individual's frequency of failure to report his road accidents. The correlation coefficients also showed that as an individual's number of road accidents increased, his number of unreported accidents also increased.

Computing Unreporting Accident Potential

Any valid comparison of potential for unreporting road accidents among different groups of drives (road users), must take into account differences in road accidents (which are strongly a function of exposure), socio-demographic characteristics, patterns of driving, and so on. Exposure is usually best represented by mileage driven (vehicle-Mile of Travel, VMT). When the amount of VMT for individual drivers/road users is not known, comparison of their accident potential and/or potential for unreporting accidents, may not be truly representive. In the absence of any information on VMT, the variable "years of driving" may be considered as a measure of exposure for each individual driver. Given this, a particular group of road users (*e.g.* drivers with no formal education), may then be compared with drivers in other educational categories, with respect to their accident involvement potential, and/or potential for unreporting accidents.

For a group of drivers/road users, with homogeneous socio-demographic characteristics, a weighted mean road accidents (weighted by frequency) involvement ($\overline{WACC_i}$), a weighted mean unreporting rate ($\overline{WUN_i}$), and weighted mean "years of driving" ($\overline{WYD_i}$) may be computed as follow:

$$\overline{WACC_i} = \sum_{j=1}^{m} N_{ij}\,\overline{ACC_{ij}} \;/\; \sum_{j=1}^{m} N_{ij} \qquad (1)$$

$$\overline{WUN_i} = \sum_{j=1}^{m} N_{ij}\,\overline{UN_{iju}} \;/\; \sum_{j=1}^{m} N_{ij} \qquad (2)$$

$$\overline{WYD_i} = \sum_{j=1}^{m} N_{ij}\,\overline{YD_{ij}} \;/\; \sum_{j=1}^{m} N_{ij} \qquad (3)$$

where: N_{ij} is the number of drivers in the socio-demographic group i (i = 1,...,n), with j-years of driving experience (j=1,...,m),

$\overline{ACC_{ij}}$ is the mean number of road accidents of drivers in group i with j-years of driving.

$\overline{UN_{ij}}$ is the mean number of unreported accidents of drivers in group i with j-years of driving.

$\overline{YD}_{ij}$ is the mean number of years of driving of drivers in group i with j-years of driving.

The potential (likelihood) for accident involvement for a homogeneous group of drivers ($PACC_i$), may then be computed as follow:

$$PACC_i = W\overline{ACC}_i \quad / W\overline{YD}_i \tag{4}$$

Similarly, the potential for unreporting road accidents (PUN_i), can be computed as:

$$PUN_i = W\overline{UN}_i \quad / W\overline{YD}_i \tag{5}$$

Utilizing the sample population data, and equations 1-5, the potential for accident involvement and for unreporting road accidents were computed for drivers with different education levels. Results are presented in Table 4. Again, drivers with no formal education experienced the highest rate of accident involvement, and consequently, the largest number of unreported road accidents. Also important, is the fact that these individuals had the lowest weighted mean years of driving when compared to all other drivers in different educational categories.

Table 4. Road accident and unreporting accident rates of sample drivers with varied education

Education potential level (i)	Weighted mean No. of acc., $W\overline{ACC}_i$	Weighted mean No. of unrep. acc., $W\overline{UN}_i$	Weighted Mean years of driving, $W\overline{YD}_i$	Potential for acc. involve, $PACC_i$	potential for not reporting, PUN_i
No formal education	3.1	2.1	6.7	0.46	0.31
Elementary	2.3	1.3	7.7	0.30	0.17
High school	2.2	1.1	7.2	0.31	0.15
Institute & college	2.9	1.7	7.3	0.40	0.23

Repair Cost of Unreported Accidents

As mentioned earlier, the mean reported damage cost for an unreported road accident was SR 641. This figure is in accordance with expectations, since most of these accidents (92.8%) resulted in minor damage and consequently, in low repair costs. However, in 23 percent of these accidents, the damage cost exceeded SR 1000, and in fact, in 10.5 percent of these accidents, the cost was more than 2000 Saudi Riyals (more than US $ 533). Due to the large variation in accident damage cost, it was hypothesized that older, married, and employed individuals, due to their greater

experience and social responsibility, may demonstrate more care while driving. If these individuals, however, are involved in a road accident, its results will more likely be of a minor nature incurring minor repair costs. The opposite may be true of young people.

The result of a cross-classification analysis performed on driver age and damage repair cost of unreported accidents indicated that the largest percentage of high-cost accidents involved young adults 30 years in age or less. For example, the percentage of accidents costing more than SR 1000 to repair, was nearly 3 times higher for persons 30 years in age or less than that of the over 45-year old individuals, and in fact, more than 20 times that of older persons 50 years of age and more. Since the extent of damage, and subsequently the damage repair cost, is directly related to travel speed, the preference of young drivers for high travel speed is again, apparent from these findings.

This conclusion may be further supported by the cumulative frequency distribution curves of unreported road accident repair costs constructed for selected age groups. For example, as can be seen from Fig. 2, more than 95 percent of unreported accidents involving individuals of between 50-60 years in age cost SR 1000 or less to repair. The percentage (for the same repair cost category) for the 35-40 years and the 16-20 years age groups were 83 and 79, respectively. It is important to note, however, that the type of vehicles that individuals drive may also affect the repair cost, should an accident occur.

The result of a three way cross-classification analysis performed on the sample population's age, marital status and the repair cost of unreported accidents indicated that single individuals had a higher damage repair cost associated with their unreported road accidents than their married counterparts (Fig. 3). This was true for all common age categories. The repair cost was at a maximum for individuals in the 25-36 years age group in both the single as well as the married categories. The slope of the repair cost curve for married individuals took a sharp declining rate for persons 36 years in age and more. This finding, again, may be interpreted as such that as individuals' age increases (from 36 years on), they drive with more care and attentiveness and with a lower travel speed. The cost of repairing an accident, if and when it happens, may consequently be lower for these individuals. This was particularly true for people in the highest age group. The sample mean unreported accident repair cost for the single and married sample population were SR 726 and 572, respectively.

In order to investigate the potential effect of an individual driver's income level on his damage cost of unreported road accidents, a category analysis was performed on the data. It was found that the mean repair cost of unreported accidents did not substantially differ for sample individuals in various income groups. Individuals in the SR 2-5 thousand monthly income range had the maximum accident repair cost at SR 719. Drivers with SR 5000 - 7000 monthly incomes experienced the lowest repair costs (SR 589) for their unreported road accidents.

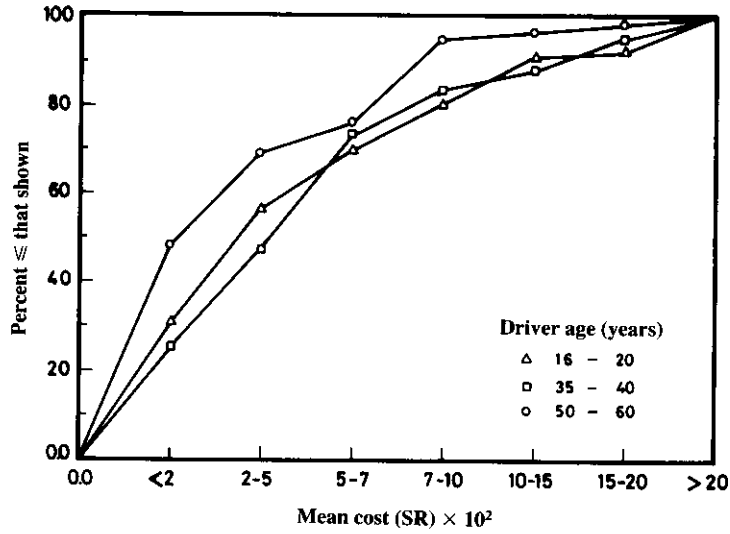

Fig. 2. Cumulative frequency distribution of unreported accident repair cost for selected driver age groups

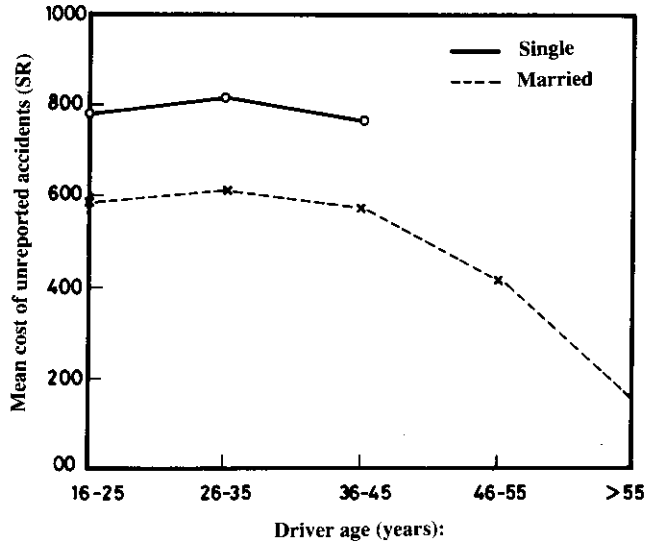

Fig. 3. Mean repair cost of unreported accidents by driver age and marital status

Individual sample's education level demonstrated a more pronounced effect on the repair cost of unreported road accidents. For example, the mean repair cost per unreported road accident varied from a low of SR 442 for individuals with no education, to SR 674 for individuals with a college degree, and to a maximum of SR 718 for individuals with elementary school education. A factor contributing to the high accident repair costs of the sample individuals with college and elementary school education was the high percentage of young students in these two education categories. Analysis of the data revealed that 36.4 percent of the sample population with elementary schooling and 50.4 percent of the sample with college degrees, included young adults of the 16-25 years age category. The indirect chain effect of driver age, lack of experience in driving, preference for higher travel speed, and consequently, the higher damage cost of a potential road accident may, therefore, be evident from this finding. Individuals with college educations had the second highest damage cost with SR 674, and those with no education experienced the lowest rate of accident repair costs (SR 442).

Reasons for Not Reporting Road Accidents

Of particular interest to the research study was the identification of reasons for not reporting road accidents. Two questions addressed this point in the questionnaire: one concerning the reasons for not reporting and the second, dealing with the importance of reporting road accidents to police officials.

Table 5. Frequency distribution of reasons for not reporting traffic accidents

Variable name	Frequency	Percent
Minor accidents	806	53.0
The other driver paid for my damage	247	16.2
Traffic police take a long time to come	187	12.3
Traffic police do not help even when they come	88	5.8
No telephone available to call police	26	1.7
Did not know what number to call	4	0.3
Other	163	10.7

The sample population's responses were analyzed with respect to reasons for not reporting road accidents. As presented in Table 5, 53% of the sample population did not report their accidents because of the minor nature of these accidents. According to the law, every accident in the Kingdom, regardless of its severity, must be reported to officials. 16.2% of the respondents indicated that the driver-at-fault paid for the damage. More than 12% indicated that the traffic police took a long time to come to the scene of the accident, and another 5.8% reported that the traffic police are not helpful even when they do appear. The unavailability of telephone and/or the

number to call, accounted for another 2% of unreporting, while 10.7% gave other reasons for not reporting road accidents.

The results of the analysis of samples' responses to the question, "Do you think it is important to report all road accidents to police officials?", indicated that more than one third (34.9%) believed that it was not important to report accidents to police. When these individuals were categorized by their level of education, no significant differences were found among them. This may be an indication of how poorly informed the driving public is (regardless of education level), concerning the importance of reporting road accidents.

Policy Implications and Conclusions

Results of this research have indicated that in the capital city of Riyadh, more than 57 percent of road accidents remained unreported during the period under study. This rate may be even higher for the isolated and remote areas of the Kingdom. With such a high frequency of not reporting road accidents, a large amount of important and needed information will also be lost. This loss of data may result in substantial inefficiency and ineffectiveness in the programs to improve road safety by distorting the safety-improving priority of accident locations.

This study has shown that the individual who more frequently did not report his road accidents, was found to be generally quite young, had a driver's license, was single and employed. Individuals with no education reported the smallest number of their road accidents, and there remained a significant variation in the rate of reporting/not-reporting of road accidents among different nationality groups.

Slightly more than one half of the unreported accidents were minor in severity. The remaining half, resulted in vehicle damage and person injury. The greatest majority of the unreported injury accidents included young drivers, and high travel speed was reported as the main cause of these accidents. A significant portion of unreported accidents occurred at intersections.

The extent of damage costs for these accidents also followed a pattern similar to that of unreported accidents. Individuals involved in more severe accidents (high repair cost) were very young, single, in possession of a driver's license and for a large portion of them, a college degree. While more than 50% of accidents remained unreported because of their minor nature, 18% of the sample individuals cited the poor performance level of accident investigating officers, with respect to arrival time at the scene, and/or level of assistance given, as reasons for not reporting their road accidents.

With such a large portion of road accidents remaining unreported, vital information concerning the where, when, why, who, how and so on of those accidents will also remain unknown to safety officials. The important point here is that the choice

of appropriate safety measures may, in turn, be adversely affected by this loss of information. It is quite likely that severe accidents (serious injury/fatality), may have occurred at locations in which these minor accidents occurred. If these minor accidents had been reported, safety hazards may have been removed, and costly accidents, in terms of human injury and/or fatality, could have been avoided. It is in this regard that the minimization of unreported road accidents assumes important dimensions.

The study has revealed that a very large portion of unreported accidents occurred at urban intersections. Current remedial measures for the alleviation of intersection accidents include modification in geometric design variables (especially sight distance), removal of safety hazard elements and evaluation of traffic sign, signal, operation, and approach speed.

Young drivers were predominantly present among drivers who did not report their accidents (as is the case for the reported accidents). These drivers should, therefore, become the target of greater vigilance on the part of enforcement officials. Stricter enforcement of speed limits is crucial for the reduction of road traffic accidents both reported and unreported.

A significant number of sample drivers/road users, educated and uneducated alike, did not believe that the reporting of all road accidents to safety officials was important. This fact undermines the need for a comprehensive safety education program for drivers and for the public as a whole. It must be remembered that Saudi Arabia progressed into the erea of technical advancement and development almost overnight. Urbanization and motorization are two major symbols of the development. It has all happened so fast that the society, as a whole, has had neither the time nor the experience nor the manpower required for the implementation of any comprehensive and effective safety education program. Efforts to educate the road user, should be tailored to take maximum advantage of the Kingdom's rich Islamic heritage which stresses the individual's obligaton to preserve the rights, and certainly, the safety of others.

It is equally important to recognize that without the presence of strict, continuous, and across-the-board enforcement measures, even the most educated of road users, may violate the rules of the road. Young drivers in Riyadh, are particularly in need of control. A more visible presence of enforcement officials on urban roadways, will also assist in the reduction of the number of unreported road accidents. Due to the minor nature of these accidents, a summary report including only the vital information concerning the accident may conveniently be prepared by the enforcement officials. This would cut down the lengthy delays cited by many as the reason for not reporting their accidents.

Stricter enforcement of an already existing law, which requires a traffic police permit for the repair of any damaged vehicle will also greatly reduce the number of

unreported road accidents. Due to lack of strict enforcement, the effectiveness of this law has greatly been diminished at the present.

These remedial measures are, by no means, easy tasks. Success in the improvement of road safety in the Kingdom requires a multi-dimensional approach, one which includes effective policies, planning, and timely implementation of safety measures. Also of paramount importance are the coordination of efforts among involved agencies, the availability of time and financial resources, and most crucial of all, the cooperation of the driving public.

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تقدير وتحليل حوادث المرور التي لا يتم التبليغ عنها في مدينة الرياض ـ المملكة العربية السعودية

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ملخص البحث. إن مقدرة وكفاءة أي سياسات تتخذ لغرض التقليل من حوادث المرور، يعتمد إلى حد كبير على تواجد ودقة المعلومات التي تبنى عليها هذه السياسات. عندما لا يتم التبليغ عن بعض حوادث المرور للجهات المختصة فإن هذا يعني ضياع معلومات كان يمكن الاستفادة منها بدراسة خواص هذه الحوادث ومسبباتها، وهذا يتسبب بدوره في التقليل من كفاءة برامج السلامة المرورية. تقدم هذه الورقة نتائج بحث أجريَ لتحديد مدى كمية الحوادث التي لا يتم التبليغ عنها للسلطات وخواصها والأسباب التي تدعو لعدم التبليغ وذلك في مدينة الرياض. لقد تم اختيار عينة عشوائية مكونة من ٢٢٠٠ شخص ممن يمارسون قيادة السيارات في الرياض وتم مقابلتهم لمعرفة خواصهم الاقتصادية و الاجتماعية، والحوادث المرورية التي حدثت لهم، ومجموع الحوادث التي لم يبّلغوا عنها، وتكلفة إصلاح ما تسببه هذه الحوادث. وبعد تحليل النتائج، اتضح أن ٦٠٪ من الحوادث المرورية لا يتم التبليغ عنها، ومعظم الذين لا يبلغون عن حوادثهم هم من الشباب غير المتزوجين ولديهم رخص قيادة سيارة، كما أن لديهم وظائف يعملون بها. كما اتضح أن غير المتعلمين بلّغوا عن أقل عدد من حوادثهم المرورية، كما كان هناك تفاوت كبير بين عدم التبليغ عن الحوادث وجنسية السائق. هذا وقد تم تطبيق وسائل إحصائية مختلفة لتحليل المعلومات والوصول إلى النتائج. وتناقش الورقة بعض الأساليب التي يمكن أن ينتج عنها التقليل من ظاهرة عدم التبليغ عن الحوادث المرورية للجهات المختصة.