

SHORTCOMINGS IN ROAD ACCIDENT DATA IN DEVELOPING COUNTRIES, IDENTIFICATION AND CORRECTION: A CASE STUDY

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This paper reports on some aspects of the findings of a recent piece of research into road traffic accidents in Yemen. The aim of the research was to provide a better understanding of road accident problems in Yemen by investigating its real dimensions. This includes the identification of the shortcomings in road accident data and to develop a method that can be adopted to adjust (correct) the official data.

Two field surveys were employed to check the shortcomings in the official records. The main findings obtained are presented as follows:

- The actual size of the road accident problem in Yemen is much greater than it appears in the official figures. In 1993, the registered accidents accounted for only about 13.3% of the estimated accidents and injuries accounted for only about 30% of the estimated injuries.
- The registered fatalities account for only about 48% of the actual number of fatalities using the 30 days definition. The 30 days definition for road accident fatalities is not adopted in Yemen and the relevant agencies are not implementing this definition properly.
- Methods for adjusting road accident data were adopted in this study. It is believed that this method can adjust the road accident data with an acceptable degree of satisfaction.

It is hoped that the findings of this research will help both researchers in their future work and decision makers in the field of road safety to encourage suitable safety programmes to be adopted which are consistent with the actual size of the problem. Knowledge of the true picture of the road accident problem will be useful for the purpose of negotiating adequate funding for road safety activities.

Estimating the actual percentage of unreported data in road accidents and casualties is very useful for any further research in road accidents and safety in Yemen. It will also help in dealing with official data and results from previous studies.

Key Words: Accidents, Fatalities, Injuries, Unreported data, Data adjustment, Developing countries, Yemen

1. INTRODUCTION

It is accepted that underreporting of road accident data is an international phenomenon. Large numbers of studies in developed countries have demonstrated the size of the problem. The problem in developed countries is limited to property damage or slight injury accident data; however the problem is beyond this level in developing countries. Unfortunately very little work is available in this area for developing countries.

In Sri Lanka, it was found that 23 percent of fatalities, 20 percent of all injuries and 65 percent of child injuries are not reported for the period 1977 to 1981¹. In developed nations, the percentage of unreported accident data varies from one country to another and from time to time. In Sweden, it was estimated that about 85 percent of all accidents that occurred in 1964 were not reported to the police² while in the UK this percentage was 28 percent for 1974-1976¹.

A road traffic accident data collection system is satisfactory only if it can produce information that can be used for analysing important road traffic problems. In Yemen, as in other developing countries, very little effort

is devoted to providing enough road accident information.

The first step towards obtaining accident data on a nationwide scale, in Yemen, was taken during the late seventies. The data collected at that time were very approximate, largely irrelevant and not reliable at any rate. The accidents reported to hospitals, at that time, were not reported to the police. Therefore, police headquarters took a further step to improve the accident reporting system by assigning a permanent police representative to each hospital. Figure 1 shows the existing road accident data collection and reporting system in Yemen. Road accident data collected by the police are mostly a crude and descriptive explanation of fatal and serious accidents. Most other types are ignored.

The existing system provides little information on the number of accidents and the number of casualties. The casualty information at present is available for two injury levels, death and injuries. The police of each governorate are supposed to report accidents and casualties to the police headquarters in monthly reports. The police headquarters is responsible for reporting the data to the Central Statistics Organisation (CSO) in the Ministry of Planning. This organisation is responsible for producing

the official statistics on road accidents.

There is no specific form for collecting road accident data. The common way of reporting the accident is through narrative reports at all levels (i.e., from the policeman on the site of the accident to the police of the area or governorate, from hospitals to the police and from the police of the governorate to police headquarters). The police headquarters are responsible for extracting the information from the narrative reports and putting it in tabular form. It should be clear from the forgoing description that the existing Yemeni information system for road accident data is inadequate. The desired qualities of information can only partly be found in the existing system. The collected data suffer

from deficiencies in both quantity and quality.

Some reasons for this are probably:

- Most of the data collection has been done without much thought for the need for uniform, relevant and reliable data. Most policemen do not take accident reporting seriously because they have to fulfil other essential tasks or do other business to have a second income because their salaries are relatively low.
- Data were, and still are, collected and presented by non-trained policemen.
- The resources allocated to data recording are insufficient.
- The way of reporting data is not efficient because hand-

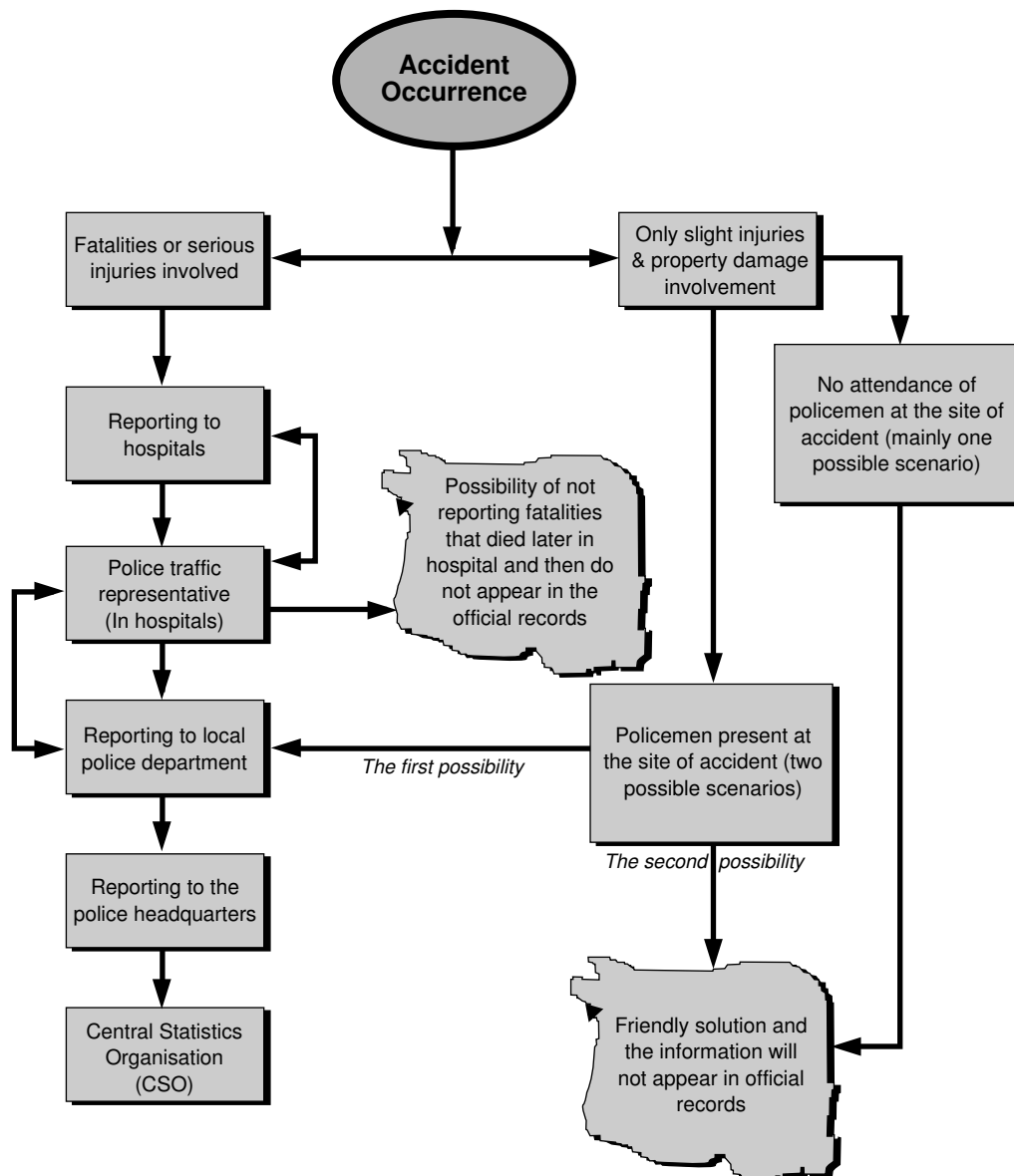


Fig. 1 The process of accident collection and reporting system showing the sources of underreporting

written narrative reports are used.

- There is a lack of a good documentation and retrieval system for the collected data.

Due to the deficiencies in the administration and legal systems, the accident notification to relevant agencies costs drivers involved in the accidents a high price in terms of time and money. The attitude of “*if you can solve the problems due to traffic accidents, without police or legal involvement do it whatever the level of injuries are*” is in practice in Yemen³. This practice usually results in a considerable proportion of accident categories not being reported to the police. These categories mainly include ‘property damage only accidents’ and ‘accidents causing slight injury to the driver only.’

2. OBJECTIVES AND HYPOTHESIS

The aim of this paper is to provide a better understanding of the actual size of the road accident problem in Yemen. The output of this research will help decision makers in the field of road safety, in adopting a suitable safety programme consistent with the actual size of the problem. Knowledge of the true picture of the road accident problem will be useful for the purpose of negotiating adequate funding for road safety activities. Estimating the actual percentage of unreported data in road accidents and casualties is very useful for any further research in road accidents and safety in Yemen. It will also enable it to be used as an indicator in the hands of decision mak-

ers when dealing with the official data or any results from previous studies. The specific objectives of this paper are to identify the actual size of the shortcomings in road accident data in Yemen and to develop a method to adjust these shortcomings. The working hypothesis of this study was: Yemeni road accident records are suffering from major distortion due to the unreported data.

3. METHODOLOGY

This paper will show how the numbers of accidents, injuries and fatalities that have occurred in Yemen in 1993, as a whole, have been estimated. The estimation of accidents and injuries was done on the basis of the answers received from a selected sample of drivers (Survey 1) and on the basis of two-month cross checking between hospitals and police records (Survey 2) in the case of fatalities. Based on the information obtained for the year 1993 and based on a reasoned assumption, the number of unreported accident data for the period 1978 to 1992 are estimated and then the official records are adjusted. Figure 2 summarises the structure of the methodology.

4. FIELD SURVEYS

4.1 Survey 1

A method similar to that used by Roosmark and

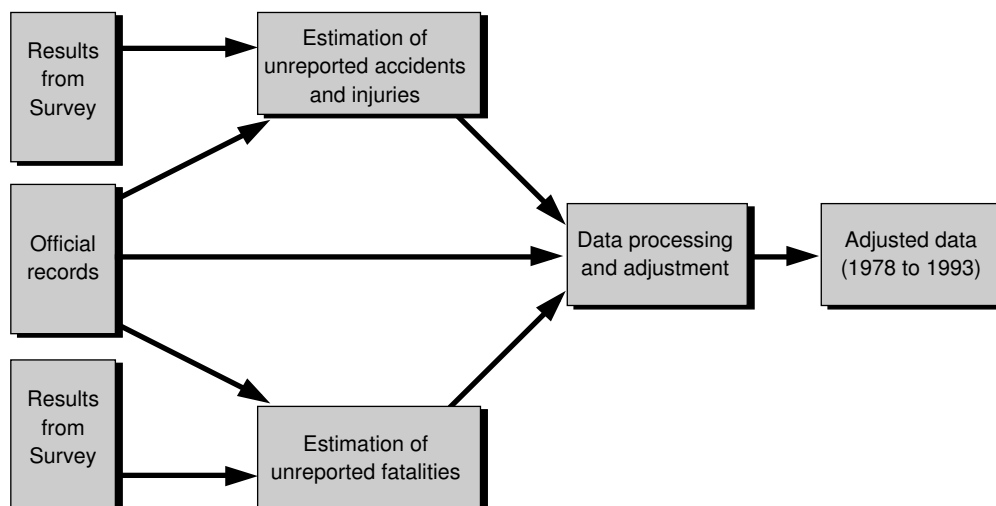


Fig. 2 The investigation methodology

Fraki² has been employed, but with the necessary adaptation to fit the conditions in Yemen. A selected sample of drivers was interviewed, during which, each driver was asked about detailed road accident information, i.e., detailed information of their past experience of being involved in road accidents over a specific period of time (1993). This method provides a possible way of obtaining detailed and reliable road accident information in Yemen. In-depth interviews with drivers usually results in reliable information where drivers respond frankly in such a close interview^{4,5}. Every possible effort was made to assure drivers that the data will be used only for research purposes and they were convinced that the interview would not abuse them in any way and that the information will be of benefit to the community. The idea behind this was to make the driver comfortable and confident and lead to an open and friendly interview, which did happen.

Sample size: Some researchers like Roscoe⁶ prefer to approach the problem of sample size by rules of thumb, which he believes is appropriate for determining sample size in behavioural research. Some of these rules of thumb, as stated by Roscoe⁶ are shown below:

- The use of statistical analysis with samples smaller than 10 in size is not recommended.
- Whenever samples are to be broken into sub-samples (e.g., males and females) and generalisations are to be drawn from these sub-samples, recommendations with respect to minimum sample size apply to the sub-samples.

Since the sampling error is a function of sample size, and the error tends to be smaller for larger samples, it was decided to start with 500 drivers (large sample). This sample size can be later increased if the number of drivers who had an accident in 1993 turned out to be less than 100. In other words this research aimed to interview at least 100 drivers who had had accidents in 1993.

Data were collected from a random sample of 1,065 drivers from 14 different places including fuel stations and major vehicle stop areas in the two main cities, Sana'a and Aden. The collection of the data took place from mid-August 1994 until the end of October 1994. As this was immediately after the 1994 summer war in the country, an extra effort was made, when possible, to try to avoid any hostility. Therefore, the author was introduced to the drivers by the organiser of the vehicle stops (Al-mandoob) during social events, i.e., (Qat* gathering) where drivers usually group together each afternoon to chew Qat. In this survey, respondents (drivers) were asked to indicate whether or not they had experienced a road traffic accident in 1993. Those who admitted having had accidents were further questioned. A special ques-

tionnaire was used for this purpose. The average duration of the survey was about 2-3 minutes for drivers who had not had an accident in 1993 and about 10-20 minutes for drivers who had had an accident.

4.2 Survey 2

Survey 2 was carried out during the same period of Survey 1. The objective of this survey was to check the accuracy of reporting fatalities to the police. This was done by comparing road accident fatalities arriving at the main hospital in the city of Sana'a, plus those who died later at the hospital, as a result of serious injuries, with those appearing in police records. For this purpose, fatalities arriving at the hospital during the two months of September and October 1994 were taken as the sample.

5. THE ESTIMATION OF THE UN-REPORTED ROAD ACCIDENT DATA IN 1993

5.1 Estimation of total accidents and injuries that occurred in 1993

In order to estimate the proportion of total accidents or injuries (p), which had occurred in 1993, on the basis of the information obtained from the questionnaire based sample, it is required firstly, to choose the confidence interval that will be used.

Under the assumption that all drivers in the country could be interviewed, a random sample consisting of n drivers was taken, among whom n_0 have had a traffic accident. Then, an unbiased estimate of p is $\hat{p} = \frac{n_0}{n}$; using the stan-

dard variable $z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$, where $q = 1 - p$, the probability

distribution of z is dependent on p . If n is large, and even when n is small and p is not extremely close to zero or one, the normal distribution can be used to approximate binomial probabilities as Ronald and Raymond⁷ emphasized.

In this study, the sample size (n) is sufficiently large (1,065 cases), therefore the approximate 90% confidence

* Qat is a small tree grown by the people in most states of the country. The Qat growing and consumption is not forbidden in Yemen, it represents an important aspect of life of Yemenis. The users chew the soft branches and leaves and absorb its juices. One local scholar in Sana'a with an interest in Qat has carried out some informal research on the subject. He found that upon asking people why they chewed Qat, 50 per cent said because it gave them energy, 20 per cent said it helped to pass the time and prevented boredom, and 11 per cent said because they like to meet their friends. Only 5 per cent said Qat relaxed them, and 1 per cent of the sample under study said they chew Qat because the government did not forbid it.

interval for p can be written as:

$$\hat{p} - 1.645 \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} < p < \hat{p} + 1.645 \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

where \hat{p} is the estimated population proportion.

5.1.1 The equivalent number of road accident and injuries

In order to form an unbiased estimate of the number of accidents, taking into account the fact that accidents which involve different numbers of vehicles have different probabilities of being represented in the selected sample, the following expression was used to calculate the Equivalent Total Number of Accidents (ETNA):

$$(ETNA) = \sum_{i=1}^{i=\max} (n_i)(\alpha_i)$$

where:

i = the number of vehicles involved in the accidents;

n_i = the number of accident with i vehicles; and

α = is a number (between 0.0 and 1) and used to eliminate the probability of represented drivers (in multi-vehicle accidents) being in the selected sample. For instance:

$(\alpha_1 = 1), (0.50 \leq \alpha_2 \leq 1), (0.333 \leq \alpha_3 \leq 1),$

$(0.25 \leq \alpha_4 \leq 1), (0.2 \leq \alpha_5 \leq 1) \& (0.167 \leq \alpha_6 \leq 1)$

When α is a minimum, this means that all drivers in each multi-vehicle accident are represented in the sample. When α is a maximum, this means that only one driver, from each multi-vehicle accident, is involved in the interview. The truth is somewhere between these two extremes. In this paper alpha was estimated based on the ratio of the number of surveyed drivers / whole number of drivers possible to be surveyed, this results in the following values of alpha: $\alpha_1 = 1, \alpha_2 = 0.999, \alpha_3 = 0.666$ and $\alpha_6 = 0.333$

In this research, and based on the information obtained from Survey 1, as Table 1 shows, the equivalent total number of accidents (ETNA) was obtained (i.e., 132

Table 1 The distribution of accidents and injuries (By number of vehicles involved in accidents)

n_i	Number of accidents	Number of injuries
n_1	34	19
n_2	97	36
n_3	1	4
n_4	0	0
n_5	0	0
n_6	1	6
Total	133 = (n_0)	65

Source: Survey 1

accidents). Similarly, the equivalent total number of injuries (ETNI) was found to be 60 injuries.

5.1.2 The estimation procedures

In order to estimate the number of total accidents that occurred in 1993, let:

1. The number of drivers who have been involved in at least one traffic accident be D1.
2. The driver’s population in Yemen be N (N= 517,897≈ 518,000 drivers).
3. The selected sample be n ($n=1,065$ drivers).
4. The number of drivers among the sample who have experienced a road traffic accident be n_0 ($n_0 =133$ drivers).

Then the unbiased estimate of $p = (D/N)$ is a function of (n_0/n) . Using a 90% confidence interval, the limits of the estimated total number of accidents were found to be 55,627 and 72,800 accidents. The procedures used to estimate the number of accidents were also used to estimate the number of injuries but with two differences:

1. The population proportion:

$$P = \frac{\text{No. of sample's injuries}}{\text{equivalent total number of accidents in the sample}}$$

Therefore: $P = (60)/(132)$ instead of $(132/1,065)$.

2. The population is 64,200 accidents instead of 518,000 drivers.

Using a 90% confidence interval, the estimated total number of injuries occurring in 1993 was found to be between 21,269 and 30,283. The mid-point of these two limits is ≈ 25,777 injuries.

5.2 Estimation of number of fatalities

The accuracy of the police data regarding fatalities was checked through comparisons of police and hospital records. From the results depicted in Table 2, it can be seen that there is:

- A full agreement between hospital and police records in the case of “on the spot fatalities”. This category also includes fatalities occurring on the way to the hospital.
- A partial agreement in the case of people who died within the first three days in the hospital. Only 45% of people (9 out of 20) who died in the first three days are reported to the police.
- No agreement in the case of people who died after three days in the hospital.

Table 2 The results from cross-checking method between hospital and police records

Categories	Hospital records	Reported to police
On the spot fatalities*	14	14
Fatalities within the first 3 days	20	9
Fatalities after 3 days until 30 days	5	None
Subtotal	39	
Fatalities from outside the city of Sana'a**	17	None
Total	56	—

Source: Survey 2

Some agencies in Yemen such as the Highway Authority claim to be using the 30 days fatality definition. The Authority is providing the International Road Federation (IRF) with annual statistics regarding road accident fatalities. However, the above results showed variations in recording fatalities. Therefore, in order to bring the fatalities to a standard 30 days definition, two steps were taken:

1. The reported fatalities were brought to the 3 days definition by increasing them by 48% that is $(20 - 9)/(14 + 9)$ as shown in Table 2 above.
2. The fatalities with the 3 days definition were brought to the standard 30 days definition following Smeed's suggestion*** (1968) as shown in Table 3. The reasons for choosing Smeed's multiplying factor rather than that of the Department of Transport⁸ in the UK is the good compatibility between Smeed's figures and the actual situation in Yemen. In other words, the results from Survey 2 revealed that the ratio between 'on the spot' to 'thirty-day fatalities' is (14 : 39), that is (1 : 2.79). This figure falls within the limit suggested by Smeed which is 2.1 to 3.4, but does not meet the figure suggested by the DOT which is 1.35.

This suggests that in the period 1968 to 1993 a person who is still alive immediately after an accident has a greater chance of subsequent survival than he or she would have had twenty-five years ago. This results mainly from improvements in both post-accident emergency services and medical care in developed countries. Thus, the corrected number of fatalities for 1,993 is 2,764, i.e., the official registered figure (1,334) * 1.48 * 1.4.

* Including those who died on their way to hospital.

** These fatalities result from accidents occurring outside the city of Sana'a (rural areas). The police claim these accidents will be registered in the Local Police Departments where the accident occurred.

*** Smeed's suggestion⁹ was adopted by researchers such as Preston¹⁰

Table 3 The percentage of fatally injured who died within different periods of time after accident and the multiplying factor to bring the number of deaths to the standard 30 days definition (Results from developed countries)

Definition of Fatalities	Source: Smeed ⁹ & Preston ¹⁰		Source: DOT ⁸
	Percentage dead	Multiplying factor	Multiplying factor
Sometime (One year)	100	0.95	0.95
30 days	93–96	—	—
7 days	80–87	1.2–1.1	1.07
3 days	70–80	1.2–1.4	1.12
1 day	59–72	1.3–1.6	1.3
1 hour or at scene	28–46	2.1–3.4	1.35

6. ROAD ACCIDENT DATA ADJUSTMENT

6.1 Accident adjustment

i) Assumption

It is well known that the high fatality indices $F_i = \frac{\text{No. of fatalities}}{\text{No. of accidents}}$ in developing countries are mainly attributed to the underreporting of the less serious accidents in those countries. The lack of medical facilities may have some contribution to the high values of fatality indices. Jacobs and Hards¹¹ emphasised that improved ambulance services might do much to ensure more lives are saved.

The medical services in Yemen are generally poor. This is particularly applicable to the first aid and ambulance services, which virtually do not exist. Ambulance services are assumed to have no effect in saving seriously injured victims. In other words it is assumed that the development in medical services and facilities has neutral effect on fatality indices F_i . The high F_i in Yemen reflects the underreporting of slight injury accidents.

It is important to note that the high fatality indices can be also attributed to other factors such as the lack of implementing the Vehicle Condition Test (VCT) and the lack of using a seat belt. These factors are not in practice in Yemen and therefore the effect of such factors on fatality indices is neutral. This assumption should be revised when there are significant improvements in medical services (especially ambulance services), accident data collection and reporting are improved or when there is enforcement of the use of seat belts and VCT.

ii) *Estimating the underreported accidents*

It was difficult to estimate the percentage of unreported accidents through Survey 1 results. The main reason for this difficulty was the fact that many reported accidents (especially slight injury accidents and property damage only accidents) by the driver do not appear in the official records for different reasons as described earlier.

Therefore, it was decided to estimate the number of unreported accidents by subtracting the number of accidents appearing in official records from the total estimated number of accidents in 1993. Thus, based on results from Survey 1, the estimated number of unreported accidents in 1993 was found to be 55,654 ≈ 55,700 accidents, i.e., 64,200 total estimated minus 8,546 total officially registered.

Using information for the year 1993, i.e., the fatality index and the number of unreported accidents and employing the assumption mentioned in the previous section, the number of unreported accidents for the period 1978 to 1992 was calculated. The following expression explains the procedures used:

$$(Fi)_{1993} * (\text{No. of unreported accident in year}_i) = (Fi)_{\text{year}_i} * (\text{No. of unreported accidents in Year}_{1993}),$$

where: i varies from 1978 to 1992.

Since $(Fi)_{1993}$, $(Fi)_{\text{year}_i}$ and the number of unreported accidents in 1993 were known, the number of unreported accidents in year $_i$ (1978 to 1992) can be calculated. The results of this calculation are shown in Figure 3.

iii) *Correction*

The corrected number of accidents was obtained by adding the estimated number of unreported accidents to the number of registered accidents as reported in the official records.

The results are illustrated in Figure 3.

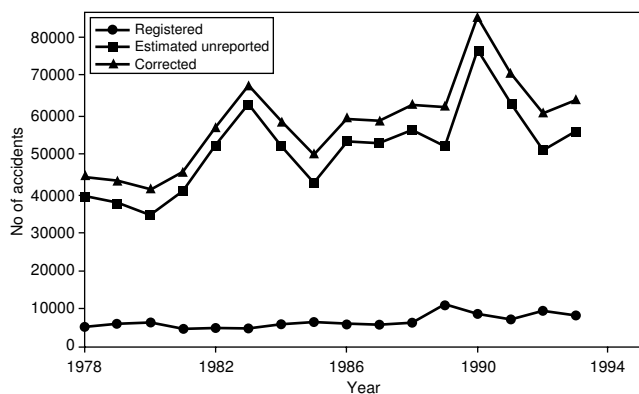


Fig. 3 Registered, unreported and corrected road accidents in Yemen

It is important to note that three major events occurred in Yemen between 1989 and 1990. The first is the opening of the border in early 1989 and free movement between South and North Yemen. The second event is the unification of Yemen in 1990. The third one is the mass deportation of Yemeni immigrants from Saudi Arabia and other Gulf States before the 1991 Gulf War. These events have strongly affected the road accident statistics in the country as shown in the figures. The third event had a very strong effect on road accidents during the year 1990 because more than one million Yemeni immigrants have been deported within a short period of time (about three months).

The high figures of road accident statistics in these two years can be attributed to the fact that a large number of drivers were deported from Saudi Arabia and other Gulf States and many others moved from South Yemen in 1989 - the first year of opening the border between South and North Yemen. These drivers were driving on new roads with a different environment, a different traffic system, and regulations. This could explain the high number of road accidents in these two years.

6.2 **Injuries Adjustment**

i) *Estimating the underreported injuries*

The procedures used to adjust unreported accidents were also used to adjust unreported road accident injuries but with two differences:

1. The ratio (F/I), that is number of fatalities over number of injuries, was used instead of the fatality index (Fi).
2. The number of unreported injuries in 1993 was used instead of the number of unreported accidents. The results are shown in Figure 4.

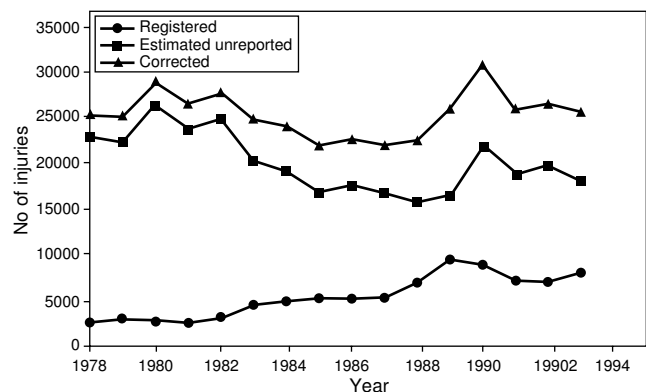


Fig. 4 Registered, estimated, unreported and corrected road accident injuries in Yemen

ii) Correction

The corrected number of injuries was obtained by adding the estimated number of unreported injuries to the number of registered injuries as reported in official records. As it can be seen from Figure 4, there is a noticeable positive trend of reported injuries over time and this may suggest that there is some improvements in reporting the less serious injuries over time.

6.3 Fatalities adjustment

There is no significant change in the system of reporting road accident fatalities. Thus, there is no reason to think that results from years other than 1993, regarding the reporting of road accident fatalities, would be very different. As a consequence, the same procedure used to estimate and adjust the number of fatalities in 1993 (see section 5.2) was also used to adjust the number of fatalities for the period 1978 to 1992. The results are shown in Figure 5.

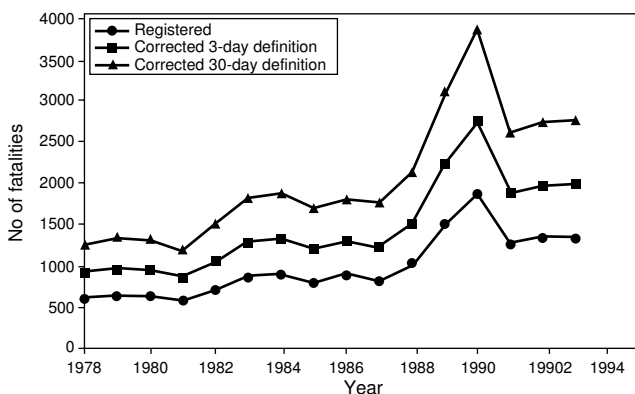


Fig. 5 Registered and corrected road accident fatalities in Yemen

7. MAIN FINDINGS AND DISCUSSION

It can be seen from the previous sections that the available data in the official Yemeni records do not reflect the actual situation and therefore can be considered as unreliable. The following findings explain the actual situation in Yemen.

- The working hypothesis of this research was that the Yemeni road accident records are suffering from a significant distortion due to the unreported data. The hypothesis was supported by the results obtained. Findings showed that the official statistics provide only about 13.3

percent of the estimated number of accidents, that is 8,546 out of 64,200 accidents and 30.4 percent of injuries, that is 7,831 out of 25,777 injuries. The reported data mainly concentrate on fatal and serious injury accidents and this explains the relatively high percentage of reported injuries compared to the percentage of reported accidents.

- In case of underreporting of fatalities, the findings showed that the 30 days definition that some agencies claim they are adopting is not valid. The results showed that only 45 percent of the seriously injured who died during the first three days after admission to hospital are reported to the police. No reporting was found for those who died after three days.
- Most official data are underestimating rather than overestimating the actual situation in Yemen and thus misleading conclusions can be drawn from official registered data. This can be seen from the comparison made between registered figures and adjusted figures presented in Table 4. Hence, fatality rates, either per vehicle or per population, are not that good in making comparisons between countries. Information for Great Britain included in Table 4 reflects the contrast between the situation in a developed country compared with a developing country.
- The method suggested to adjust road accidents and injuries in this paper is based on the assumption that high fatality indices $F_i = (\text{fatalities} / \text{accidents})$ and the ratio (fatalities / injuries) in Yemen are attributable to the underreporting in road accident data and the fact that medical facilities have no effect. These assumptions have been supported by findings from the developed causa-

Table 4 Comparison between Yemen (the estimated figures and registered figures) and Great Britain

	Yemen (1993)		Great Britain (1993)
	Registered figures	Adjusted figures	
Accidents	8,546	64,200	229,000
Injuries	7,831	25,777	302,000
Fatalities	1,334	2,764	3,814
Population	13,336,000	13,336,000	56,559,000
Vehicles	620,487	518,000	24,826,000
Fatality rate per 10,000 vehicles	21.5	53.3	1.54
Fatality rate per 10,000 people	1.0	2.07	0.674
Fatality rate per 1,000 accidents	156.1	43.1	16.66

Source for Great Britain data: DOT⁸

* Findings from this part have been presented in separate paper.

tion model* where medical services, measured by the number of beds in hospitals and the number of general practitioners, showed insignificant relation to the road accident fatalities over the period 1978 to 1993.

8. RECOMMENDATIONS

1. Road accident statistics of sufficiently high quality cannot be obtained unless more resources are allocated, more trained staff are involved, suitable computer packages are adopted and a separate organisation is formed for this activity. This organisation should be separated from the police so that the inadequacies of legal and administrative aspects of road accidents do not influence the reporting. The Highway Authority or the Ministry of Health are nominated organisations for such a job because they have divisions that cover most of the governorates of the country.
2. The actual size of the road accident problem in Yemen is much greater than that appearing in the official figures. In 1993, only 8,546 out of 64,200 estimated accidents were reported in official records. In the case of injuries, only 7,831 injuries were reported in official records out of 25,777 estimated injuries. Moreover, the estimated number of fatalities using the 30 days definition is 2,764 while the official figure is only 1,334. Therefore, a suitable safety programme consistent with the actual size of the problem is needed.
3. The 30 days definition for road accident fatalities is not valid in Yemen and the relevant agencies are not implementing this definition properly. Therefore, care must be taken when comparing with other countries.
4. It is recommended that fatalities obtained from police departments must be adjusted for the 30 days definition before being reported to international agencies such as The International Road Federation (IRF).
5. Innovative methods for adjusting road accident data were used in the reported research. It is believed that these methods can adjust for road accident data with an acceptable degree of satisfaction. However, these methods are limited to the contemporary situation and the near future in Yemen or countries with similar conditions to Yemen. When there are significant other improvements in accident data collection and reporting, improvements in medical services (especially ambulance services), and/or when there is enforcement in the use of seat belts and VCT, then the methods need to be revised.
6. Accident data recorded by the police are far from an ideal source of research data. Therefore, the use of the method suggested by this research to adjust the number of accidents and injuries is recommended even for the short and medium term, until there is a significant improvement in medical services especially in the provision of ambulances. In case of underreporting of fatalities, it is suggested that the state of serious injuries that arrive at hospital during the first thirty days should be continuously monitored. Any changes in the patient's state should be reported to the police. It is recommended that the level of reporting fatalities between hospitals and police be checked regularly, say every three to four years, in order to update any changes in reporting levels.

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