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# Time to reach health-care facility and hospital exit outcome among road traffic accident victims attending a tertiary care hospital, Puducherry

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## Abstract:

**BACKGROUND:** In India, most of the deaths due to road traffic accidents (RTAs) occur within 24 h of the accident. Hence, this study aimed to assess the proportion of RTA victims reaching the health-care facilities within the golden hour.

**MATERIALS AND METHODS:** This cross-sectional study was conducted in a tertiary care center in South India between August and September 2017. All RTA victims who were admitted for treatment in the emergency department during the study period were included. Data were collected using structured, pretested, and validated pro forma. Hospital exit outcomes between those who reached within 1 h and those who did not were expressed as proportion with a 95% confidence interval (CI). The factors associated with hospital exit outcomes were analyzed using a Chi-square test.

**RESULTS:** Among 626 RTA victims, the mean (standard deviation) age was 37.4 (2.6) years, and about 83% ( $n = 521$ ) were male. More than one-third (37%) of the RTAs occurred on urban roads ( $n = 235$ , 37.5%). A total of 424 (67.7%) were referred from other hospitals. The mean time taken for RTA victims to reach any health-care facility was 3 h. More than half ( $n = 346$ , 55% [95% CI: 51.3–59.2]) of the RTA victims had reached a health-care facility within the golden hour. Among those who reached beyond the golden hour, one-fourth ( $n = 77$ , 27.5%) were delayed due to the unavailability of transporting vehicles. Delay in communication ( $n = 59$ , 21.1%), prolonged travel ( $n = 41$ , 14.6%), lack of knowledge about nearby facilities ( $n = 39$ , 13.9%), nonavailability of attenders ( $n = 35$ , 12.5%) and financial issues ( $n = 29$ , 10.4%) were the other reasons for the delay.

**CONCLUSION:** Almost half of the RTA victims reached the health-care facilities after the golden hour. Unavailability of ambulances or vehicles for transport and delay in communication were the important factors that played a role in the delay.

## Keywords:

Driving, golden hour trauma, prehospital care, road safety, road traffic accidents

## Introduction

Road traffic accidents (RTAs) have reemerged as a major public health problem globally and are the leading cause of death, mainly among the younger generation.<sup>[1]</sup> It is estimated to become the fifth leading cause of death by 2030.<sup>[2]</sup>

Low- and middle-income countries account for around 90% of fatalities due to RTAs, even though these countries contribute only 50% of the world's total vehicle population while 82% of the world's human population.<sup>[3]</sup> Mortality due to RTAs in low- and middle-income countries is twice more than the high-income countries.<sup>[4]</sup>

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India has one of the highest motorization growth rates globally with the rapid expansion of road networks and urbanization.<sup>[5]</sup> The country is now facing new challenges in terms of reducing RTAs and fatalities. Pedestrians, motorized two-wheeler users, and pedal cyclists are the most vulnerable road user groups in India.<sup>[6]</sup> About 57 accidents and 17 deaths are happening on average every hour on Indian roads. About 54.1% of all deaths due to RTAs belong to the age group between 15 and 34 years in the year 2015.<sup>[7]</sup> The golden hour can be defined as “the 1<sup>st</sup> h after injury which will largely determine a critically injured person’s chance of survival.” Studies reported that the time taken to avail emergency care plays a vital role in patient recovery.<sup>[8,9]</sup> Even though the international literature still debates the “golden hour” theory, some state that the time to reach trauma care differs, depending on the type of injury.

Lack of first aid, delays in the transfer of patients,<sup>[10]</sup> inadequate knowledge,<sup>[11]</sup> the longer the time interval between getting injured and reaching a definitive hospital, absence of triage, and lack of facilities in hospitals are some of the major problems with trauma care in India. A long delay in trauma victims reaching the hospitals may result in unfavorable outcomes.<sup>[12]</sup> Most deaths due to RTAs occur within 24 h of the accident and mostly before reaching the hospital and are mainly due to delays in access to a proper health facility.<sup>[13]</sup> Hence, this study aimed to find the factors that determine the time to reach the hospital after a RTA and to assess the proportion of RTA victims reaching the health-care facilities within the golden hour.

## Materials and Methods

### Study design and setting

This was a hospital-based cross-sectional study conducted in a tertiary care center at the department of emergency medicine and trauma care in South India during August–September 2017. This institute has been rendering services to the population from Puducherry and neighboring Tamil Nadu districts, South India. All types of medical and surgical emergencies such as RTAs, assault, burns, poison, myocardial infarction, and others have been treated here. The average daily attendance of patients in the Emergency Medical Services (EMS) department was in the range of 200–300 cases, out of which 10–20 were road traffic injuries. After reaching EMS, the patient is then shifted to the triage desk for assessing their Emergency Severity Index (ESI) level, based on their pulse rate, blood pressure, oxygen saturation, and consciousness level. Depending on their ESI levels, ESI 1 and ESI 2 patients are shifted to the EMS intensive care unit. ESI 3, 4, and 5 level patients are treated in a common treating area. After the initial triggering and assessment, the disposition decision of the

patient is done by the emergency physician. If the patient needs any specialist care, then such cases are transferred to the respective departments.

### Study participants and sampling

All patients with RTAs who attended the department of emergency medicine and trauma care in our center during the study period were included in this study. The patient presented with the history of RTA information that was obtained from the triage desk register in EMS.

### Data collection tool and technique

A pretested, validated, structured pro forma was used for data collection. Data such as age, gender, place and time of the accident, mode of RTA, time taken to reach the initial health-care facility, and tertiary care facility are extracted from patient records. Other relevant details were collected from the referral notes and medicolegal case records given to the patient by the referring hospitals. All necessary details were noted down in the data collection pro forma. As soon as the patients were stabilized and admitted in the trauma ward after initial treatment, proper consent from patients (if conscious) or a close relative was obtained if they were in alerting sensorium. This included relevant data with reasons for the delay in reaching the health-care facility like delay in communication to report the accident, delay in the arrival of the vehicle, duration of transport, and financial issue to arrange a paid vehicle, which were collected by a structured questionnaire pro forma on interview basis. Those patients who were treated and discharged as an outpatient had been collected before discharge or contacted telephonically.

Information on the outcome status of RTA victims admitted to the inpatient ward was obtained from the hospital information system (HIS).

### Statistical analysis

The data were entered into EpiData version 3.1 [EpiData Association, Odense, Denmark] and analyzed using Statistical Package for the Social Sciences (SPSS) Version 17.0 [SPSS Inc. Chicago: USA]. Patients’ sociodemographic details such as age group, gender, and mode of RTA were summarized as proportions with 95% confidence interval (CI) and average. Time taken to reach any health facility was expressed in the median and interquartile range (IQR). Reasons for delay in reaching the health facility were summarized in proportions. Hospital exit outcomes between those who reached within 1 h and those who did not were expressed as proportion with a 95% CI. The factors associated with hospital exit outcomes were analyzed using a Chi-square test.  $P < 0.05$  was considered statistically significant.

### Ethical consideration

The study protocol was approved by the Institute

Ethics Committee (IEC) of Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, on July 12, 2016 (approval number JIP/IEC/SC/2016/910).

## Results

Among 626 RTA victims, the mean (standard deviation) age was 37.4 (2.6) years, and about 83% ( $n = 521$ ) were male. The sociodemographic characteristics of the participants are shown in Table 1.

The maximum number of RTAs that occurred in urban roads was 235 (37.5%), followed by rural roads 201 (32.1%) and then the highways 190 (30.4%). About one-third (32.3%) of the RTA victims came to our center directly. About 51.1% received early treatment from other tertiary care hospitals and district hospitals. 28.8% of RTAs occurred between 16.00 and 20.00 h. The description of RTAs reported is depicted in Table 2.

The average time taken for the RTA victims to reach health facilities is shown in Table 3. Among 626 RTA victims, 346 (55%) had reached a health-care facility within the golden hour. Out of the 626 RTA victims, 475 (75.9%) were discharged, followed by 128 (20.4%) being admitted in critical care, 20 (3.2%) patients died, and only 3 out of 625 (0.5%) RTA victims left the hospital against medical advice.

Out of 280 RTA victims who reached any health-care facility beyond the golden hour, one-fourth (77 [27.5%]) of the RTAs reported that the delays were due to delay in the vehicle's arrival followed by delay in communication. Nonavailability of attenders and financial issues were the reasons for the delay in 35 (12.5%) and 29 (10.4%) injured people [Table 4].

**Table 1: Sociodemographic characteristics of study participants at a tertiary care institute in South India ( $n=626$ )**

Variable	n (%)
Age (years)	
<18	49 (7.8)
18-28	184 (29.4)
29-38	145 (23.2)
39-48	108 (17.3)
>48	140 (22.4)
Gender	
Male	521 (83.2)
Female	105 (16.8)
Place of residence	
Villupuram	299 (47.8)
Cuddalore	123 (19.6)
Puducherry	110 (17.6)
Thiruvannamalai	40 (6.4)
Others districts of Tamil Nadu	54 (8.6)

The factors associated with hospital outcomes are described in Table 5. It was found that the hospital exit outcome was better if patients reach the health facility within the golden hour.

## Discussion

During the study period, around 800 RTA victims availed services from our emergency medicine and trauma care department. Out of which, 626 patients enrolled

**Table 2: Description of road traffic accidents reported by study participants based on the vehicles involved, place of incidence, time of incidence, and mode of transport at a tertiary care institute in South India ( $n=626$ )**

Characteristics	n (%)
Mode of RTA	
Self-fall from two-wheeler	184 (29.4)
Two versus two-wheeler	132 (21.1)
Two versus four-wheeler	126 (20.1)
Pedestrian versus two-wheeler	78 (12.5)
Pedestrian versus four-wheeler	38 (6.1)
Four versus four-wheeler	34 (5.4)
Others	34 (5.5)
Place of occurrence	
Urban roads	235 (37.5)
Rural roads	201 (32.1)
Highways	190 (30.4)
Time of accident (24 h)	
00.00-04.00	27 (4.3)
04.00-08.00	72 (11.5)
08.00-12.00	118 (18.8)
12.00-16.00	120 (19.2)
16.00-20.00	180 (28.8)
20.00-00.00	109 (17.4)
Mode of transportation	
108 ambulances	275 (44)
Private ambulance	189 (30.2)
Hired auto/car	111 (17.7)
Own auto/car	43 (6.9)
Others	8 (1.3)
Treatment given	
Referred	424 (67.7)
Direct	202 (32.3)
Referred by	
Medical college hospital	167 (39.4)
District hospital	153 (36.2)
Taluk hospital	83 (19.6)
Private hospital	12 (2.8)
PHC	8 (1.9)
Hospital exit outcome	
Discharge	475 (75.4)
Admitted in ICU	128 (20.4)
Left AMA	3 (0.5)
Died	20 (3.2)

RTA=Road traffic accident, PHC=Primary health center, ICU=Intensive care unit, AMA=Against medical advice

**Table 3: Average time taken for the road traffic accident victims to reach health facilities with respect to age, gender, and place reported by study respondent at a tertiary care institute in South India (n=626)**

Variables	Median (IQR), time (h) taken
Average time taken	3.00 (1.30-5.10)
Age (years)	
<18	3.20 (1.33-6.31)
18-28	2.20 (1.13-4.48)
29-38	3.10 (1.40-5.17)
39-48	2.34 (1.21-4.45)
>48	3.35 (2.00-5.52)
Gender	
Male	3.00 (1.30-5.11)
Female	2.50 (1.13-4.82)
Place of occurrence	
Urban roads	3.10 (1.30-5.25)
Rural roads	3.17 (2.00-5.45)
Highways	2.15 (1.09-4.11)
Referral from other health facilities	
Referred	4.10 (2.38-6.21)
Not referred	1.07 (0.40-1.46)

IQR=Interquartile range

**Table 4: Reasons for delay in reaching the health facility among road traffic accident victims at a tertiary care institute in South India (n=280)**

Reasons for delay	n (%)	95% CI
Arrival of vehicle	77 (27.5)	22.4-33.1
Communication	59 (21.1)	16.4-26.3
Transport period	41 (14.6)	10.7-19.3
Lack of knowledge	39 (13.9)	10.1-18.5
Nonavailability of attenders	35 (12.5)	8.9-16.9
Financial issues	29 (10.4)	7.0-14.5

CI=Confidence interval

for the present study. As per the present study, the age group more vulnerable to RTAs was the younger age population. The majority of the killed and injured are younger persons in their economically productive years.

The maximum number of RTAs occurred in the evening (16.00–20.00 h) followed by mornings (12–16 h). Similar findings were observed by Radjou and Kumar in Puducherry with 26% in the evening (16–20 h) followed by morning (12–16 h).<sup>[14]</sup> In the area under study, an increase in RTAs in the evenings occurred due to reduced visibility and more vehicle congestion.

The present study found that the maximum number of RTAs was due to self-fall from the two-wheeler. Similarly, a study was done by Madhuvardhana *et al.*<sup>[15]</sup> and Kalaiselvan *et al.*<sup>[16]</sup> also had similar observations. However, in the present study, motorcycles were responsible for the majority of RTAs in contrast to RTAs data 2015, in which it was shown that 41.2% of the RTAs were due to motorcycles. This difference might

be because most people who had taken part in our study were owners of motorcycles. In the current study, RTAs occurred on a similar scale on all types of roads. According to the National Pedestrian Crash Report, most accidents occur in urban roads followed by highways, and the difference may be due to the difference in the study setting.<sup>[17]</sup>

Our study observed that most of the RTA victims were referred from some other hospitals. A similar study has been done in Puducherry by Radjou and Kumar,<sup>[14]</sup> which also found that 44% of the injured directly came to the hospital, and the remaining 56% were referred from other hospitals. The reasons could be the present study setting being a tertiary care hospital. Our study also found that the time to reach any health-care facility after having an accident was 3 h with IQR (1.30 h–5.10 h). This was contrary to studies done in the USA that found that the average time to reach any health-care facility was 36 min. The above difference might be due to the study setting's difference with the latter study being carried out in a developed nation where roads and transport are much better than our country.

The present study found that the mortality rate was statistically lower when the RTA victims directly arrived at the tertiary care facilities compared to the victims referred from another health-care facility. This might be because the latter patients might have had severe injuries, and other environmental and transport factors lead to higher mortality. A patient who reached the health-care facility within the golden hour had a better outcome than others who came late.

This research also found that the number of road accident victims who reached the health-care facilities within 1 h is 55%. A study done in Israel by Tiruneh *et al.* reported a higher percentage<sup>[18]</sup> due to faster and a professional evacuation of persons injured in RTAs in Israel. In the current study, the percentage of RTA victims who got discharged after treatment was 76%. These findings are similar to studies done in Ethiopia<sup>[19,20]</sup> and India.<sup>[21]</sup> A study by Seid *et al.* reported 5.6% admitted in critical care, 10.8% left against medical advice, and 7.4% died.<sup>[19]</sup> The difference in the critical care and left against medical advice may be due to differences in the study setting and patient dissatisfaction. The high percentage of fatalities indicates a critical lack of prehospital and EMS.<sup>[19,21]</sup> Delays in reporting accidents and in the transfer of those wounded to a treatment facility, lack of adequate prehospital treatment, and lack of proper care in hospital emergency departments are among significant determinants of potential injury outcomes.<sup>[22]</sup>

Reasons for delay in reaching the health-care facilities in our study are delay in communication, delay in the



**Table 5: Association between hospital exit outcome and its associated factors among patients attending an emergency trauma care center in Puducherry, South India**

Variable	Discharge, n (%)	Admitted in ICU, n (%)	Died, n (%)	P
Time to reach health facility (h)				
Within 1	166 (82.0)	30 (14.8)	6 (0.02)	0.03
>1	309 (72.8)	98 (23.0)	17 (4.2)	
Age (years)				
<18	40 (81.6)	7 (14.3)	2 (4.1)	0.15
18-28	142 (77.2)	40 (21.7)	2 (1.1)	
29-38	110 (75.9)	30 (20.7)	5 (3.4)	
39-48	83 (76.9)	22 (20.4)	3 (2.8)	
>48	100 (67.1)	29 (19.5)	11 (7.4)	
Gender				
Male	389 (74.7)	112 (21.5)	20 (3.8)	0.28
Female	86 (81.9)	16 (15.2)	3 (2.9)	
Place of accident				
Urban roads	183 (77.9)	43 (18.3)	9 (3.8)	0.411
Rural roads	156 (77.6)	37 (18.4)	8 (4.0)	
Highways	136 (71.6)	48 (25.3)	6 (3.2)	
Time of accident (24 h)				
00.00-04.00	17 (63)	10 (37)	0 (0)	0.19
04.00-08.00	63 (87.5)	7 (9.7)	2 (2.8)	
08.00-12.00	89 (75.4)	25 (21.2)	4 (3.4)	
12.00-16.00	95 (79.2)	22 (18.3)	3 (2.5)	
16.00-20.00	129 (71.7)	41 (22.8)	10 (5.6)	
20.00-00.00	82 (75.2)	23 (21.1)	4 (3.7)	

ICU=Intensive care unit

vehicle's arrival, and prolonged transport period. In a similar study done in Bangalore by Raghav *et al.*,<sup>[23]</sup> the delay in reaching the RTA victims was poor access, lack of communication facilities, and transportation difficulties.

### Limitations and recommendations

To the best of our knowledge, this is the first research that assessed the time taken by RTA victims to reach the hospital and the proportion of them reached the hospital within the golden hour. We have included all the patients attending EMS during the study period and collected data prospectively. However, there are few limitations. Since the data on referral hospitals, time of incidence, and reasons for delay were collected from records, the accuracy of this information is not sure. Since we have collected the data from a single tertiary care hospital, the generalizability of the findings is limited. Our study findings highlight the importance of improving public awareness regarding the golden hour of RTAs.

### Conclusion

The average time taken for RTA victims to reach any health-care facility is 3 h (median). Out of the total, 280 RTA patients had reached the hospitals after the Golden Hour. The reasons for the delay were arrival of the vehicle, delay in communication, period of transport, and lack of knowledge. Those who were come directly to the

emergency department had better hospital exit outcomes than those referred from other hospitals to our center.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

### References

1. Bhuyan PJ, Ahmed F. Road traffic accident: An emerging public health problem in Assam. *Indian J Community Med* 2013;38:100-4.
2. World Health Organisation. *World Health Statistics 2008*. Geneva: World Heal Organ; 2010.
3. World Health Organisation. *The State of Road Safety Around the World*. Geneva: World Health Organ; 2018.
4. Martinez S, Sanchez R, Yañez-Pagans P. Road safety: Challenges and opportunities in Latin America and the Caribbean. *Lat Am Econ Rev* 2019;28:1-30.
5. Sharma R, Jain S, Singh K. Growth rate of motor vehicles in India – Impact of demographic and economic development. *J Econ Soc Stud* 2011;1:137-50.
6. Constant A, Lagarde E. Protecting vulnerable road users from injury. *PLoS Med* 2010;7:e1000228.
7. Government of India Ministry of Road Transport and Highways.

- Road Accidents in India-2018. New Delhi: Government of India Ministry of Road Transport and Highways; 2019.
8. Arbon P, Hayes J, Woodman R. First aid and harm minimization for victims of road trauma: A population study. *Prehosp Disaster Med* 2011;26:276-82.
  9. Bigdeli M, Khorasani-Zavareh D, Mohammadi R. Pre-hospital care time intervals among victims of road traffic injuries in Iran. A cross-sectional study. *BMC Public Health* 2010;10:406.
  10. Jafari M, Shakeri K, Mahmoudian P, Bathaei SA. Innovation in the use of motor ambulance for prehospital emergency care. *J Educ Health Promot* 2019;8:38.
  11. Jothula KY, Sreeharshika D. Knowledge, attitude, and practice toward road safety regulations among college students in Telangana state. *J Educ Health Promot* 2021;10:25.
  12. Beltrán Guzmán I, Gil Cuesta J, Trelles M, Jaweed O, Cherestal S, van Loenhout JA, et al. Delays in arrival and treatment in emergency departments: Women, children and non-trauma consultations the most at risk in humanitarian settings. *PLoS One* 2019;14:e0213362.
  13. Gopalakrishnan S. A public health perspective of road traffic accidents. *J Family Med Prim Care* 2012;1:144-50.
  14. Radjou AN, Kumar SM. Epidemiological and clinical profile of fatality in vulnerable road users at a high volume trauma center. *J Emerg Trauma Shock* 2018;11:282-7.
  15. Madhuvadana T, Naveen N, Arun M, Balakrishna Rao AJ, Kagne RN. Profile of road traffic accident cases in a tertiary care hospital, Puducherry. *Int J Recent Trends Sci Technol* 2015;14:63-7.
  16. Kalaiselvan G, Dongre AR, Mahalakshmy T. Epidemiology of injury in rural Pondicherry, India. *J Inj Violence Res* 2011;3:62-7.
  17. Mishra P. Vital stats overview of road accidents in India. *PRS Legis Res Inst Policy Res Stud* 2017;4343:4801-2.
  18. Tiruneh A, Siman-Tov M, Radomislensky I; Israel Trauma Group, Peleg K. Inequality in in-hospital mortality due to road traffic accident between ethnic populations in specified groups living in the same country. *Isr J Health Policy Res* 2020;9:17.
  19. Seid M, Azazh A, Enquselassie F, Yisma E. Injury characteristics and outcome of road traffic accident among victims at Adult Emergency Department of Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A prospective hospital based study. *BMC Emerg Med* 2015;15:10.
  20. Woyessa AH, Heyi WD, Ture NH, Moti BK. Patterns of road traffic accident, nature of related injuries, and post-crash outcome determinants in western Ethiopia – A hospital based study. *Afr J Emerg Med* 2021;11:123-31.
  21. Osoro AA, Ng'ang'a Z, Yitambe A. An analysis of the incidence and causes of road traffic accident in Kisii, Central district, Kenya. *IOSR J Pharm* 2015;5:41-9.
  22. Mogaka EO, Ng'ang'a Z, Oundo J, Omolo J, Luman E. Factors associated with severity of road traffic injuries, Thika, Kenya. *Pan Afr Med J* 2011;8:20.
  23. Raghav P, Prasad NB, Dholakia M. A study of road traffic accidents and road safety behavior in Pune: A mixed-method approach. *Indian J Community Fam Med* 2015;1:75-8.