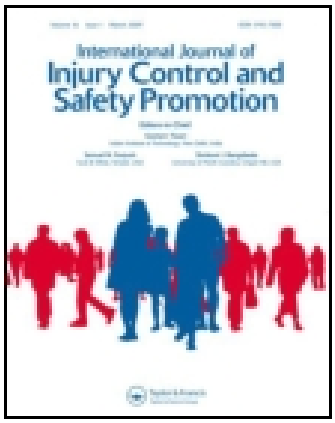
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Traffic law enforcement in Hyderabad, India

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Traffic law enforcement in Hyderabad, India

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The aim of the study was to understand traffic law enforcement (TLE) carried out by the police to reduce non-compliance with traffic laws on the roads of Hyderabad city in India for 2001–2003.

The Traffic Police database of citations issued to drivers who violated traffic laws in Hyderabad was analysed for the years 2001–2003 to describe the TLE activities of the police, to describe and compare the TLE activities for the different types of vehicles and to compare the TLE activities for the 3 years. The violations were classified in five categories – those related to driving, parking, vehicle, document and others; and TLE into safety and other TLE.

A total of 646 161 traffic-law violations were registered in 2001, 904 447 in 2002 and 964 275 in 2003 for Hyderabad. Driving and parking violations were the most common violations registered in all 3 years, with parking violations slightly higher in 2001 (43.5%) and driving violations slightly higher in 2002 (35%) and 2003 (36.4%). Auto-rickshaws (three-wheel commercial passenger vehicles) accounted for the highest violations registered in 2001 (41.4%) whereas motorized two-wheelers had the highest registered violations in 2002 (35.5%) and 2003 (33.2%). Safety TLE activity (detecting and registering driving violations) was only one-third of all the TLE activity performed by the police in the 3 years, and disobeying traffic signals was the most common violation registered under safety TLE. Indian rupees 50 (US$1.1) were collected by way of a fine in 87% of the cases registered. Age and gender of the violators were not recorded in the database.

These data can be used for planning, monitoring and evaluating TLE in Hyderabad. These can help identify traffic control and human factors that could lead to traffic non-compliance, and help identify priorities for improving road safety. These data indicate a need to enhance the safety TLE activity of the police, to make TLE more visible in Hyderabad, and to assess the effectiveness of the current legal action as deterrence to improve road safety. Recommendations to enhance TLE within the given resources of the police are made. More effort is needed towards systematic collection and analysis of data on TLE in India to facilitate long-term improvements in TLE for safer roads.

Keywords: Enforcement; India; Road safety; Traffic laws; Violations

1. Introduction

Worldwide, an estimated 3000 people are killed and 30 000 are seriously injured on roads every day (Roberts 2002). A total of 79 956 people were killed and 382 680 were injured in road traffic crashes in India in the year 2001 according to the Ministry of Road Transport and Highways, Government of India (Road Safety Cell 2001),

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which translates into 219 people killed every day. An estimated 217 000 people were killed in road traffic crashes in India in 1998 according to WHO (Krug 1999), and this number was 76 732 according to Government of India estimates (Road Safety Cell 2001). Irrespective of the wide variations in numbers, the effect of road traffic crashes in India is large, as many of the victims are males in the economically productive age group (Krug 1999, National Crimes Records Bureau 2001, Dandona and Mishra 2004, Mohan 2004). It is estimated that the direct costs of road traffic crashes is 1–2% of the gross national product annually in the low- and middle-income countries (Jacobs *et al*. 2000).

One of the interventions recommended to reduce the burden of road traffic injuries in the *World Report on Road Traffic Injury Prevention* is setting and securing compliance with key road safety rules (Peden *et al*. 2004). Traffic law enforcement (TLE) by the police is one of the methods in securing such compliance. TLE is defined as the activity aimed at controlling road user behaviour by preventative, persuasive and punitive measures for safe and efficient movement of traffic (Organization for Economic Co-operation and Development 1974). The direct objective of TLE is to assure compliance with the traffic laws and regulations that specify acceptable road user behaviour. TLE helps maintain traffic and road conditions that pose fewer hazards to the road users, and by enforcing traffic laws, TLE reduces the chance of road users being involved in road traffic crashes.

Extensive and consistent TLE can reduce the risk of fatal motor-vehicle crashes in highly motorized countries and inadequate or inconsistent TLE can contribute to thousands of deaths each year worldwide (Zaal 1994, Desapriya and Nobutada 2002, Shepherd 2002, Zaidel 2002, Redelmeier *et al*. 2003, Peden *et al*. 2004).

It is well recognized that the citations resulting from TLE activities of the police are samples of traffic-law violations that take place on the roads, as the police can attend to only a small proportion of actual violations being committed on the roads given the enforcement priorities, resources and strategies. Knowledge of the current TLE activities by the police is critical in planning and evaluating TLE activities that are meant to reduce injuries and fatalities due to crashes on the roads.

The aim of this study was to review the TLE activities by the police on the roads of Hyderabad city in southern India for the years 2001–2003 and to provide an overview of current enforcement issues with regard to improving road safety. Hyderabad is the sixth largest city in India with an estimated population of 5.53 million of the Hyderabad urban agglomerate in 2001, half of them males and 70% of them literates (Register General of India 2001). A total of 1 178 121 motor-vehicles were registered in the city in the year 2001–2002, of which 77% were motorized two-wheelers, 11% cars and the rest were accounted for by other types of motor-vehicles (Andhra Pradesh Transport Commissioner 2004).

2. Materials and methods

TLE in the city is the responsibility of the Traffic Department of the Hyderabad Police, with the Additional Commissioner of Police – Traffic as the functional and administrative head. Violations of the traffic laws are registered under the Motor-Vehicle Act, as stated by the orders of the Government of India (1988).

2.1. *Issue of citation*

The process of issue of citation for traffic-law violation is shown in figure 1. A traffic police personnel issues a *challan* (citation/ticket) when a vehicle driver commits a traffic-law violation. If the driver is available, then the *challan* is issued and the driver is required to pay the fine for the particular traffic-law violation as per the prescribed norms. If the driver pays the fine to the traffic personnel at that time, it is treated as an 'on-the-spot' payment of fine. If the driver is unable to pay the prescribed fine amount, then the traffic personnel may take the driver's licence or vehicle registration documents and direct the driver to pay the fine amount at the compounding booth (centralized fine collection centre). These documents are then returned following the payment of the fine. In cases where the vehicle driver is not available (for example, parking violation) or if the traffic personnel is unable to stop the driver who has committed the violation but is able to record the vehicle registration number (for example, disobeying a traffic signal), then notice is served to the driver. This notice directs the driver to pay the prescribed fine amount for the violation at the compounding booth within 7 days. This notice is served either by sticking it on the vehicle (for example, in the case of a parking violation) or by post.

The driver who is charged with a traffic-law violation has the right to present his/her case in the Court of Law or to the Deputy Commissioner of Police – Traffic, if he/she does not agree with the charges.

In addition to documenting the details of traffic personnel who issue the *challan*, the date, time and place of violation, name of the violator and that of his/her father, address of violator, vehicle registration number of the violator, section of Motor-Vehicle Act under which the *challan* is issued, amount of fine, details of on-the-spot payment, contact details of compounding booth and Court of Law where the *challan* can be challenged by the violator and signatures of the violator and the traffic personnel are documented on the *challan*.

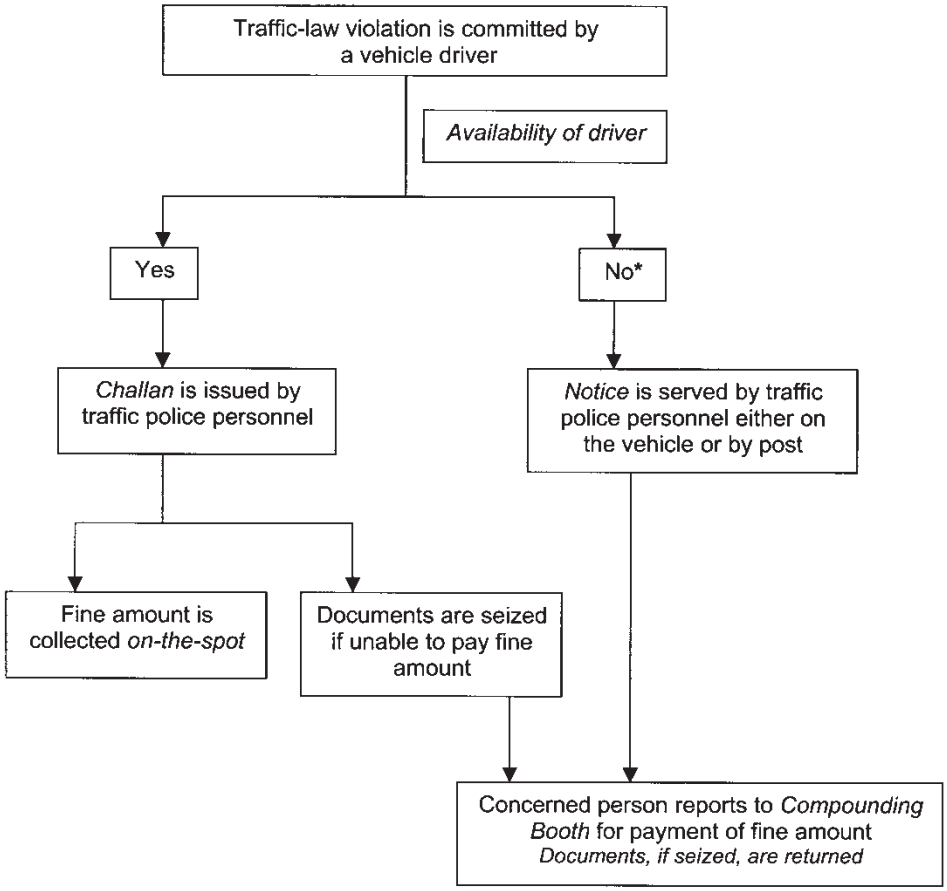


Figure 1. The process of issuing a citation by the traffic police for traffic-law violations in Hyderabad. *Vehicle driver may not be available in some parking violations (notice served on the vehicle) or when traffic police personnel are unable to stop the person committing the offence but records the vehicle registration number of the vehicle driven by that person (notice served by post).

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2.2. *Citation database*

All *challans* are issued in duplicate. The original form is given to the driver for the details of the violation and it also serves as the receipt of payment of the fine. Duplicate forms are submitted to the Traffic Police Headquarters for entry into the *challan database* on a daily basis. Data are entered into a Fox-pro database that is maintained by the Traffic Police. This database has 24 categories of vehicles and 50 categories of traffic-law violations recorded under the 19 traffic police stations in the city.

2.3. *Data analysis*

Access to the above database for the years 2001–2003 was provided to the authors for analyses. Traffic-law violations and vehicles were categorized for analysis in order to make tangible recommendations for action and these categories are described below.

2.3.1. Categories of traffic-law violations.

- Driving violations – these included disobeying/jumping a traffic signal, driving on the wrong side of the road (driving opposite to the direction of the traffic), entering a no-entry zone, making a U-turn in a 'no U-turn' zone, overtaking a vehicle from the wrong side, rash driving, speeding, drink–driving, three people riding on a two-wheeler meant for two people and use of mobile phone while driving.
- Parking violations – these included parking in a no-parking zone, parking in a bus-bay and parking in a manner that obstructs the flow of traffic.
- Document violations – violations related to lack of: driver's licence; vehicle registration documents; vehicle pollution check certificate; and proper driving permit in case of small-load and heavy-load vehicles.
- Vehicle violations – these violations were related to poor condition of vehicle and included no display or

improper display of vehicle registration number, no functional headlight, use of dazzling light, no horn or a multi-toned horn, extra projections on the vehicle, use of red/blue lights, no rear-view mirror and tampering of the fare meter in auto-rickshaws (three-wheeler commercial passenger vehicles).
- Other violations – all the other violations were combined under this category and included demand for extra money from passengers by auto-rickshaw drivers, obstruction of driver's view due to a person sharing the seat with the driver in auto-rickshaws, extra passengers in a vehicle, underage driving, driving of a passenger transport vehicle without proper uniform, refusal to give information to police on demand and adulteration of diesel with kerosene.

2.3.2. Categories of traffic law enforcement activity. With the aim of understanding the TLE activities of police, which have an implication of mortality and morbidity due to road traffic crashes, the above categories of violations were re-categorized as those that were directly related to safety of the road users (safety TLE) and those that were not directly related to safety (other TLE). Registering of driving violations was categorized as safety TLE activity and the rest of the violations as other TLE activity.

2.3.3. Categories of vehicles.

- Cars – this category included cars only.
- Motorized two-wheelers – this included motorcycles, scooters and mopeds.
- Auto-rickshaws – these are three-wheeler commercial passenger vehicles that are meant to carry three adult passengers.
- Small-load vehicles – the vehicles that carry a small amount of load within the city limits were included in this category.
- Others – this category included buses, trucks, tractors, jeeps and other vehicles.

Analysis was done to describe the TLE activities of the police in the city, to describe and compare the TLE activities for the different types of vehicles and to compare the TLE activities for the years 2001–2003. Data were analysed using SPSS software. Univariate analysis, followed by multiple logistic regression, was carried out to understand the safety TLE activities of the police. In the multiple logistic regression model, the effect of each category of a multi-categorical variable was assessed by keeping the first or the last category as a reference. All the variables were introduced in this model simultaneously and none of the variables was optimized.

3. Results

The Hyderabad Traffic Police had registered a total of 646 161 traffic-law violations in the year 2001, 904 447 in the year 2002 and 964 275 in 2003. To extrapolate these numbers in terms of the population of Hyderabad: 1168 violations were registered per 10 000 population in 2001; 1602 violations in 2002; and 1675 violations in 2003. In terms of the number of motor vehicles registered in the city,

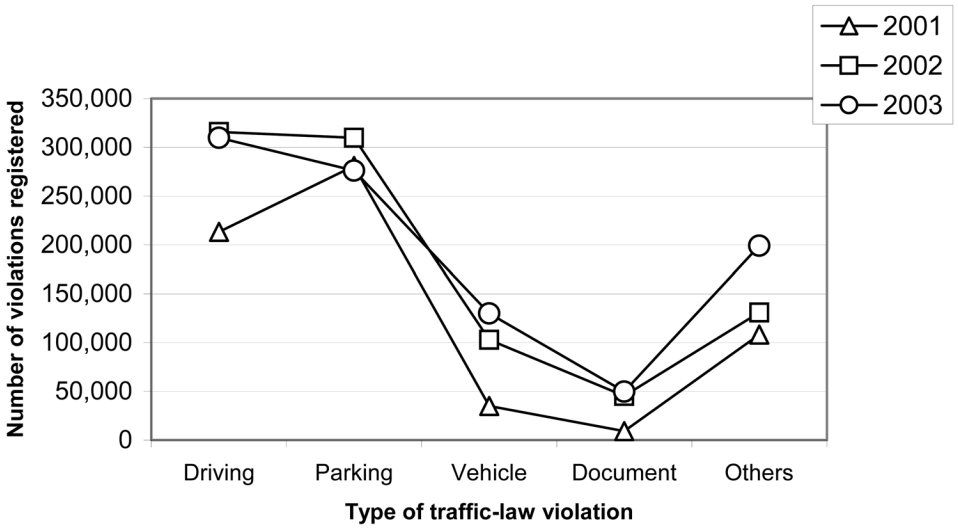


Figure 2. Distribution of the number of violations registered for the types of traffic-law violations in the years 2001, 2002 and 2003 in Hyderabad.

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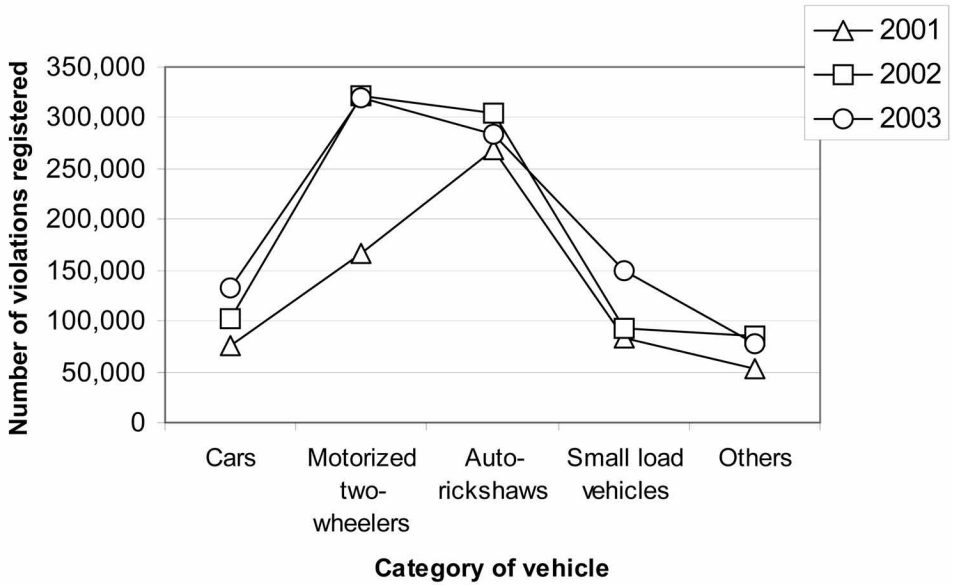


Figure 3. Distribution of the number of violations registered for the categories of vehicles in the years 2001, 2002 and 2003 in Hyderabad.

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5876 violations were registered per 10 000 motor vehicles in 2001, 7677 violations in 2002 and 8035 violations in 2003.

Driving and parking violations were the most common registered in all the 3 years, with parking violations slightly higher in 2001 and driving violations slightly higher in 2002 and 2003 (figure 2). The categories of vehicles registered for violations for the 3 years are shown in figure 3. Motorized two-wheelers and auto-rickshaws were the most common vehicles registered for violations in all the 3 years. A similar pattern was seen in all the 3 years for the violations registered for the different types of vehicles, with some variations for cars and small-load vehicles (table 1). For cars, the most commonly registered violations in 2001 and 2002 were parking-related and in 2003 were driving-related. Of all the traffic-law violations, parking and other violations were registered more commonly for small-load vehicles in 2001 but vehicle violations accounted for the most in the years 2002 and 2003.

The distribution of TLE activities of the police is summarized in table 2. Considering the TLE activity for the 3 years together, safety TLE was 35% of all the TLE activity by the police. More than half of the TLE activity related to motorized two-wheelers and other vehicles was safety TLE and this trend was also seen for each separate year (data not shown). The majority of safety TLE activity resulted in on-the-spot fine collection (76%) and in the fine amount of Indian rupees 50 (US$1.1) (69.7%). On applying multiple logistic regression among the vehicles registered for safety TLE, the odds were significantly higher than motorized two-wheelers and other vehicles were compared with cars and the odds were significantly higher for the vehicles of these three group of vehicles, as compared with auto-rickshaws and small-load vehicles. The odds of the fine amount collection being more than Indian rupees 500 were significantly higher for safety TLE.

The distribution of various driving violations that were recorded as safety TLE for the 3 years is shown in figure 4. Disobeying traffic signals was the most common violation recorded as part of safety TLE by the police. Although the absolute numbers of this violation had increased, between 2001 and 2003 its proportion had decreased.

4. Discussion

Approaches to reduce the burden of road traffic injuries can be mostly classified as education, enforcement and engineering (O'Neill 2001). Good enforcement is an integral part of road safety. TLE is based upon the assumption that not all road users will adhere to the specified traffic laws and regulations and they may need to be encouraged, educated and persuaded to do so. In addition to the traffic laws and regulations, TLE consists of two other components aimed at safe use of roads by the users and play an important role in determining the impact and effectiveness of TLE. These are: 1) traffic policing, to ensure that road users comply with laws and regulations; and 2) legal action can be taken when road users do not comply (Rottengator 1990).

Table 1. Distribution of traffic-law violations registered in the years 2001, 2002 and 2003 for the various categories of vehicles in Hyderabad.

Type of vehicle	Year 2001	Year 2002	Year 2003
Car	75 948 (11.8%)	101 541 (11.2%)	133 306 (13.8%)
Driving	25 110 (3.9%)	39 527 (4.4%)	64 088 (6.6%)
Parking	44 552 (6.9%)	47 997 (5.3%)	51 036 (5.3%)
Vehicle	2659 (0.4%)	6262 (0.7%)	6506 (0.7%)
Document	646 (0.1%)	2878 (0.3%)	6839 (0.7%)
Others	2981 (0.5%)	4877 (0.5%)	4837 (0.5%)
Motorized two-wheelers*	166 595 (25.8%)	321 405 (35.5%)	319 918 (33.2%)
Driving	99 221 (15.4%)	166 335 (18.4%)	162 776 (16.9%)
Parking	52 919 (8.2%)	84 509 (9.3%)	80 800 (8.4%)
Vehicle	9723 (1.5%)	29 167 (3.2%)	26 213 (2.7%)
Document	1889 (0.3%)	31 645 (3.5%)	30 566 (3.2%)
Others	2843 (0.4%)	9749 (1.1%)	19 563 (2%)
Auto-rickshaw†	267 982 (41.4%)	303 993 (33.7%)	284 361 (29.5%)
Driving	45 546 (7%)	45 755 (5.1%)	52 188 (5.4%)
Parking	140 071 (21.7%)	138 859 (15.4%)	106 563 (11%)
Vehicle	4588 (0.7%)	21 117 (2.3%)	18 921 (2%)
Document	5243 (0.8%)	8003 (0.9%)	7816 (0.8%)
Others	72 534 (11.2%)	90 259 (10%)	98 873 (10.3%)
Small-load vehicles‡	82 714 (12.8%)	92 443 (10.3%)	148 698 (15.4%)
Driving	15 133 (2.3%)	15 026 (1.7%)	30 747 (3.2%)
Parking	25 830 (4%)	16 203 (1.8%)	16 206 (1.7%)
Vehicle	13 942 (2.2%)	39 724 (4.4%)	71 272 (7.4%)
Document	847 (0.1%)	1624 (0.2%)	2352 (0.2%)
Others	26 962 (4.2%)	19 866 (2.2%)	28 121 (2.9%)
Others§	52 920 (8.2%)	85 056 (9.3%)	77 985 (8.1%)
Driving	27 781 (4.3%)	48 689 (5.4%)	41 081 (4.3%)
Parking	17 413 (2.7%)	22 023 (2.4%)	21 357 (2.2%)
Vehicle	4005 (0.6%)	6549 (0.7%)	6973 (0.7%)
Document	472 (0.1%)	1161 (0.1%)	1977 (0.2%)
Others	3249 (0.5%)	6634 (0.7%)	6597 (0.7%)
TOTAL	646 159 (100%)	904 438 (100%)	964 268 (100%)

Data were not available for 2, 9 and 7 violations for the years 2001, 2002 and 2003, respectively.
* Includes motor cycle, scooter and moped.
† Three wheel vehicle for carrying three adult passengers.
‡ Does not include trucks or similar heavy-load vehicles.
§ Includes jeeps, heavy-load vehicles, tractors and buses.

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A recent major review of TLE has identified several issues that are important for TLE to be effective. These include visible and consistent TLE over a period of time, use of specific strategies targeted at particular behaviours and locations, meaningful deterrents and efficient legal action (Zaal 1994). The TLE activities of the police of Hyderabad and the background of these issues, which are important for effective TLE, are discussed.

4.1. *Current traffic law enforcement scenario*

Like any other Indian city, the traffic in Hyderabad is a mixture of pedestrians, non-motor vehicles, commercial and private motor vehicles and animals. The motorized two-wheel vehicles form the majority of the motor vehicles on the road (Andhra Pradesh Transport Commissioner 2004). The city has 1250 km of road length, 386 junctions (intersections) of which 224 (58%) are manned junctions and 86 traffic signals (Reddy *et al*. 2004). The use of camera technology at certain traffic signals for TLE has been approved for implementation but none is currently in use (Reddy *et al*. 2004).

The current strength of the Traffic Police Department in Hyderabad is 1173, of whom 1162 (99%) are required to be on duty on the roads for an average of 8 hours per day for 6 days per week (Reddy *et al*. 2004). For an estimated population of 5 757 000 in 2003 for Hyderabad, two traffic personnel are available per 10 000 population. These traffic personnel perform three main functions: 1) traffic regulation, which involves the day-to-day management of traffic; 2) TLE to reduce non-compliance with traffic laws; and 3) traffic restriction and management, which involves making special arrangements in traffic by restricting movement of the public during the movement of politicians or during

Table 2. Relation of select factors with safety traffic law enforcement (TLE) activities of the police in Hyderabad city for years 2001, 2002, and 2003.

	Total TLE (2 514 876)	Safety TLE* n (%)	Odds of safety TLE with multiple logistic regression (95% CI)
Year†			
2001	646 160	213 205 (33%)	1.00
2002	904 441	315 874 (34.9%)	0.90 (0.89 – 0.90)
2003	964 275	350 882 (36.4%)	0.96 (0.95 – 0.97)
Type of vehicle†‡			
Car	310 795	128 725 (41.4%)	1.00
Motorized two-wheeler	807 918	428 332 (53%)	1.51 (1.50 – 1.52)
Auto-rickshaw	856 336	143 489 (16.8%)	0.28 (0.27 – 0.28)
Small load vehicle	323 855	60 906 (18.8%)	0.35 (0.35 – 0.35)
Other vehicles	215 961	118 505 (54.9%)	1.64 (1.62 – 1.66)
Action taken†§			
On-the-spot fine	1986 371	668 265 (33.6%)	1.00
Notice served	346 768	154 185 (44.5%)	1.28 (0.89 – 1.84)
Document seized	181 039	57 083 (31.5%)	1.04 (0.72 – 1.49)
Fine amount (Indian Rupees)†¶			
None	528 585	211 724 (40.1%)	1.00
50	1383 136	466 099 (33.7%)	1.06 (0.74 – 1.52)
51 – 100	418 044	107 605 (25.7%)	0.72 (0.50 – 1.03)
101 – 500	171 096	85 488 (50%)	1.25 (0.87 – 1.80)
> 500	14 014	9044 (64.5%)	1.99 (1.39 – 2.86)

*Safety TLE activity includes driving violations.
†$p < 0.001$, Chi-square test univariate analysis.
‡ Motorized two-wheeler includes motor cycle, scooter and moped; auto-rickshaw is a three-wheel vehicle for carrying three adult passengers; small load vehicles does not include trucks or similar heavy-load vehicles; other vehicles includes jeeps, heavy-load vehicles, tractors and buses; data not available for 11 cases.
§Data not available for 698 cases.
¶Indian rupees 50 = US$1.1 in May 2004; On-the-spot fine = fine for violation collected by traffic personnel at the time of issuing citation; notice served = citation is not issued because of non-availability of violator, and violator pays fine later; document seized = some documents are seized if violator is unable to pay the fine at the time of violation, and violator pays fine and collects the documents later; data not available for one case.

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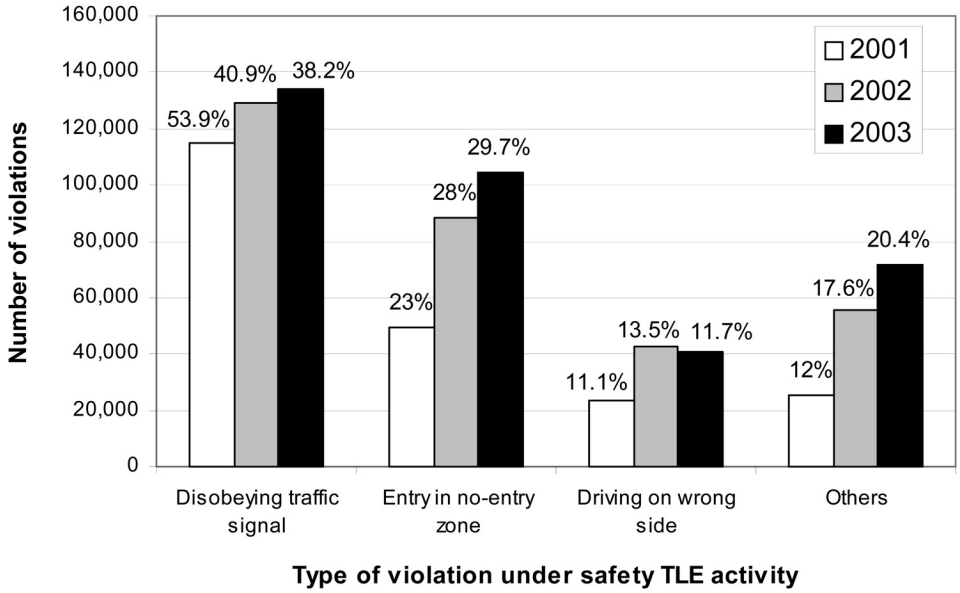


Figure 4. Distribution of the types of driving violations categorized as safety traffic law enforcement (TLE) activity for the 3 years combined in Hyderabad. (Percentages based on the total number of driving violations for each year as denominator).

festivals/rallies. It is estimated that 70% of the time of these personnel is spent in traffic restriction and management (personal communication with the Deputy Commissioner of Police – Traffic, Hyderabad city; 26 March 2004).

4.2. *Visibility and consistency of traffic law enforcement*

With an estimated 30% of the time of traffic personnel spent in traffic regulation and TLE activities, in effect, only 0.6 traffic personnel are available per 10 000 people in the city. Because of such a low presence of these personnel on the roads for TLE, the perceived risk of being detected and punished for a violation is low among drivers, which makes them less apprehensive of TLE, as has been reported previously (Mohan 1983).

In addition, only traffic personnel above the rank of constable can authorize a *challan* and in the city the ratio of such personnel to constables is 1:6. Hence, a constable cannot stop a driver who has committed a violation in order to issue a *challan* if the personnel with authority are not available. This further results in a perception of less and inconsistent TLE among the drivers even if traffic personnel are seen on the road. Therefore, the actual number of violations committed is higher than the number of *challans* issued.

4.3. *Traffic law enforcement activities*

4.3.1. Vehicles and violations. Considering all the violations registered in the 3 years, the proportion of cars, motorized two-wheelers and auto-rickshaws registered for violations was 12.3, 32.0 and 34.0%, respectively. Of the total number of vehicles registered in the city in 2001–2002, the proportion of cars, motorized two-wheelers and auto-rickshaws was 10.6, 77.0 and 5.4%, respectively and these proportions were similar in 2003.

The higher proportion of violations registered against auto-rickshaws should be seen in the context of their commercial use and competition for passengers. Auto-rickshaws are the largest group of commercial passenger vehicles in the city (Andhra Pradesh Transport Commissioner 2004). The most common type of violation by auto-rickshaws was parking violation especially for parking in bus-bays. It is common for these drivers to occupy bus-bays in order to look for passengers even where designated parking places are available. However, this occupancy starts a chain of sequence – the bus drivers stop the buses on the road as their allotted space is pre-occupied, which results in passengers standing/walking/running on the road with the traffic in order to catch the bus, thereby leaving them exposed to risk of a road traffic crash. In addition, the auto-rickshaw drivers are commonly observed as driving fast and rashly, which may also be related to their desire to pick up more passengers in order to earn more money.

The motorized two-wheelers were the most commonly registered private motor vehicles for violation, which is not surprising as these vehicles are the largest in number in the city (Andhra Pradesh Transport Commissioner 2004). However, this high number is of significance because the drivers of motorized two-wheelers are one of the most vulnerable population groups on the Indian roads (Dandona and Mishra 2004, Mohan 2004, Peden *et al*. 2004). These drivers accounted for 32 and 38% of road traffic crash fatalities in the city during the years of 2002 and 2003, respectively (Department of Traffic Police 2003, Dandona and Mishra 2004). It is not possible to comment on the contribution of non-compliance with traffic laws by these drivers as the cause of vehicle crashes, because these data are not routinely documented in such cases (Dandona and Mishra 2004).

4.3.2. Safety traffic law enforcement activities. Safety TLE activity (detecting and registering driving violations) was only one-third of all the TLE activity performed by the police in the 3 years. Driving violations are 'moving violations' that carry a higher risk of being involved in a crash. The proportion of traffic signal (red light) violations was the highest among the safety TLE activity.

In a recent report by WHO, two TLE activities have been recommended for reducing fatal road traffic crashes: 1) enforcement of the speed limit; and 2) prevention of driving under the influence of alcohol (Peden *et al*. 2004). In Hyderabad, the proportion of *challans* issued for speeding and driving under the influence of alcohol was < 0.1 and 0.3%, respectively. Enforcing speed limits may not be a safety TLE priority in the city as most of the roads are narrow with highly mixed traffic moving at varying speeds, which does not allow much speeding. The Traffic Police Department has six breath analysers for enforcing alcohol impairment laws (Reddy *et al*. 2004). However, this law is mainly enforced during festivals and New Year celebrations, as the proportion of drivers under the influence of alcohol is considered high during these events. The data on the contribution of speeding and driving under the influence of alcohol, for road traffic crash fatalities in the city are not available as this is not routinely documented (Dandona and Mishra 2004).

Violations such as driving on the wrong side of the road (opposite to the direction of traffic) are quite common in the city. On the one hand, some drivers attempt to take a short-cut route either to save time or fuel, thereby committing a violation. On the other, due to lack of coordination between the Traffic Police Department and the Municipal Corporation of the city (responsible for road infrastructure), the gap in the median of the roads does not take the by-lanes into consideration, which results in drivers opting for driving on the wrong side of the road.

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Not wearing a helmet does not feature in the safety TLE, as wearing a helmet for riders of two-wheelers is optional in the city.

4.4. *Deterrence and legal action*

The predominant outcome of TLE was on-the-spot collection of a fine for the committed violation. These data show that the majority of the violations incurred a fine of Indian rupees 50 (US$1.1) to the drivers. Using the gross domestic product (GDP) per capita of India (US$462) (United Nations Development Programme 2003), the GDP per day is US$1.26, which reflects the average for the country. Many of the people who reflect the average GDP/day are likely to be pedestrians or users of the public transport system and hence do not feature in the TLE activity of the police. The average income per day of drivers who feature in TLE activity is likely to be higher. For example, a starting secretary makes about Indian rupees 100 (US$2.2) a day on average. Therefore, the average fine of US$1.1 is less than the income of 1 day even for the lower end of the income spectrum of vehicle owners in Hyderabad. The effectiveness of this amount as a deterrent needs to be assessed and revisions made accordingly. However, there is also a suggestion that imposing stricter penalties does not affect road user behaviour significantly but can reduce the level of enforcement in some settings (Bjornskau and Elvik 2001).

In addition, when the police serve notice by post to a driver for a violation committed, the chances of it reaching the violator are considered low in India as the addresses in the vehicle registration and drivers' licence databases are commonly not updated. With the current workforce limitations, the traffic police department does not have the capacity to pursue legal action against the drivers who are served notice for violation but who do not pay the fine (Reddy *et al*. 2004).

4.5. *Utility and limitations of these data*

These data could be used for planning, monitoring and evaluating TLE in the city and can serve three functions to increase road safety: 1) identification of factors in traffic control that generate non-compliance; 2) identification of human factors that generate non-compliance; and 3) administrative use. From an organizational perspective, the priorities for improving road safety can be planned. These data show that only one in three violations recorded by the traffic police were the ones that had a relatively higher risk of causing injury on the roads (safety TLE).

These violations can be linked to age, gender and vehicle in order to understand 'who on the roads is more likely to be registered for violation' or 'drivers of which types of vehicle are more likely to be registered for which type of violations'. This information could then be used to plan strategies of TLE for different target populations. It can be argued that age and gender of the violator should not be of much interest to TLE, as law enforcement is about compliance, irrespective of the personal attributes of the violator. However, in a developing country setting without substantial technology to assist in detection of violations and given the available limited manpower for TLE, understanding age, gender and vehicle factors would be important to improve road safety. It is known that young males driving motorized two-wheelers are one of the main victims of road traffic crashes in the city (Department of Traffic Police 2003, Dandona and Mishra 2004). The data on non-compliance show that the drivers of motorized two-wheelers accounted for one-third of all those who were registered for violations in the city. Therefore, it may not be unreasonable for TLE to have special focus on young men driving motorized two-wheelers. However, this type of analysis was not feasible with the currently available data on non-compliance, as age and gender of the violator were not recorded on the *challans* that were issued for violation. Another limitation of these data is that this is not representative of all the violations that are committed. This is because issuing a *challan* for violation depends on the availability of traffic personnel for TLE and it is not uncommon for some violators to pay money to traffic personnel when caught for violation without having a *challan* issued for the violation.

4.6. *The way forward*

These data clearly indicate that there is a need to set priorities for safety TLE activity of the police and to make it more visible in Hyderabad for improving road safety. To accomplish better TLE within the given resources, the Traffic Police Department could:

- attempt to re-allocate the time of staff to TLE activities in order to make TLE more visible to road users;
- prioritize TLE activities to those violations that have a higher risk of causing injury to road users;
- record age and gender of the violator on the *challan* forms;
- explore the possibility of increasing the fine for violations to a level that can serve as a deterrent for future violations and at the same time not be too high that it reduces the level of TLE;
- routinely analyse the violations registered to assess the relationship between planned TLE operations and actual outcomes of TLE;

- establish effective linkages with the department responsible for city planning in order to reduce violations that are caused by poor road design;
- attempt to link data on non-compliance with traffic laws to the road traffic crash data in order to better understand the contribution of traffic-law violations to mortality and morbidity due to road traffic injuries.

To reduce injuries and fatalities due to road traffic crashes in the long term, more detailed understanding of the traffic scenario for various types of road users, effectiveness of different TLE strategies, association between non-compliance with traffic laws and crashes and the working of the Traffic Police Department within the social, economic and political context would be needed. Meanwhile, the above recommendations could serve as an initial step towards the long-term goal.

5. Conclusion

These data on traffic-law violations indicate a need to enhance the safety traffic law enforcement activities of the police, to make traffic-law enforcement more visible, and to assess the effectiveness of the current legal action as deterrence to improve road safety in Hyderabad. These data can be used for planning, monitoring and evaluating traffic law enforcement in Hyderabad. More effort is needed towards systematic collection and analysis of data on traffic law enforcement in India to facilitate long-term improvements in and to help identify priorities for improving road safety.

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