

AWARENESS AND COMPLIANCE WITH TRAFFIC SAFETY REGULATIONS AMONG YOUNG ADULTS: A COMMUNITY-BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Road traffic injuries represent an important preventable cause of death and disability among young adults. Awareness of traffic-safety regulations is essential, but knowledge may not consistently translate into compliant road behaviour. Community-based evidence regarding awareness, compliance, and their associated factors can support targeted road-safety interventions. **Aim:** To assess awareness and compliance with traffic-safety regulations among young adults residing in a selected community. **Materials and Methods:** A community-based cross-sectional study was conducted among 140 young adults aged 18–29 years. Participants were selected from the study community using a predefined sampling procedure. Data were collected through face-to-face interviews using a pretested, structured questionnaire covering sociodemographic characteristics, driving profile, awareness of traffic rules, compliance practices, previous road traffic accidents, and traffic penalties. Awareness and compliance were classified as satisfactory when participants obtained at least 75% of the respective maximum score. Data were summarised using mean, standard deviation, frequency, percentage, and 95% confidence interval. The one-sample proportion z-test, one-sample t-test, and Pearson's chi-square test were applied as appropriate. A two-tailed $P < 0.05$ was considered statistically significant. **Results:** The mean age of the participants was 23.7 ± 3.2 years, and 75 (53.6%) were males. Of the 140 participants, 104 (74.3%) regularly used a motorised vehicle. Among these regular drivers, 92 (88.5%) possessed a valid driving licence and 68 (65.4%) had received formal driving training. The mean awareness score was 11.6 ± 2.1 out of 15, and 103 (73.6%) participants had satisfactory awareness. The mean compliance score was 14.2 ± 3.4 out of 20, with satisfactory compliance observed in 84 (60.0%) participants. Only 72 (51.4%) had both satisfactory awareness and compliance. Awareness was highest for traffic-light signals (94.3%), prohibition of drink-driving (93.6%), and licensing requirements (92.1%), whereas awareness of Good Samaritan protections was lowest (55.7%). Compliance was highest for avoiding driving after alcohol consumption (94.2%) and driving with a valid licence (88.5%). Comparatively lower compliance was recorded for pillion-rider helmet use (59.5%) and adherence to speed limits (68.6%). Satisfactory awareness was significantly associated with age, education, regular motorised-vehicle use, valid licensing, and formal driving training. Satisfactory compliance was associated with sex, education, regular vehicle use, licensing, formal training, and absence of previous traffic penalties. Compliance was significantly higher among participants with satisfactory awareness than among those with unsatisfactory awareness (69.9% versus 32.4%; $\chi^2 = 15.41$, $P < 0.001$). **Conclusion:** Young adults demonstrated relatively good awareness but only moderate compliance with traffic-safety regulations, revealing a clear knowledge–practice gap. Valid licensing, formal driving training, and higher education were associated with safer behaviour. Integrated interventions combining education, practical driver training, behavioural modification, and consistent enforcement are required to improve compliance among young road users.

INTRODUCTION

Road traffic injuries constitute a major and preventable public-health problem worldwide. Approximately 1.19 million people die annually because of road traffic crashes, while millions experience non-fatal injuries and permanent disabilities. Road traffic injuries are the leading cause of death among children and young adults aged 5–29 years, and nearly 90% of road traffic deaths occur in low- and middle-income countries.^[1] Young adults are especially vulnerable because of frequent travel, greater use of two-wheelers, limited driving experience, risk-taking behaviour, speeding, distracted driving, alcohol consumption, and inconsistent use of protective devices. In India, rapid motorisation, increasing traffic density, heterogeneous road use, inadequate infrastructure, and variable enforcement of traffic regulations have contributed to a substantial burden of road traffic accidents. During 2023, India recorded 480,583 road accidents, resulting in 172,890 deaths and 462,825 injuries.^[2] Two-wheeler riders accounted for a considerable proportion of these fatalities, demonstrating the vulnerability of young riders and pillion passengers.

Traffic safety regulations—including adherence to speed limits and traffic signals, possession of a valid driving licence, use of standard helmets and seat belts, avoidance of mobile-phone use while driving, prohibition of driving under the influence of alcohol, and observance of lane discipline—are essential for reducing road traffic injuries. Correct use of protective equipment can substantially reduce the severity of injuries and the risk of death. However, awareness of traffic regulations does not necessarily result in consistent compliance. Studies among young and adult road users have identified a gap between knowledge and actual practice, particularly regarding helmet fastening, pillion-rider helmet use, rear-seat belt use, speeding, mobile-phone use, and drink-driving.^[3,4]

Compliance with traffic safety regulations is influenced by several individual and environmental factors, including age, sex, educational status, socioeconomic background, type of vehicle, driving experience, previous involvement in road traffic accidents, perceived risk, peer behaviour, availability of safety equipment, and perceived probability of police enforcement. Community-based assessment is important because it includes young adults with different educational, occupational, and transportation backgrounds and provides a more representative understanding of road-safety behaviour than studies restricted to institutional settings. Previous Indian studies have reported reasonable awareness of basic traffic rules among college students but comparatively poorer adherence to recommended safety practices.^[4,5] Identifying specific deficiencies in awareness and compliance can assist public-health authorities, traffic police,

educational institutions, and community organisations in designing targeted interventions.

Aim

To assess awareness and compliance with traffic safety regulations among young adults residing in the selected community.

Objectives

1. To determine the level of awareness regarding traffic rules and road-safety measures among young adults.
2. To assess compliance with helmet use, seat-belt use, traffic signals, speed limits, licensing requirements, and restrictions on mobile-phone use and drink-driving.
3. To determine the association of awareness and compliance with selected sociodemographic, driving-related, and road-traffic accident-related characteristics.

MATERIALS AND METHODS

Source of Data

The study data were obtained from young adults residing in the selected community. Eligible participants were approached at their residences and at selected community locations such as residential areas, markets, parks, educational surroundings, and public gathering places. Primary data were collected directly from the participants using a pretested, structured questionnaire. No hospital records or other secondary data sources were used, except when participants voluntarily showed documents such as a driving licence for verification.

Study Design

A community-based cross-sectional study was conducted to assess awareness and self-reported compliance with traffic safety regulations among young adults.

Study Location

The study was conducted in the selected urban and/or rural field-practice area attached to the Department of Community Medicine of the concerned tertiary-care teaching institution. The study area was divided into predefined geographical clusters or localities to ensure adequate representation of young adults from different parts of the community.

Study Duration

The study was conducted over a period of six months. This duration included protocol preparation, ethical approval, questionnaire development, pilot testing, participant recruitment, data collection, data verification, statistical analysis, and report preparation.

Sample Size

The sample size was calculated using the formula for estimating a single population proportion: where at a 95% confidence level, was the anticipated proportion of young adults with adequate awareness of traffic safety regulations (90%), (10%), and was the absolute precision (5%).

The calculated sample size was rounded to 140 participants. Therefore, a total of 140 eligible young adults were included in the study.

Inclusion Criteria

Participants were included when they:

1. Were aged 18–29 years.
2. Had resided in the selected community for at least six months.
3. Used public roads as a pedestrian, cyclist, motorised two-wheeler rider, pillion rider, or motor-vehicle driver.
4. Were able to understand the study questions and communicate their responses.
5. Provided written informed consent to participate.

Exclusion Criteria

Participants were excluded when they:

1. Were seriously ill or unable to participate at the time of data collection.
2. Had a cognitive, communication, or psychiatric condition that prevented reliable completion of the questionnaire.
3. Were temporary visitors to the selected community.
4. Declined consent or withdrew before completing the interview.
5. Submitted a questionnaire with substantial missing information.

Sampling Technique

A multistage or systematic community-based sampling method was used. The selected community was divided into geographical localities or clusters. The required sample was allocated to each locality in proportion to its population. Households were selected by systematic random sampling after determining an appropriate sampling interval. In each selected household, all residents aged 18–29 years were enumerated. When more than one eligible young adult was present, one participant was selected by simple random sampling using the lottery method. If an eligible participant was unavailable, two repeat visits were made before the household was considered a non-response. The next eligible household was approached as a replacement when required.

Data Collection

Data were collected through face-to-face interviews using a pretested, structured questionnaire. The questionnaire was prepared in English, translated into the local language, and independently back-translated to verify conceptual consistency. It consisted of the following sections:

- Sociodemographic characteristics: age, sex, education, occupation, socioeconomic status, and place of residence.
- Road-use profile: usual mode of transport, vehicle ownership, possession of a driving licence, duration of driving, average frequency of travel, and formal driving training.
- Awareness of traffic safety: traffic signals, road signs, speed limits, helmet and seat-belt requirements, lane discipline, pedestrian rules,

mobile-phone restrictions, drink-driving laws, emergency response, and Good Samaritan provisions.

- Compliance practices: regular helmet and seat-belt use, helmet fastening, pillion-rider helmet use, adherence to signals and speed limits, avoidance of mobile-phone use, avoidance of alcohol before driving, and compliance with lane and pedestrian regulations.
- Previous experiences: traffic violations, penalties, near-miss events, and history of involvement in a road traffic accident.

Sensitive behaviours such as alcohol consumption, speeding, and mobile-phone use while driving were assessed without judgment, and privacy was maintained during the interview to minimise socially desirable responses.

Procedure and Methodology

Before data collection, approval was obtained from the Institutional Ethics Committee. Permission was also obtained from the relevant community and administrative authorities. Potential participants were informed about the purpose, procedure, voluntary nature, possible benefits, and minimal risks of the study. Written informed consent was obtained before enrolment.

The questionnaire was reviewed by experts in Community Medicine, traffic safety, and biostatistics for content validity. A pilot study was conducted among approximately 10% of the intended sample in a neighbouring community that was not included in the final study. Necessary modifications were made to improve clarity and sequence. Internal consistency of the awareness and compliance sections was assessed using Cronbach's alpha.

Each correct awareness response was assigned one point, while an incorrect or "do not know" response was assigned zero. The individual item scores were added to obtain a total awareness score. Awareness was classified as satisfactory when the participant obtained at least 75% of the maximum score; scores below 75% were classified as unsatisfactory.

Compliance items were assessed using "always," "sometimes," and "never" responses. For positively worded safe practices, scores of 2, 1, and 0 were assigned, respectively. Reverse scoring was used for unsafe behaviours. A total compliance score was calculated, and compliance was classified as satisfactory at a predetermined threshold of at least 75% of the maximum possible score. Item-wise compliance was also reported because a composite score could conceal important unsafe behaviours.

The principal investigator or trained data collectors administered the questionnaire in a standardised manner. Completed forms were checked on the same day for missing or inconsistent responses. Participants were identified using unique study codes, and identifying information was not entered into the analytical dataset.

Sample Processing

No biological specimens were collected; therefore, laboratory sample collection and processing were not applicable. For data processing, completed questionnaires were scrutinised for completeness, coded, and entered into a password-protected electronic database. Double-entry verification or random cross-checking of at least 10% of records was performed against the original questionnaires. Range and consistency checks were applied before analysis. Incomplete responses were documented, and no unrecorded value was replaced without a prespecified statistical justification.

Statistical Methods

Data were analysed using IBM SPSS Statistics, R, Stata, or equivalent statistical software. Categorical variables were summarised using frequencies and percentages. Continuous variables were assessed for distribution and presented as mean with standard deviation or median with interquartile range, as appropriate. Overall awareness and compliance proportions were reported with 95% confidence intervals.

The chi-square test or Fisher's exact test was used to evaluate associations between categorical variables. The independent-samples t-test or Mann-Whitney U test was used to compare continuous scores between

two groups. One-way analysis of variance or the Kruskal-Wallis test was used for comparisons involving more than two groups. Correlation between awareness and compliance scores was examined using Pearson's or Spearman's correlation coefficient.

Variables with a univariate, along with clinically important variables, were considered for multivariable binary logistic regression to identify independent predictors of satisfactory compliance. Adjusted odds ratios with 95% confidence intervals were reported. Multicollinearity and model fit were assessed before interpretation. All statistical tests were two-tailed, and was considered statistically significant.

Ethical Considerations

Participation was voluntary, and written informed consent was obtained from every participant. Confidentiality and anonymity were maintained throughout the study. Participants were informed that they could decline any question or withdraw without penalty. No invasive procedure was performed. At the end of the interview, participants were briefly counselled regarding helmet and seat-belt use, speed control, avoidance of distracted and drink-driving, and appropriate emergency response.

RESULTS

Table 1: Overall profile, awareness, and compliance with traffic-safety regulations among young adults (N=140)

Parameter	n (%) or Mean (SD)	95% CI	Test of significance	P value
Age, years	23.7 (3.2)	23.17–24.23	—	—
Age 18–23 years	70 (50.0)	41.8%–58.2%	$z=0.00†$	1.000
Age 24–29 years	70 (50.0)	41.8%–58.2%	$z=0.00†$	1.000
Male sex	75 (53.6)	45.3%–61.6%	$z=0.85†$	0.398
Female sex	65 (46.4)	38.4%–54.7%	$z=-0.85†$	0.398
Graduate education or above	85 (60.7)	52.4%–68.4%	$z=2.54†$	0.011*
Regular motorised-vehicle user	104 (74.3)	66.5%–80.8%	$z=5.75†$	<0.001*
Possessed a valid driving licence‡	92 (88.5)	80.9%–93.3%	$z=7.84†$	<0.001*
Received formal driving training‡	68 (65.4)	55.8%–74.0%	$z=3.14†$	0.002*
Previous involvement in a road traffic accident	31 (22.1)	16.1%–29.7%	$z=-6.59†$	<0.001*
Previous traffic violation or penalty	27 (19.3)	13.6%–26.6%	$z=-7.27†$	<0.001*
Awareness score, maximum 15	11.6 (2.1)	11.25–11.95	$t=23.11§$	<0.001*
Satisfactory awareness	103 (73.6)	65.7%–80.2%	$z=5.58†$	<0.001*
Compliance score, maximum 20	14.2 (3.4)	13.63–14.77	$t=14.62§$	<0.001*
Satisfactory compliance	84 (60.0)	51.7%–67.7%	$z=2.37†$	0.018*
Both satisfactory awareness and compliance	72 (51.4)	43.2%–59.6%	$z=0.34†$	0.735

†One-sample proportion z-test against 50%.

‡Calculated among 104 participants who regularly drove a motorised vehicle.

§One-sample t-test against the midpoint of the respective scale: 7.5 for awareness and 10 for compliance.

*Statistically significant.

Among the 140 young adults, the mean age was 23.7 ± 3.2 years (95% CI: 23.17–24.23). Participants were equally distributed between the age groups of 18–23 and 24–29 years, with 70 (50.0%) in each group. There were 75 (53.6%) males and 65 (46.4%) females, with no significant difference in their proportions ($P=0.398$). A significantly greater proportion had graduate-level education or above (60.7%; $P=0.011$). Regular use of a motorised vehicle was reported by 104 (74.3%) participants ($P<0.001$). Among these regular drivers, 92 (88.5%) possessed a valid driving licence and 68 (65.4%) had received formal driving training; both proportions were

significantly greater than 50% ($P<0.001$ and $P=0.002$, respectively). Previous involvement in a road traffic accident was reported by 31 (22.1%) participants, while 27 (19.3%) had previously received a traffic penalty. The mean awareness score was 11.6 ± 2.1 out of 15, and 103 (73.6%) participants had satisfactory awareness ($P<0.001$). The mean compliance score was 14.2 ± 3.4 out of 20, with satisfactory compliance observed in 84 (60.0%) participants ($P=0.018$). However, only 72 (51.4%) participants had both satisfactory awareness and compliance, which was not significantly different from 50% ($P=0.735$).

Table 2: Awareness regarding traffic rules and road-safety measures among young adults (N=140)

Awareness item—correct response	n (%)	95% CI	Test of significance†	P value
Correctly identified traffic-light signals	132 (94.3)	89.1%–97.1%	z=10.48	<0.001*
Knew that certified helmets were compulsory	128 (91.4)	85.6%–95.0%	z=9.80	<0.001*
Knew that the helmet should be properly fastened	125 (89.3)	83.1%–93.4%	z=9.30	<0.001*
Knew that seat-belt use was compulsory	124 (88.6)	82.2%–92.8%	z=9.13	<0.001*
Knew the prescribed speed restrictions	113 (80.7)	73.4%–86.4%	z=7.27	<0.001*
Knew that mobile-phone use while driving was prohibited	119 (85.0)	78.2%–90.0%	z=8.28	<0.001*
Knew that drink-driving was illegal	131 (93.6)	88.2%–96.6%	z=10.31	<0.001*
Knew that a valid licence was required before driving	129 (92.1)	86.5%–95.6%	z=9.97	<0.001*
Correctly identified common road signs	117 (83.6)	76.6%–88.8%	z=7.94	<0.001*
Knew pedestrian-crossing rules	108 (77.1)	69.5%–83.3%	z=6.42	<0.001*
Knew lane-discipline and overtaking rules	112 (80.0)	72.6%–85.8%	z=7.10	<0.001*
Knew the emergency ambulance number	97 (69.3)	61.2%–76.3%	z=4.56	<0.001*
Aware of Good Samaritan protections	78 (55.7)	47.4%–63.7%	z=1.35	0.176
Overall awareness score, maximum 15	11.6 (2.1)	11.25–11.95	t=23.11‡	<0.001*
Satisfactory awareness, score ≥75%	103 (73.6)	65.7%–80.2%	z=5.58	<0.001*
Unsatisfactory awareness, score <75%	37 (26.4)	19.8%–34.3%	z=-5.58	<0.001*

†One-sample proportion z-test against 50%.

‡One-sample t-test against the scale midpoint of 7.5.

*Statistically significant.

Awareness of basic traffic rules was generally high among the participants. Traffic-light signals were correctly identified by 132 (94.3%), while 128 (91.4%) knew that certified helmets were compulsory and 125 (89.3%) knew that helmets should be properly fastened. Awareness that seat-belt use was compulsory was reported by 124 (88.6%) participants. Knowledge regarding prescribed speed restrictions and prohibition of mobile-phone use while driving was present in 113 (80.7%) and 119 (85.0%) participants, respectively. Most participants knew that drink-driving was illegal (93.6%) and that a valid driving licence was required (92.1%). Common road signs were correctly identified by 117

(83.6%), while 108 (77.1%) knew pedestrian-crossing rules and 112 (80.0%) knew lane-discipline and overtaking rules. Knowledge of the emergency ambulance number was comparatively lower at 69.3%. Awareness of Good Samaritan protections was the poorest domain, reported by only 78 (55.7%) participants, and this proportion was not significantly different from 50% (P=0.176). All other item-wise awareness proportions were significantly greater than 50% (P<0.001). The mean awareness score was 11.6±2.1 out of 15, which was significantly higher than the scale midpoint (P<0.001). Overall, 103 (73.6%) participants had satisfactory awareness, whereas 37 (26.4%) had unsatisfactory awareness.

Table 3: Compliance with traffic-safety regulations among eligible young adults

Compliance practice	Eligible participants	Always complied, n (%)	95% CI	Test of significance†	P value
Wore a helmet while riding a two-wheeler	116	91 (78.4)	70.1%–85.0%	z=6.13	<0.001*
Properly fastened the helmet strap	116	86 (74.1)	65.5%–81.2%	z=5.20	<0.001*
Ensured helmet use by the pillion rider	116	69 (59.5)	50.4%–68.0%	z=2.04	0.041*
Used a seat belt while travelling in a car	94	72 (76.6)	67.1%–84.0%	z=5.16	<0.001*
Obedied traffic-light signals	140	118 (84.3)	77.4%–89.4%	z=8.11	<0.001*
Followed prescribed speed limits	140	96 (68.6)	60.5%–75.7%	z=4.39	<0.001*
Drove only with a valid driving licence	104	92 (88.5)	80.9%–93.3%	z=7.84	<0.001*
Avoided handheld mobile-phone use while driving	104	87 (83.7)	75.4%–89.5%	z=6.86	<0.001*
Never drove after alcohol consumption	104	98 (94.2)	88.0%–97.3%	z=9.02	<0.001*
Followed lane-discipline and overtaking regulations	140	101 (72.1)	64.2%–78.9%	z=5.24	<0.001*
Used designated pedestrian crossings whenever available	140	109 (77.9)	70.3%–83.9%	z=6.59	<0.001*
Overall compliance score, maximum 20	140	14.2 (3.4)‡	13.63–14.77	t=14.62§	<0.001*
Satisfactory overall compliance, score ≥75%	140	84 (60.0)	51.7%–67.7%	z=2.37	0.018*
Unsatisfactory overall compliance, score <75%	140	56 (40.0)	32.3%–48.3%	z=-2.37	0.018*

†One-sample proportion z-test against 50%.

‡Presented as Mean (SD), rather than n (%).

§One-sample t-test against the compliance-scale midpoint of 10.

*Statistically significant.

Compliance with traffic-safety regulations varied across different practices. Among 116 eligible two-wheeler users, 91 (78.4%) always wore a helmet and 86 (74.1%) properly fastened the helmet strap. However, only 69 (59.5%) ensured helmet use by the pillion rider, representing the lowest helmet-related compliance ($P=0.041$). Among 94 eligible car occupants, 72 (76.6%) regularly used a seat belt. Traffic-light signals were obeyed by 118 (84.3%) participants, whereas compliance with prescribed speed limits was comparatively lower at 68.6%. Among 104 regular drivers, 92 (88.5%) drove with a valid licence, 87 (83.7%) avoided handheld mobile-

phone use, and 98 (94.2%) reported that they never drove after consuming alcohol. Lane-discipline and overtaking regulations were followed by 101 (72.1%), while 109 (77.9%) used designated pedestrian crossings whenever available. All individual compliance practices were significantly more prevalent than the reference proportion of 50%. The mean compliance score was 14.2 ± 3.4 out of 20, which was significantly higher than the scale midpoint ($P<0.001$). Overall, 84 (60.0%) participants demonstrated satisfactory compliance, while 56 (40.0%) had unsatisfactory compliance ($P=0.018$).

Table 4: Association of satisfactory awareness and compliance with selected participant characteristics (N=140)

Characteristic	Total	Satisfactory awareness, n (%)	Test statistic	P value	Satisfactory compliance, n (%)	Test statistic	P value
Age group							
18–23 years	70	57 (81.4)	$\chi^2=4.45$	0.035*	47 (67.1)	$\chi^2=2.98$	0.084
24–29 years	70	46 (65.7)			37 (52.9)		
Sex							
Male	75	58 (77.3)	$\chi^2=1.18$	0.278	52 (69.3)	$\chi^2=5.86$	0.015*
Female	65	45 (69.2)			32 (49.2)		
Educational level							
Graduate or above	85	72 (84.7)	$\chi^2=13.80$	<0.001*	58 (68.2)	$\chi^2=6.11$	0.013*
Below graduate level	55	31 (56.4)			26 (47.3)		
Regular motorised-vehicle use							
Yes	104	82 (78.8)	$\chi^2=5.51$	0.019*	69 (66.3)	$\chi^2=7.99$	0.005*
No	36	21 (58.3)			15 (41.7)		
Possession of valid driving licence							
Yes	92	82 (89.1)	$\chi^2=33.41$	<0.001*	67 (72.8)	$\chi^2=18.39$	<0.001*
No/not applicable	48	21 (43.8)			17 (35.4)		
Formal driving training							
Received	68	61 (89.7)	$\chi^2=17.70$	<0.001*	49 (72.1)	$\chi^2=8.01$	0.005*
Not received/not applicable	72	42 (58.3)			35 (48.6)		
Previous road traffic accident							
Yes	31	26 (83.9)	$\chi^2=2.17$	0.141	14 (45.2)	$\chi^2=3.65$	0.056
No	109	77 (70.6)			70 (64.2)		
Previous traffic penalty							
Yes	27	19 (70.4)	$\chi^2=0.18$	0.675	9 (33.3)	$\chi^2=9.91$	0.002*
No	113	84 (74.3)			75 (66.4)		
Awareness level							
Satisfactory	103	—	—	—	72 (69.9)	$\chi^2=15.41$	<0.001*
Unsatisfactory	37	—	—	—	12 (32.4)		

All comparisons were performed using Pearson's chi-square test. Fisher's exact test should be used if any expected cell frequency is below five.

Satisfactory awareness and compliance were defined as scores of at least 75% of the respective maximum score.

***Statistically significant.**

Satisfactory awareness was significantly associated with age, educational level, regular motorised-vehicle use, possession of a valid driving licence, and formal driving training. Participants aged 18–23 years had a higher prevalence of satisfactory awareness than those aged 24–29 years (81.4% versus 65.7%; $\chi^2=4.45$, $P=0.035$). Awareness was also significantly higher among graduates than among participants educated below graduate level

(84.7% versus 56.4%; $\chi^2=13.80$, $P<0.001$). Regular motorised-vehicle users had greater satisfactory awareness than non-users (78.8% versus 58.3%; $P=0.019$). Similarly, satisfactory awareness was higher among participants possessing a valid driving licence (89.1% versus 43.8%; $P<0.001$) and those who had received formal driving training (89.7% versus 58.3%; $P<0.001$). Awareness was not significantly associated with sex, previous road traffic accidents, or previous traffic penalties.

Satisfactory compliance was significantly higher among males than females (69.3% versus 49.2%; $\chi^2=5.86$, $P=0.015$) and among graduates compared with participants educated below graduate level (68.2% versus 47.3%; $\chi^2=6.11$, $P=0.013$). Regular motorised-vehicle users had better compliance than

non-users (66.3% versus 41.7%; $P=0.005$). Possession of a valid driving licence (72.8% versus 35.4%; $P<0.001$) and formal driving training (72.1% versus 48.6%; $P=0.005$) were also significantly associated with satisfactory compliance. Participants with a previous traffic penalty demonstrated substantially poorer compliance than those without such a penalty (33.3% versus 66.4%; $\chi^2=9.91$, $P=0.002$). Compliance did not differ significantly according to age group ($P=0.084$) or previous involvement in a road traffic accident ($P=0.056$). Importantly, participants with satisfactory awareness were considerably more likely to demonstrate satisfactory compliance than those with unsatisfactory awareness (69.9% versus 32.4%; $\chi^2=15.41$, $P<0.001$), indicating a significant positive relationship between traffic-safety awareness and compliant behaviour.

DISCUSSION

The present community-based study assessed awareness and compliance with traffic-safety regulations among 140 young adults. Overall, awareness was satisfactory in 73.6% of participants, whereas satisfactory compliance was observed in only 60.0%. Only 51.4% demonstrated both satisfactory awareness and compliance, indicating an appreciable knowledge–practice gap. This finding is important because young adults constitute one of the groups most vulnerable to road traffic injuries. The World Health Organization reported that road traffic injuries remain the leading cause of death among persons aged 5–29 years, with pedestrians, cyclists, and motorcyclists accounting for more than half of global road deaths [1]. In India, 480,583 road accidents, 172,890 deaths, and 462,825 injuries were reported during 2023, and speeding and non-use of protective devices remained important contributors [2].

Overall awareness and compliance

The mean age of the study participants was 23.7 ± 3.2 years, with equal representation of the 18–23- and 24–29-year age groups. Males constituted 53.6% of the sample, 60.7% had graduate-level education or above, and 74.3% regularly used a motorised vehicle. Among regular drivers, 88.5% possessed a valid driving licence, but only 65.4% had received formal driving training. Vijayakrishnan et al. (2022) [3], in a study of 500 university students in Tamil Nadu, reported a mean age of 21.4 years, male predominance of 61.6%, and possession of a driving licence by 77.8%. The higher prevalence of valid licences in the present study may be related to the slightly older age of participants and inclusion of community-based regular drivers.

Previous involvement in a road traffic accident was reported by 22.1% of the participants, while 19.3% had previously received a traffic penalty. Swetha et al. (2021) [4] reported that 14.1% of medical students had experienced a road traffic accident and 15.9%

had been caught by traffic police. The comparatively higher proportions in the current study could be due to the inclusion of community participants with different educational and occupational backgrounds and greater cumulative exposure to road travel.

The satisfactory awareness prevalence of 73.6% in the present study was comparable to the 75% good-knowledge prevalence reported by Vijayakrishnan et al. (2022) [3]. It was higher than the 61.4% average knowledge reported among college students in Chennai by Shrivastava and Shrivastava (2020) [5] and the 59.6% adequate awareness observed by Gaire et al. (2022) [6]. Jothula and Sreeharshika (2021) [7] also reported generally satisfactory knowledge among college students in Telangana but identified deficiencies in certain legal and practical aspects. Differences between studies may be explained by variation in scoring criteria, questionnaires, local enforcement, educational exposure, age composition, and access to road-safety information.

Although awareness was satisfactory in nearly three-fourths of the present participants, satisfactory compliance was found in only 60.0%, and just 51.4% had both satisfactory awareness and compliance. A similar knowledge–practice discrepancy was reported by Cacodcar and Naik (2020) [8], who found that college students generally possessed good road-safety knowledge but did not consistently translate it into safe practices. Kalbandkeri et al. (2018) [9] and Shrivastava and Shrivastava (2020) [5] similarly observed that knowledge of road-safety measures was higher than adherence to helmet use, speed limits, zebra crossings, and restrictions on mobile-phone use. These comparisons suggest that providing information alone may not be sufficient; behaviour-oriented education, consistent enforcement, access to protective devices, and modification of peer and community norms are also required.

Awareness regarding individual traffic-safety measures

Knowledge of basic traffic regulations was high in the present study. Traffic-light signals were correctly identified by 94.3%, while 91.4% knew that certified helmets were compulsory and 89.3% knew that helmets should be fastened correctly. Vijayakrishnan et al. (2022) [3] reported that 98.4% of students knew that helmets were compulsory and 95.2% knew that pillion riders should also wear helmets. The slightly lower awareness in the present study may reflect its community-based population, which was more heterogeneous than a university sample. Ratna et al. (2017) [10] also documented satisfactory awareness of helmet and seat-belt requirements among undergraduate students, although recognition of some traffic signs was relatively poor.

Awareness that seat-belt use was compulsory was reported by 88.6% of the current participants. This was higher than the 69.4% of students who knew that all car occupants should use seat belts in the study by Vijayakrishnan et al. (2022). [3] The difference may reflect increased public discussion and enforcement of seat-belt regulations. Nevertheless, awareness

must cover both front- and rear-seat occupants because knowledge of general seat-belt requirements does not necessarily imply understanding of universal occupant protection.

Knowledge that mobile-phone use while driving was prohibited was present in 85.0%, while 93.6% knew that drink-driving was illegal. Jothula and Sreeharshika (2021),^[7] observed high awareness that mobile-phone use and alcohol consumption increased crash risk but identified limited knowledge of some legal limits and penalties. Phanindra and Chaitanya (2016),^[11] similarly found that most college students understood the dangers of mobile-phone use and drink-driving, although unsafe practices persisted among a smaller but important proportion.

In the present study, 80.7% knew the prescribed speed restrictions, 83.6% correctly identified common road signs, 77.1% knew pedestrian-crossing rules, and 80.0% knew lane-discipline and overtaking rules. Vijayakrishnan et al. (2022),^[3] found that 81.8% knew the correct side for overtaking and 77.4% recognised zebra crossings, closely corresponding with the present results. However, only 64.4% and 69.2% correctly identified the prescribed speed limits for cars and motorcycles, respectively, suggesting that precise knowledge of speed regulations may be weaker than general recognition of traffic rules.^[3]

Knowledge of the emergency ambulance number was comparatively lower at 69.3%. The lowest awareness was recorded for Good Samaritan protections, known to only 55.7% of participants. This proportion was not significantly different from the 50% reference value. Although young adults may recognise commonly displayed traffic signs and safety rules, legal protection for bystanders assisting road-crash victims receives less routine public exposure. Road-safety education should therefore include emergency activation, safe first response, and Good Samaritan protections rather than focusing exclusively on crash prevention. The Road Safety in India Status Report also emphasised the importance of coordinated prevention, trauma response, and post-crash care.^[12]

Compliance with traffic-safety regulations

Among two-wheeler users, 78.4% always wore a helmet and 74.1% properly fastened the helmet strap. However, only 59.5% ensured helmet use by the pillion rider. Thombre et al. (2020),^[13] in a study of motorised two-wheeler riders in Delhi, reported substantially lower compliance, with only 60.6% using an ISI-marked helmet and 49.1% meeting the driving-licence-related compliance measure. The relatively better compliance in the present study could be related to stronger enforcement, greater educational attainment, or self-reporting. However, the lower pillion-helmet compliance indicates that many participants may perceive the rider as requiring greater protection than the passenger, despite both being vulnerable to head injury.

Seat-belt use was reported by 76.6% of eligible participants. This was substantially higher than the

37.4% adult seat-belt use observed by Al-Hajj et al. (2022),^[14] in a large observational study in Lebanon. In that study, adult helmet use was also only 38.9%, and distracted behaviour was observed in approximately one-fourth of drivers and motorcycle riders.^[14] The difference may partly arise because the present study used self-reported behaviour, which is susceptible to social-desirability bias, whereas the Lebanese study directly observed road users.

Traffic signals were obeyed by 84.3%, but only 68.6% consistently followed prescribed speed limits. Swetha et al. (2021),^[4] found that 33.2% of medical students reported exceeding the speed limit, which corresponds closely to the 31.4% non-compliance implied by the current findings. Shrivastava and Shrivastava (2020),^[5] also identified adherence to speed limits as a weaker road-safety practice. This finding is particularly relevant in India, where official data identify speeding as the dominant traffic-rule violation associated with fatal crashes.^[2]

Among regular drivers, 88.5% drove with a valid licence, 83.7% avoided handheld mobile-phone use, and 94.2% reported never driving after alcohol consumption. Swetha et al. (2021),^[4] found that 25.5% of students had used a mobile phone while driving, compared with 16.3% non-compliance in the present study. Their study further reported overall traffic-rule non-compliance of approximately 25%–30%, broadly comparable to the current compliance levels. Nevertheless, self-reported avoidance of drink-driving may be overestimated because alcohol-related conduct is sensitive and legally punishable.

Compliance with lane-discipline and overtaking regulations was 72.1%, while 77.9% reported using designated pedestrian crossings. These practices were lower than compliance with traffic signals and drink-driving restrictions. This pattern suggests that young adults may comply more consistently with prominently enforced or widely publicised laws than with routine road-sharing behaviours. Educational programmes should consequently incorporate practical demonstrations of lane discipline, overtaking, pedestrian priority, and hazard anticipation.

Factors associated with awareness and compliance

Younger participants aged 18–23 years demonstrated greater satisfactory awareness than those aged 24–29 years (81.4% versus 65.7%; $P=0.035$), although age was not significantly associated with compliance. This unexpected pattern may reflect recent exposure to road-safety education among students and younger adults. However, novice road users can remain at increased crash risk despite good theoretical knowledge because of limited experience, poor hazard perception, distraction, and risk-taking behaviour.

Educational attainment was significantly associated with both awareness and compliance. Graduates had higher satisfactory awareness than those educated below graduate level (84.7% versus 56.4%; $P<0.001$) and better compliance (68.2% versus 47.3%;

P=0.013). Gaire et al. (2022),^[6] demonstrated that educational exposure or training in traffic rules was significantly associated with adequate awareness. This supports the role of education in improving comprehension of traffic signs, legal requirements, and consequences of unsafe behaviour.

Regular motorised-vehicle users demonstrated better awareness and compliance than non-regular users. Direct exposure to road conditions, licensing processes, enforcement, and driving-related information may improve familiarity with regulations. Nevertheless, repeated exposure can also normalise unsafe behaviour; therefore, experience should be accompanied by structured and periodically reinforced safety training.

Possession of a valid licence showed the strongest associations with awareness and compliance. Satisfactory awareness was present in 89.1% of licensed participants compared with 43.8% of those without a licence or for whom licensing was not applicable (P<0.001). Likewise, satisfactory compliance was 72.8% versus 35.4% (P<0.001). Formal driving training was similarly associated with higher awareness (89.7% versus 58.3%; P<0.001) and compliance (72.1% versus 48.6%; P=0.005). Swetha et al. (2021),^[4] found that only 27.3% of participants had learned through a driving school and that 44.1% began driving before obtaining a licence, highlighting deficiencies in formal driver preparation. The present findings support greater access to certified driving schools, competency-based licensing, and periodic reinforcement of traffic rules.

Sex was not significantly associated with awareness, but males showed better self-reported compliance than females (69.3% versus 49.2%; P=0.015). Evidence regarding sex differences is inconsistent. Shrivastava and Shrivastava (2020),^[5] found significant gender differences in selected practices, while Gaire et al. (2022),^[6] reported an association between sex and awareness. Differences may reflect vehicle access, frequency of driving, local gender roles, and unequal exposure to licensing and training. The present result should therefore not be interpreted as an inherent behavioural difference without adjustment for driving frequency and vehicle use.

A previous road traffic accident was not significantly associated with awareness (P=0.141) or compliance (P=0.056), although participants with previous accidents had numerically poorer compliance. Similarly, previous traffic penalties were unrelated to awareness but were strongly associated with poor compliance: only 33.3% of previously penalised participants had satisfactory compliance compared with 66.4% of those without penalties (P=0.002). This indicates that penalties may identify persistently risky road users rather than automatically correct their behaviour. Enforcement should consequently be combined with remedial education, counselling, and monitoring of repeat offenders.

Most importantly, satisfactory awareness was significantly associated with satisfactory compliance.

Compliance was satisfactory among 69.9% of participants with adequate awareness compared with only 32.4% of those with inadequate awareness (P<0.001). This supports awareness as a necessary component of safe road use. Nevertheless, the fact that nearly 30% of knowledgeable participants still did not demonstrate satisfactory compliance confirms that knowledge alone was insufficient. Swetha et al. (2021),^[4] demonstrated that structured educational intervention improved awareness and subsequent behaviour, while Al-Hajj et al. (2022),^[14] emphasised the combined importance of awareness, enforcement, and environmental determinants. Multicomponent strategies integrating education, licensing reform, practical training, consistent enforcement, safer infrastructure, and community participation are therefore required.

CONCLUSION

The study showed that most young adults had satisfactory awareness of traffic-safety regulations; however, this knowledge was not consistently translated into safe road behaviour. Although 73.6% had satisfactory awareness, only 60.0% demonstrated satisfactory compliance, and 51.4% achieved satisfactory levels in both domains. Awareness was particularly high regarding traffic signals, helmet and seat-belt requirements, licensing, and the prohibition of drink-driving. In contrast, awareness of Good Samaritan protections and compliance with pillion-rider helmet use and speed limits were comparatively low. Higher education, possession of a valid driving licence, formal driving training, and regular motorised-vehicle use were associated with better awareness and compliance. Previous traffic penalties were associated with poorer compliance. Participants with satisfactory awareness demonstrated significantly better compliance, indicating that knowledge is important but insufficient by itself to ensure safe behaviour. Road-safety programmes should therefore combine targeted education with formal driver training, effective licensing, consistent enforcement, behavioural interventions, and greater promotion of Good Samaritan provisions and pillion-rider safety.

Limitations of Study

The study had several limitations. First, its cross-sectional design permitted identification of associations but could not establish temporal or causal relationships between participant characteristics, awareness, and compliance. Second, the study was conducted in a single selected community with a relatively small sample of 140 young adults; therefore, the findings may not be generalisable to young adults in other geographical, cultural, or socioeconomic settings. Third, compliance was assessed primarily through self-report and was not confirmed through direct roadside observation, creating the possibility of recall and social-desirability biases. Participants may have

underreported behaviours such as speeding, mobile-phone use, unlicensed driving, and driving after alcohol consumption.

Fourth, the awareness and compliance scores depended on the selected questionnaire items and the predetermined cut-off of 75%, which may limit direct comparison with studies using different instruments or classifications. Fifth, exposure to traffic, frequency and distance of driving, vehicle type, enforcement intensity, road conditions, peer influence, risk perception, and access to protective equipment may not have been measured comprehensively. Sixth, compliance questions had different eligible denominators because helmet, seat-belt, and licensing practices were applicable only to particular categories of road users. Seventh, the study did not verify the quality or certification of helmets, correct seat-belt positioning, validity of driving licences, or actual speed through objective methods. Finally, the reported associations were primarily unadjusted; residual confounding may consequently have influenced the findings. Larger multicentric studies incorporating validated instruments, roadside observation, and multivariable analysis are recommended.

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