

## Original Research Article

# Road safety awareness and practices among university students

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## ABSTRACT

**Background:** Road traffic accidents (RTAs) remain a major cause of preventable death and disability worldwide particularly among young adults aged 15 to 29 years. University students are especially vulnerable because of frequent vehicle use and greater engagement in risk taking behaviours. This study assessed road safety-reported practices among university students in Lucknow, India, and examined differences by gender and year of study.

**Methods:** A descriptive cross-sectional study was conducted among 308 students at the University of Lucknow between January and May 2026 using a pre tested, self-administered questionnaire. Participation was voluntary, and informed consent was obtained from all participants before data collection. Awareness and practice scores were analysed using independent samples t tests and one way ANOVA, with statistical significance set at  $p < 0.05$ .

**Results:** The study included 200 males (65%) and 108 females (35%), with mean ages of 21.05 and 22.21 years, respectively. Most participants correctly identified zebra crossings, Knowledge of helmet regulations was poor and less than half of the participants possessed a valid driving license, and a notable proportion reported driving after consuming alcohol. No significant differences in awareness or practice scores were observed by gender or year of study ( $p > 0.05$ ).

**Conclusions:** University students demonstrated moderate road safety awareness, but substantial gaps remained between knowledge and safe practices, particularly regarding helmet use, licensing, and drink driving. Curriculum integrated road safety education, stricter enforcement, and licensing initiatives are needed to promote safe driving behaviours.

**Keywords:** Road traffic accidents, Road safety awareness, University students, Helmet use, Drink-driving, Cross-sectional study

## INTRODUCTION

Road traffic accidents (RTAs) remain one of the world's most significant, yet largely preventable, public health problems. Globally, RTAs are responsible for an estimated 1.19-1.35 million deaths each year and leave millions more with non-fatal, often disabling injuries.<sup>1,2</sup> Low- and middle-income countries (LMICs) bear a disproportionate share of this burden, where rapid urbanization, rising traffic density and inconsistent enforcement of traffic laws combine to heighten risk.<sup>2</sup>

India exemplifies this pattern: the country records more than 150,000 road traffic deaths annually, accounting for roughly 11% of the global RTA death toll.<sup>2,3</sup> Speeding, unsafe overtaking, alcohol consumption, non-use of protective equipment and mobile-phone use while driving are consistently identified as the principal contributing factors, compounded by road infrastructure that has not kept pace with the rapid growth in vehicle ownership.<sup>3,4</sup>

Young adults aged 15-29 years are the most vulnerable group, a pattern attributed to inexperience, risk-taking

tendencies and susceptibility to peer-drive behaviour that normalizes unsafe driving.<sup>5</sup> University students, who travel frequently and are establishing lifelong driving habits, sit at centre of this vulnerability; their knowledge, attitudes and behaviour affect not only their own safety but that of fellow road users. Road safety awareness spans familiarity with traffic rules (meaning of signals, pedestrian right-of-way, speed limits) and safe practices (helmet and seatbelt use, abstaining from alcohol before driving). Recurring finding across literature is that students often possess reasonable declarative knowledge of road safety rules yet fail to translate this into safe practice.<sup>2,3,6</sup> Understanding the extent and character of this knowledge-practice gap is essential to designing effective, evidence-based interventions.

While road safety knowledge, attitudes and practices (KAP) have been extensively studied among medical and allied-health student in India, evidence from the general university student population- who represent the largest share of India's university-educated young adults-remains comparatively limited. This study therefore aimed to assess road safety awareness and self-reported practices among students at the university of Lucknow, and to examine whether these varied by gender and year of study. Specifically, the study sought to (i) determine students' level of awareness of road safety measures, (ii) describe self-reported road safety practices, (iii) quantify the gap between awareness and practice, and (iv) generate evidence-informed recommendations to road safety among university students.

International and Indian evidence consistently documents a gap between road safety knowledge and practice among students. In a study of 371 Malaysian university students, Rahman et al found that although more than 90% held a driving licence and recognized that accidents were often attributable to poor road safety knowledge, over half could not correctly interpret common traffic signs and only 38% knew the expressway speed limit illustrating a pattern of strong general awareness paired with weak regulation-specific knowledge.<sup>7</sup> In India, Mukhopadhyay surveyed 200 students at a north Indian higher-education institution and reported that female students had greater knowledge of road signs and safety rules, yet traffic-rule violation remained common, particularly among male and inexperienced drivers; analysis of 347 recorded accidents attributed 60.7% to improper overtaking underscoring the behavioural dimension of risk.<sup>3</sup> Bajpai et al studied 200 undergraduate medical students in western Uttar Pradesh and found a substantial knowledge practice gap, with around 29% of respondents willing to disregard lane discipline; students who had received formal road safety education demonstrated markedly better knowledge of required documents (72.1% versus 42%) and helmet-related penalties (58.1% versus 38.2%) pointing to the value of structured education in narrowing this gap.<sup>6</sup>

Jothula and Sreeharshika reported that among 132 licenced pharmacy students in Telangana, 81.1% knew

the minimum legal driving age, yet only 16% always obeyed traffic signals; 75% complied with helmet use on long trips but not on short trips, revealing selective, context-dependent compliance.<sup>2</sup> Kulkarni et al studied 260 medical students in south India and documented a striking prevalence of alcohol-impaired driving (25%), distracted driving (20%) and speeding (68%) despite generally sound knowledge of traffic signs.<sup>8</sup> Ramya et al surveying 540 medical students in Bangalore, found very high awareness of traffic rules (99.2%) and helmet use (98.8%), but comparatively low awareness of seatbelt-use requirements (67%) and hands-free device rules (64.8%), alongside a notable prevalence of traffic offences and alcohol use.<sup>9</sup> This pattern extends beyond India: Elshambaty et al found that Saudi Arabian medical students who had never received formal driving instruction breached traffic rules more than five times in the past year in 70% of cases, despite high self-reported awareness of traffic laws (93.6%).<sup>10</sup> More recently, Christion and Thakkar conducted a crass-sectional study of 446 undergraduates in Ahmedabad and found that although (90.3%) held a driving licence, 56.8% used mobile phones while driving and 14.1% had begun driving below the legal age.<sup>11</sup>

Comparable Indian studies reinforce this picture. Sharma and Saini, assessing KAP related to RTAs among health-care students in Uttarakhand, similarly reported adequate rule-based knowledge alongside inconsistent safe-driving behaviour, while Tamilchudar et al found generally sound awareness of road safety rules among south Indian students but noted persistent gaps in practical application of that knowledge.<sup>12,13</sup> Earlier work by Redhwan and Karim likes wise found that university students stated attitudes toward road traffic regulations considerably more favourable than their actual reported practice.<sup>14</sup> Taken together, these studies show that Indian and international university students typically demonstrate moderate-to-high declarative knowledge of road safety rules but consistently fail to translate this knowledge into safe practice a gap that calls for targeted behavioural, another than purely informational, interventions.

## METHODS

### Study design

This was a descriptive, cross-sectional study. The study was conducted at the University of Lucknow, Uttar Pradesh, India. The university enrolls a large and diverse students' population across multiple disciplines and levels of study, providing a range of road-use exposures suitable for this investigation. The study was conducted between January 2026 to May 2026.

### Study population

The study population comprised undergraduate, postgraduate and doctoral students enrolled at the

University of Lucknow who were available and willing to participate during the data collection period.

### **Sample size and sampling technique**

The minimum required sample size was calculated using Cochran's formula at a 95% confidence level ( $Z=1.96$ ), a 5% margin of error ( $e=0.05$ ) and an assumed prevalence of 50% ( $p=0.5$ ), yielding a minimum requirement of 386 participants.<sup>15</sup> For practical and logistical reasons, a convenience sample of 308 students was recruited; all students who approached and willing to participate were included, drawn from all the years of study and both genders.

### **Inclusion and exclusion criteria**

Students currently enrolled at the university who provided written information consent were included. Students who declined to participate or did not complete the questionnaire were excluded.

### **Data collection instrument**

Data were collected using a pre-tested, structured, self-administered questionnaire comprising three sections: demographic information (age, sex, faculty, year of study, vehicle ownership and possession of a driving licence); road safety awareness items (knowledge of traffic signals, road signs, and helmet regulations); road safety practice items (possession of a driving licence, helmet and seatbelt use, drink-driving behaviour).

### **Scoring system**

Awareness was scored from knowledge-based items (maximum score: 13), and practice was scored from behaviour-based items (maximum: 60). Higher scores indicated greater awareness or safer self-reported practice, respectively.

### **Data collection procedure**

Data were collected through a combination of paper-based and web-based surveys. Participants were briefed on the purpose of the study, and written informed consent was obtained prior to participation. Anonymity and confidentiality were assured throughout.

### **Statistical analysis**

Data were entered and analysed using SPSS and Microsoft excel. Descriptive statistics (frequencies, percentages, means and standard deviations) were used to characterize the sample. Awareness and practice scores were compared between male and female independent samples *t* tests, and across years of study using one-way analysis of variance (ANOVA). Statistical significance was set at  $p<0.05$ .

### **Research hypotheses**

The following null hypotheses were tested.

#### *H01*

There is no significant difference in mean road safety awareness scores between male and female students.

#### *H02*

There is no significant difference in mean road safety practice scores between male and female students.

#### *H03*

There is no significant difference in mean road safety awareness scores across years of study.

#### *H04*

There is no significant difference in mean road safety practice scores across years of study.

### **Ethical considerations**

Participation was voluntary, and informed consent was obtained from all participants. Data were anonymised, treated as confidential, and used solely for the purposes of this research; no personally identifying information was collected or reported.

## **RESULTS**

### **Sociodemographic profile**

A total of 308 students participated, comprising 200 males (65%) and 108 females (35%). The mean age was 21.05 years ( $SD=3.10$ ; range 16-43) among males and 22.21 years ( $SD=3.35$ ; range 18-40) among females (Table 1). The gender imbalance in the sample should be borne in mind when interpreting gender comparisons, and may reflect differential response rates or the gender composition of the faculties sampled.

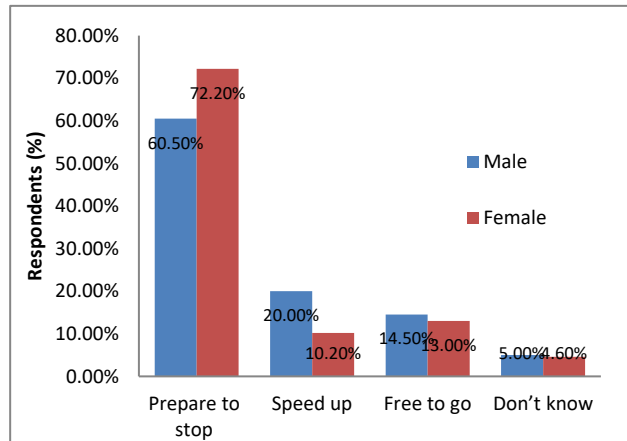
**Table 1: Descriptive statistics for age, by gender.**

| Statistics               | Male  | Female |
|--------------------------|-------|--------|
| <b>Valid</b>             | 200   | 108    |
| <b>Missing</b>           | 0     | 0      |
| <b>Mean (in years)</b>   | 21.05 | 22.21  |
| <b>Median (in years)</b> | 20.00 | 21.00  |
| <b>Mode (in years)</b>   | 19.83 | 20.40  |
| <b>Std. deviation</b>    | 3.103 | 3.352  |
| <b>Range</b>             | 27.00 | 22.00  |
| <b>Minimum</b>           | 16.00 | 18.00  |
| <b>Maximum</b>           | 43.00 | 40.00  |

## Road safety awareness

### Understanding of the amber traffic light

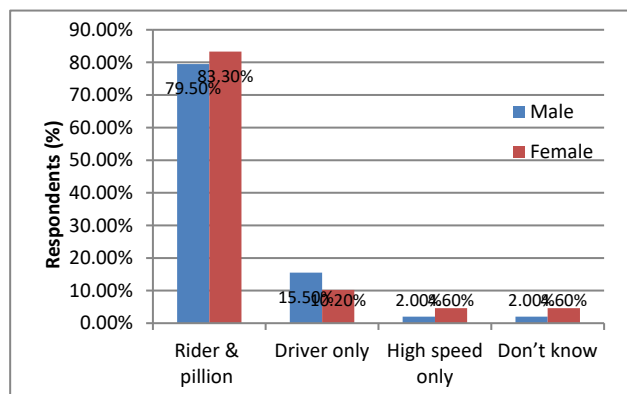
The majority of participants correctly understood the amber (yellow) signal to mean “prepare to stop” (121 males, 60.5%; 78 females, 72.2%). Incorrect responses “speed up” (40 males, 11 females), “free to go” (29 males, 14 females) and “don’t know” (10 males, 5 females) indicate a persistent gap in basic signal literacy among a sizeable minority (Figure 1).



**Figure 1: Understanding of the amber (yellow) traffic light, by gender.**

### Knowledge of helmet regulations

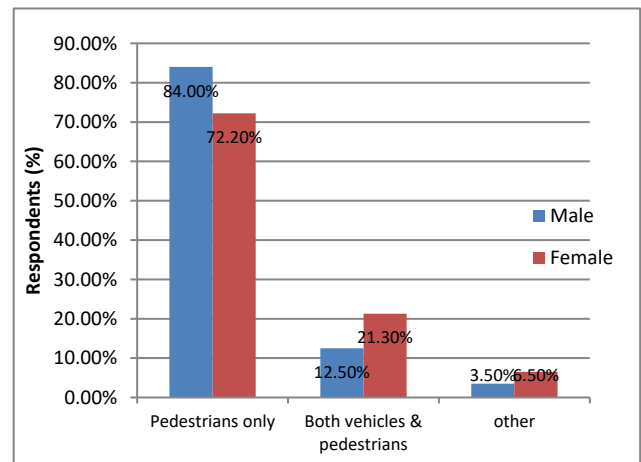
On a general item asking who is required to wear a helmet, most students correctly selected “rider and pillion” (159 males, 90 females). However, when asked to correctly identify the specific statutory requirement mandating helmet use for both parties, only 2% of males and 4.6% of females answered correctly; a notable proportion instead believed helmet were mandatory only for the driver (31 males, 11 females) or only at high speed (4 males, 5 females). This divergence between broad conceptual awareness and precise legal knowledge is one of the study’s most striking findings (Figure 2).



**Figure 2: Knowledge of the mandatory helmet-use regulation, by gender.**

### Understanding of zebra crossings

Most students correctly identified zebra crossings as pedestrian priority areas (168 males, 84.0%; 78 females, 72.2%). A minority believed they were intended for both vehicles and pedestrians (25 males, 12.5%; 23 females, 21.3%), with the remainder selecting other incorrect responses, indicating incomplete understanding of pedestrian right-of-way (Figure 3).

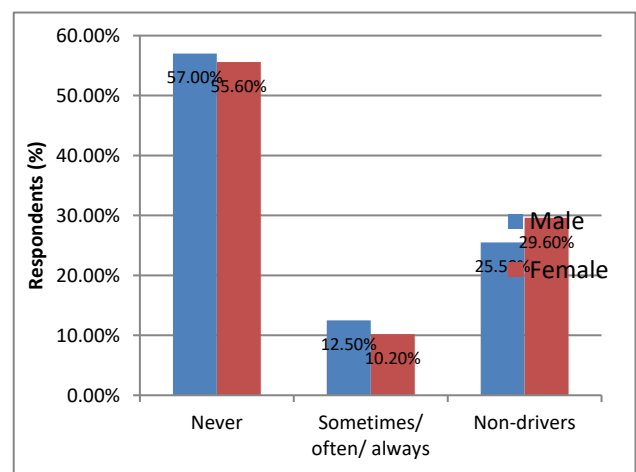


**Figure 3: Understanding of the purpose of a zebra crossing, by gender.**

### Road safety practice

#### Driving after alcohol consumption

Most participants who drove reported never driving after drinking alcohol (114 males, 57.0%; 60 females, 55.5%). However, 25 males (12.5%) and 11 females (10.2%) reported doing so at least sometimes a finding of considerable public health concern given the well-established impact of alcohol on reaction time and judgement. A further 51 males and 32 females identified as non-drivers (Figure 4).



**Figure 4: Self-reported driving after alcohol consumption, by gender.**

### Awareness score by gender

Mean awareness score (maximum 13) was 8.48 for males and 8.28 for females.

Although males scored marginally higher, an independent-samples t-test found no statistically significant difference ( $p=0.413$ );  $H_0$  is therefore retained, indicating that gender was for not significantly associated with road safety awareness in this samples.

### Practice score by gender

Mean practice scores (maximum 60) were slightly higher among females (35.49) than males (33.56), suggesting marginally safer self-reported practice among female students.

However, this difference was not statistically significant (t-test,  $p=0.113$ );  $H_0$  is retained.

### Awareness scores by year of study

Mean awareness scores by year of study were: 1<sup>st</sup> year, 8.57; 2<sup>nd</sup> year, 8.21; 3<sup>rd</sup> year, 8.32; 4<sup>th</sup> year, 7.65; postgraduate, 8.76; and PhD, 9.50 (Table 2). One-way ANOVA showed no significant variation across academic levels,  $F(5,303)=1.257$ ,  $p=0.283$ ;  $H_0$  is retained.

### Practice score by year of study

Mean practice scores by year of study were: 1<sup>st</sup> year, 33.07; 2<sup>nd</sup> year, 33.15; 3<sup>rd</sup> year, 30.58; 4<sup>th</sup> year, 35.24; PG, 35.00; and PhD, 47.50 (Table 3). One-way ANOVA indicated no statistically significant difference across academic levels,  $F(5,303)=1.364$ ,  $p=0.238$ ;  $H_0$  is retained. Although PhD students recorded the highest mean practices sore, this subgroup was very small in number, and finding should be interpreted with caution rather than as evidence of the genuine academic-level effect.

**Table 2: One-way ANOVA: awareness scores across years of study.**

| Sources       | Sum of square | Df | Mean square | F     | P     |
|---------------|---------------|----|-------------|-------|-------|
| Year of study | 25.53         | 5  | 5.106       | 1.257 | 0.283 |

**Table 3: One-way ANOVA: practice scores across years of study.**

| Source        | Sum of square | Df | Mean square | F     | P     |
|---------------|---------------|----|-------------|-------|-------|
| Year of study | 764.6         | 5  | 152.9       | 1.364 | 0.238 |

## DISCUSSION

This study provides a detailed picture of road safety awareness and self-reported practice among university students in Lucknow. Overall, the findings suggest a pattern of moderate general awareness coexisting with specific, practically important knowledge gaps and a persistent disconnect between what students know and how they behave.

The relatively high awareness of zebra crossings as pedestrian priority areas (84.0% males; 72.2% females) is encouraging and consistent with the strong pedestrian-safety awareness reported among Indian students by Ramya et al and Ratan et al.<sup>5,9</sup> Understanding of the amber traffic signal (60.5% males; 72.2% females) was moderate and broadly comparable with findings from similar Indian student populations.

By contrast, awareness of the specific helmet-use regulation was markedly poor: only 2% of males and 4.6% of females correctly identified the statutory requirement that both rider and pillion passenger must wear a helmet. A concerning minority believed helmet use was mandatory only at high speed a misconception of particular importance given that the majority of two-wheeler head injuries occur during low-speed riding. This finding echoes Kulkarni et al who similarly reported the

selective helmet use restricted to long-distance trips, and suggests that general conceptual awareness (most students recognized that riders and pillion passengers “should” wear helmet) does not necessarily extend to accurate knowledge of the law itself.<sup>8</sup>

Licensing status was similarly concerning: only 47.5% of males and 38.9% of females reported holding a valid driving licence. Unlicensed driving reflects not only non-compliance with legal requirements but also a likely deficit in the structured training a licensing process provides, reinforcing Christion and Thakkar’s observation that high exposure to road risk can coexist with reasonable awareness of relevant laws among Indian university students a combination that may be particularly hazardous.<sup>11</sup>

Although most students reported never driving after drinking, 12.5% of males and 10.2% of females reported doing so at least occasionally. Alcohol impairs reaction time, judgement and coordination even at low levels of intoxication, meaning this relatively small subgroup may carry a disproportionate share of crash risk.

The absence of significant gender differences in awareness ( $p=0.413$ ) or practice ( $p=0.113$ ) diverges from Mukhopadhyay and Kulkarni et al both of whom reported higher awareness among females students.<sup>3,8</sup> This



discrepancy may reflect a relatively uniform educational environment at the University of Lucknow, or may be influenced by the samples gender imbalance; regardless, it suggests that road safety deficits in this population cut across gender lines and that interventions need not be gender-specific, although subtle behavioural differences (such as the slightly higher practices score among females) may still warrant tailored components within a broader universal strategy.

Similarly, the absence of a significant difference by year of study (awareness  $p=0.283$ ; practice  $p=0.238$ ) is noteworthy: neither awareness nor practice improved consistently with academic progression, and fourth-years students recorded the lowest awareness score of any undergraduate cohort. This pattern suggests that road safety is not currently embedded as a recurring component of the university curriculum or campus culture. The comparatively high scores among PhD students most likely reflect selection effects associated with a very small subgroup rather than a genuine effect of academic seniority. Collectively, these findings are consistent with the broader knowledge-practice gap documented in the public health literature and underline that awareness alone is an insufficient lever for behaviour change; it must be paired with structural, enforcement-based and normative interventions.<sup>2,3,6,12,13</sup>

### Limitations

This study has several limitations that should be considered when interpreting its findings. First, the convenience sample was drawn from a single university and cannot be assumed to be representative of the wider Students population, either within India or internationally. Second, the cross-sectional design precludes causal inference; the directionality of the relationship between awareness and behaviour cannot be established. Third, all data were self-reported and may be subject to social desirability or recall bias, particularly for sensitive practices such as drink-driving. Fourth, some subgroups notably postgraduate and PhD students had small sample sizes, limiting the statistical power of subgroup comparisons. Future research would benefit from larger, multi-institutional and longitudinal study designs, ideally incorporating observed rather than solely self-reported driving behaviour.

### CONCLUSION

University students in Lucknow demonstrate moderate general road safety awareness including reasonably strong understanding of pedestrian crossings and traffic signals but exhibit critical knowledge gaps regarding specific legal requirements, most notably helmet regulations, alongside low rates of licensing and a meaningful minority who report drink-driving. Neither gender nor year of study was a significant predictor of awareness or practice, indicating that these deficits are broadly distributed across the student population rather

than confined to particular subgroups. For university administrator, public health planners and traffic authorities, this points to a clear implication: raising awareness alone is unlikely to close the knowledge-practice gap. Sustained improvement will require intervention strategies that combine behaviour-change education, institutional enforcement mechanisms and efforts to shift campus-level social norms around road safety. Given that only 2-4.6% of students correctly understood the mandatory bilateral helmet-use law, universities should implement focused, multimedia-based helmet-awareness campaigns- using peer testimonials and case-based learning to close this specific legal knowledge gap. Evidence-based, iteratively optimized education formats, such as the multiphase approach described by Buttazzani et al may offer a useful template for designing these campaigns. With fewer than half of students holding a valid licence, universities should partner with regional transport offices (RTOs) to organize periodic on-campus licence application camps and associated awareness drives. To address the 10-12.5% prevalence of self-reported drink-driving, universities should implement peer-education programmes, designated-driver initiatives, and visible collaboration with traffic police. As academic progression was not associated with improved awareness or practice, road safety content should be formally incorporated into student orientation programmes and elective coursework to ensure consistent exposure across all years of study. The absence of substantial gender differences supports a universal rather than gender-targeted intervention approach, although minor behavioural differences may be accommodated through inclusive, participatory programme design. Institutionalized partnerships with traffic authorities including regular campus checks, road safety classes and joint awareness campaigns would strengthen both the educational and enforcement dimensions of road safety on campus. Universities should establish a periodic assessment system to track road safety knowledge and behaviour over time, allowing intervention strategies to be revised in response to emerging data.

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