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Determinants of helmet use among health-care providers in urban India: Leveraging the theory of planned behavior

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Abstract:

CONTEXT: Wearing helmet during road traffic accidents among motorcycle riders decreases the likelihood of death by 39%. The theory of planned behavior (TPB), a psychological model helps to explain the failure in helmet usage, by assuming a causal chain. The current study was taken up as no studies have elicited the determinants of helmet usage in terms of TPB among health-care providers, the role models for healthful behavior by virtue of their profession in the current urban Indian context.

AIMS: The aims of the study were (1) to determine the proportion of proper use of helmets and (2) to identify TPB-related factors and other factors influencing the use of helmets.

MATERIALS AND METHODS: A cross-sectional study was conducted among 147 students and staff of a tertiary health-care center, Bengaluru, using a pretested, validated, semi-structured, self-administered questionnaire. Convenience sampling was used. Hierarchical regression model was used to explain variation in the scores of helmet-use behavior on the basis of TPB variables. $P < 0.05$ was considered as statistically significant.

RESULTS: About 65% of respondents practiced "proper use" of helmets. Intention, perceived behavioral control (direct), and attitude (indirect) were significant predictors of helmet use ($P < 0.05$). Mean scores of knowledge on helmet use and behavior showed positive correlation ($P > 0.05$).

CONCLUSIONS: Application of TPB in urban Indian context was successful in identifying precursors of helmet use. This study throws a light on the strong influencers of helmet use which can assist policy developers in developing effective programs to successfully promote the "proper use" of helmets.

Keywords:

Health-care providers, helmet-use behavior, proper use of helmets, theory of planned behavior

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Introduction

Road traffic accidents

A global issue and a serious urban scenario: Road traffic accidents are one of the leading causes of disability and premature deaths in developing countries. Globally, 1.24 million road traffic deaths have been reported per year.[1] India has an estimated road traffic death rate of 18.9/100,000 population and 24.9% of two-wheeler riders were its victims.[2] Vehicle crashes are a major concern in rapidly growing urban clusters. All the 36 States/Union Territories have reported more than two-third of fatal accidents in urban areas during 2014.[3,4] Karnataka accounts for 8% of the road accidents in India.[3] A total of 755 deaths and 4475 injuries has been reported in the year 2012, in Bengaluru, the capital city of Karnataka state. However, underreporting cannot be ruled out.[5]

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Nearly, 60%–70% of the injured or killed two-wheeler riders sustain injury to the brain and wearing a standard, good-quality helmet reduces the risk of deaths and serious injuries by 40% and 70%, respectively. In Bengaluru, 60% of the riders have been reported to use helmets and many still continue to use half headed, nonstandard, and damaged helmets.[6]

The role of health-care professionals in designing and implementing a successful helmet program is significant. In addition to this, health counseling from trusted professionals such as doctors form an important component. For instance, a hospital-led promotion campaign, an intervention in the United Kingdom, has resulted in an escalated use of helmets among teenagers.[7]

Barriers of helmet use identified in the various studies include: (i) Sociodemographics (younger age, lower education, and type of employment), (ii) physical discomfort (helmet strap impinging and too much of heat), (iii) road physiognomies (type, travelling time, and distance), (iv) helmet characteristics (quality, price, style, and experience), (v) risky traffic behavior and personal characteristics (unlicensed rider, riding experience, previous history of accidents, anticipation of meeting a traffic police, norms and attitudes toward helmet use, and lack of awareness on traffic rules and law enforcements), and (vi) laws and regulations (lack of helmet law enforcement).[8-13]

The theory of planned behavior (TPB) is one of the psychological models that assume a causal chain. It links behavioral, normative, and control beliefs to behavioral intentions and behaviors, through attitudes, subjective norms, and perceived behavioral control (PBC) to study the health-related behavior (helmet use).[14]

To the best of our knowledge, no studies have elicited the determinants of helmet usage in terms of TPB among the health-care providers in the current urban Indian context. Hence, the study was conducted among health-care providers in an urban area to explain helmet-use behavior through the application of TPB with the following objectives: (a) to determine the proportion of proper use of helmets among health-care providers and (b) to identify the TPB-related factors and other factors influencing the use of helmets.

Materials and Methods

This was a cross-sectional study conducted between April and September 2015 among the students and staff of a tertiary health-care center located in Bengaluru Urban district, Karnataka state, South India.

Considering the estimated prevalence (p) of helmet use as 60% based on previous studies,[6] with 95% confidence interval and permissible error (*L*) in the estimate of "p" as 20% of "p," $q = 100\text{-}p$, $Z = 1.96$ at 95% confidence interval, using the formula $n = z^2 (pq/L^2)$, the minimum sample size works out to be 64, considering the nonresponse rate of 15% of n, $n \approx 75$. Convenience sampling was followed. We enlisted all the staff and students in the tertiary care institution who were currently two-wheeler users. Even though the minimum sample size required was 75, we considered all the enlisted study participants who consented for the study. Thus, the total sample studied was 147.

Ethics approval was taken from the institutional ethics committee of the tertiary health-care center bearing the reference number BGSGIMS/287/2014-2015. A semi-structured, self-administered questionnaire was used for the study and it consisted of five sections. Section-I, II, III, IV dealt with socio-demographic information, general information, any past history of accidents, knowledge about "proper use" of helmets, TPB with questions on five subscales, namely, attitude, subjective norms, PBC, intention, and behavior related to helmet use, respectively. Finally, Section V was applicable only to the participants who owned a helmet and dealt with details on "practice" and the quality of helmets used. Written informed consent was taken before administering the questionnaire.

The knowledge section of the questionnaire consisted of six questions and the responses "don't know" or "incorrect" were scored as zero ("0") and the rest as one ("1"). The mean scores of the questions for all the respondents were calculated. The mean scores of ≤ 0.5 and >0.5 were arbitrarily considered as having poor and good knowledge, respectively.

Subscales of the TPB questionnaire

The five subscales of TPB questionnaire included attitude, subjective norms, PBC, intention, and helmet-use behavior. All the subscales except for helmet-use behavior were measured using Likert-type scales with number of items in each being 7, 4, 7, and 5, respectively. Negatively worded items were reverse scored. The higher mean scores of 4 and 5 were considered favorable and indicated positive attitude, positive PBC, positive intentions, and stronger subjective norms with respect to helmet use [Table 1].

Helmet-use behavior

The helmet-use behavior was a one-item scale designed to note a number from 0 to 10 (total possible scores) to measure on an average, number of times the participants would use helmet in every ten times of motorcycling. Higher scores of >5 were arbitrarily considered as

favorable and ≤5 as unfavorable response for helmet-use behavior (practice).

The content validity of the instrument was established by the subject experts and the fellow faculties by evaluating their appropriateness, relevance of items, and response formats. The feedbacks were used to revise and modify the instrument. The questionnaire was then pilot tested over a week on a sample of 30 health-care providers from the same tertiary care center, and the internal consistency of the scales was estimated using Cronbach's alpha. This pilot sample was not included in the final sample.

Table 1: Questions on each constructs

Attitude
Using helmet is tiresome for me
Using helmet is very useful for me
There is no need to wear helmet while motorcycling
Using helmet is important for me
Helmet is a good safety device
In order to be totally safe, it is essential to use the helmet irrespective of the distance traveled on that trip
In order to be totally safe, it is essential to use the helmet irrespective of the speed at which we travel
Subjective norms
Most of my relatives agree with helmet use while motorcycling
The faculty of our college confirm helmet use while motorcycling
My family, always, persuade me to use helmet while motorcycling
Most of motorcyclists think that I should use helmet while motorcycling
Perceived behavioral control
Using helmet is impossible for me
Using helmet regularly is very difficult for me
The problems and barriers prevent me from using helmet
I use helmet only because of law
I don't use helmet because wearing helmet causes hair fall
I don't use helmet because I cannot carry it everywhere
Intention
In the next month, I intend to use helmet while motorcycling always
In the next month, I will plan to use helmet while motorcycling always
In the next month, I will try to use helmet while driving always
I have decided not to ride the two-wheeler without helmet, any more
I have decided not to use the helmet while riding the two-wheeler
Helmet-use behavior
On the average, how many times have you used helmet in every 10 times of motorcycling? (please, only note a number from 1 to 10)

The possible and observed ranges of the scales, number of items, mean and standard deviations of variables, and reliability coefficients of the constructs are listed in Table 1. The Cronbach's alpha coefficient of all the items were ≥0.7 and hence reliability of the questionnaire was "acceptable"[15] [Table 2].

Operational definitions used in the present study:

- Proper use of helmets: The use of right quality helmets which fulfills the Bureau of Indian Standards of helmets and wearing it in a right manner
- Health-care provider/health personnel: Any person working in the institution including the students of this institution.

Outcomes

- Attitude: Attitudes refer to an individual's positive or negative disposition when performing a particular behavior[16]
- Subjective norms: Subjective norms refer to an individual's perception of relevant opinions on whether to perform a particular behavior[16]
- PBC: A three-item scale was developed for measurement of PBC regarding helmet use while motorcycling[16]
- Intention: The amount of effort one is willing to exert to attain a goal[17]
- Behavior (helmet use): The degree with which the participants use their helmet while motorcycling measure.[16]

Statistical analysis

The data obtained were entered into an Excel sheet. The analysis was done using SPSS version 18.0 (SPSS Inc., Chicago, IL, USA). The proportion of "proper use" of helmets among the respondents was expressed in percentages. The correlation between knowledge and behavior, the nature of associations between helmet-use behavior, and the TPB variables were demonstrated using Spearman's correlation coefficient. Multiple regression analysis (hierarchical regression model) was used to explain the variation in the scores of helmet-use behavior on the basis of these TPB variables. The hierarchical regression model was applied after testing the data for normality using Kolmogorov–Smirnov test. The other categorical data were analyzed using the Fisher's exact

Table 2: Theory of planned behavior variables, possible and observed ranges, number of items, mean and standard deviation of variables, and reliability coefficients

Studied constructs	Number of items	α in pilot sample	Possible range	Observed range	Mean	SD
Attitude	7	0.72	7-35	7-35	30.57	3.45
Subjective norms	4	0.73	4-20	4-20	17.23	2.27
Perceived behavioral control	7	0.70	7-35	7-35	23.07	4.40
Intention	5	0.86	5-25	5-25	20.60	4.14
Helmet-use behavior	1	-	0-10	0-10	4.97	3.86

SD=Standard deviation

and/or Chi-square tests. Statistical tests were considered significant at 5% significance level.

Results

Socio-demographic factors

There were a total of 147 respondents, and their median age and interquartile range being 19 years and 18–20 years, respectively. The ages of the respondents ranged from 17 to 65 years. Majority (57.8%) of the participants were male. About 93% belonged to socioeconomic Class V of Modified B.G. Prasad Classification (June 2015).[18-20] Eighty percent belonged to a nuclear family. Majority of the participants' fathers (59%) and mothers (42%) were graduates/post graduates/professionals and 62% of them used two-wheelers regularly to reach the tertiary health-care center.

Factors influencing the purchase of helmet

Among 147 respondents, 32% had history of minor accidents, among which 23.4% had no history of wearing the helmet during the accident. About 75% of the respondents (110/147) owned a helmet. Thirteen percent of those owning a helmet bought it from the street market. Major concern to buy a helmet among majority was quality (89%), followed by comfort (65%), style/looks (56%), price (46%), color (44%), potential of being penalized by the police (19%), other factors (8%), and history of previous accidents (6%) (Note: multiple responses were allowed).

Usage of helmets/practice (assessed among individuals owning a helmet)

Non-respondents (27/110) were excluded (hence n = 83). Among the 83 respondents, 65% practiced "proper use" of helmets (54/83). About 96.3% of them used uncracked helmets, 91.6% used right quality helmets (ISI marked), 87.9% used correctly fitting helmets, 79.5% strapped the chin straps snuggly, 78.3% of them used full face helmet, 45.8% of them used helmets with red color striped adhesives on the back of the headgear, and 24.1% used light-colored helmets [Table 3].

Table 3: Practices of proper helmet usage among the two-wheeler riders

Questions on Practices	Correct practice (n=83)*, n (%)
Use of right quality helmet with ISI mark	76 (91.6)
Use of safest type of helmet among different types	65 (78.3)
Use of uncracked helmets	80 (96.3)
Use of light-colored helmets	20 (24.1)
Use of helmets with red color striped adhesives on the back of the headgear	38 (45.8)
Correct fitting of the helmet	73 (87.9)
Strapping and fitting of chin strap	66 (79.5)

*Applicable only for the 110 participants who owned a helmet and the 27 non-respondents were excluded (hence n=83). ISI=Indian standard institute

Subscales of theory of planned behavior

Greater proportion of respondents gave relatively favorable response for attitude (89.8%) and subjective norms (83.0%) compared to intention (79.6%) and PBC (64.6%). About 74% of the respondents gave favorable response for helmet-use behavior.

All the variables of TPB had significant positive correlations with the scores of helmet use except for the subjective norms. PBC (r = 0.49) and intention (r = 0.44) had a significantly strong relationship with helmet-use behavior (P < 0.05). Attitude (r = 0.53) and PBC (r = 0.50) followed by subjective norms (r = 0.27) had significantly strong relationships with intention (P < 0.05) [Table 4].

Factors influencing the use of helmets based on the theory of planned behavior

A hierarchical regression model was applied for which the order and content of the blocks of variables were based on the theoretical tenets of the TPB and previous research.[21] Initially, in hierarchical regression analysis (HRA), helmet-use behavior (dependent variable) was linearly regressed on intention and PBC (Block 1) through which 29% of the variance in helmet-use behavior (F = 29.35, P < 0.05) was explained. Intention (β = 0.35, P < 0.05) and PBC (β = 0.27, P < 0.05) both predicted the behavior significantly; however, intention was the strongest. In the second HRA, intention (dependent variable) was regressed on attitude and subjective norms (Block 1) and PBC (Block 2). Attitude and subjective norms (Block 1) together explained 28.7% of the variance in intention (F = 29.02, P < 0.05); attitude (β = 0.491, P < 0.05) and provided significant contribution compared to subjective norms (β =0.103, P > 0.05). The addition of PBC in Block 2 explained an additional 11% of the variance in intention (F = 31.38, P < 0.05). Hence, even with the presence of attitude (β = 0.384, P < 0.05) and subjective norms (β =0.076, P > 0.05), PBC (β = 0.352, P < 0.05) maintained its unique contribution. Thus, among attitude, PBC, and subjective norms, attitude and PBC were the strong predictors of intention (P < 0.05), among which attitude was the strongest, and subjective norms, the weakest (P > 0.05) in predicting the intention of helmet use [Table 5].

Other factors influencing the use of helmet

The factors such as age, gender, occupation, type of family, socioeconomic status, educational and occupational statuses of father and mother, and history of accident with the use of helmets were not associated with the use of helmets (P > 0.05).

On asking various questions regarding the standards of helmets, laws and other facts, majority of the respondents

Table 4: Theory of planned behavior constructs with helmet-use behavior correlation matrix (*n*=147)

Variables	1	2	3	4	5
1. Helmet-use behavior	1	0.44* (*P*<0.001)	0.21* (*P*=0.012)	0.11 (*P*=0.192)	0.49* (*P*<0.001)
2. Intention		1	0.53* (*P*<0.001)	0.27* (*P*=0.001)	0.50* (*P*<0.001)
3. Attitude			1	0.35* (*P*<0.001)	0.33* (*P*<0.001)
4. Subjective norms				1	0.18* (*P*=0.026)
5. Perceived behavioral control					1

*Correlations were significant at *P*<0.05

Table 5: Hierarchical regression analysis for the theory of planned behavior constructs (*n*=147)

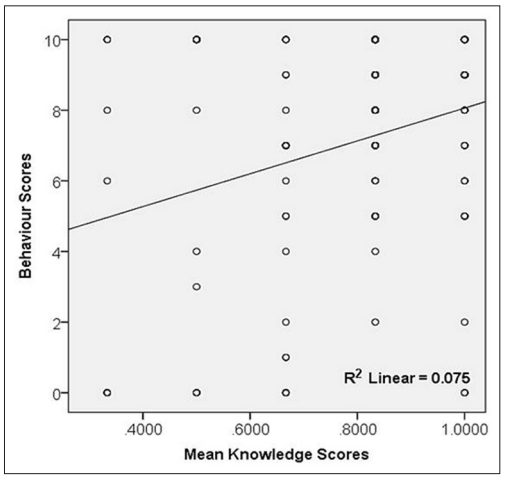
Variables	R^2	*F*	*P*	Standardized β coefficients	Change statistics	
					R^2 change	*P*
Predicting behavior						
Block 1			0.001*			
1. Intention	0.290	29.35	<0.001*	0.353		
2. Perceived behavioral control			0.001*	0.267		
Predicting intention						
Block 1			<0.001*			
1. Attitude	0.287	29.02	<0.001*	0.491	0.287	<0.001
2. Subjective norms			0.172	0.103		
Block 2			<0.001*			
1. Attitude	0.397	31.38	<0.001*	0.384	0.110	<0.001
2. Subjective norms			<0.277	0.076		
3. Perceived behavioral control			<0.001*	0.352		

*Values were significant at *P*<0.05

identified the correct responses for the safest type of helmet as full-face helmets (104/147 ≈ 92.5%) followed by 79% (116/147) identified retroreflection and illumination as the purpose of red color striped adhesives on the back of the headgear, 77% (113/147) said wearing helmet even by the pillion rider helps in reducing the likelihood of head injury, 73% (107/147) answered about the compulsory law for helmet usage among two-wheeler riders (Note: wearing the helmet was not compulsory for the pillion rider/(s) in Bengaluru, when the study was conducted), 70% (104/147) said that the helmet should confirm for the standards of Indian Standard Institute, and 51% (75/147) answered that the light-colored helmets improve the visibility of the rider. About 83% of them scored an average score of ≥0.6 indicating good knowledge.

Among those who owned a helmet, though 83% (82/110) had good knowledge (mean knowledge scores >0.6), the practice of helmet use was poor (≤5). However, the association was not statistically significant ($P > 0.05$).

Correlation of knowledge with mean behavior scores ($n = 110$) showed that mean scores of behavior increased as the mean knowledge scores increased ($r = 0.184$; $P = 0.054$); however, it was not statistically significant ($P > 0.05$) [Graph 1].



Graph 1: Correlation between mean knowledge scores and scores of behavior of helmet use ($n = 110$)

Discussion

There are many factors affecting the use of helmet. Some of which have been considered in the present study, concentrating mainly on the TPB model that has been successfully used to explain the change in various health behaviors.

In the present study, only 65% of the respondents who owned and responded for the practice questions used helmets properly with a correct fitting, ISI marked, and properly strapped helmets. The studies by NIMHANS have shown that the helmet usage rate in Bengaluru as 60% in 2008[6] and 50% of those helmet users in Bengaluru have been reported to use it in a proper manner, and 55.6% of those two-wheeler riders are reported to wear full-face helmets and are nearly similar to the current

study findings.[21] In a study by Wadhwaniya *et al*. have found that nearly all (94.2%) of those who had helmets were wearing standard helmets and it was also reported that respondents also gave importance to quality and certification when purchasing a helmet. The self-reported and observed rates of wearing helmets were nearly 65% and 29%.[22] The difference in the rates observed may be due to the different study settings and study design. Nearly, 91% of them used right quality helmet with ISI mark, 87.9% used well-fitted helmets, 79.5% firmly fastened the chin straps of their helmets, and 78.3% used full face helmet in the present study, and similarly, Kulanthayan *et al*. in Malaysia reported that 54.4% used helmets properly in which a properly used safety helmet was defined as a helmet which was worn with the strap correctly fastened.[10] The difference in the current study and Kulanthayan *et al*., which needs to be observed is each element of proper usage is recorded as different in our study, whereas in the compared study, it is clubbed together. Yadukul *et al*. conducted in Bengaluru have noted that only 21.4% were wearing a full face helmet, 8% were wearing open-face helmet, and only 13.4% wore ISI standard full-face helmets and are noted to be lesser compared to our findings and are due to the selection of the study respondents, where the respondents were the ones who had presented with two-wheeler crash and are likely to have lesser usage of proper helmets.[23] Karuppanagounder and Vijayan in Calicut have noted that only 45% of them in the general population used helmets with ISI mark. The difference in the proportion of respondents using ISI marked helmets as noted by Karuppanagounder and Vijayan compared to the present study may be due to the different study settings and different populations selected for the study.[24] About 32% of the respondents of the present study had a history of accidents, among which 23.4% did not wear the helmet during the accident.[24] Yadukul *et al*. have noted that 49.1% of two-wheeler rider/pillion rider were not wearing any helmet at the time of crash and is slightly higher compared to current study due to the inclusion of even pillion riders in that proportion.[23]

The 13% of them bought helmet due to color, price, style/look, quality, paying fine, and other factors. Similarly, Bachani *et al*. in Cambodia also found that the factors such as helmet quality, price, style, and color as important influencing factors in the decision to purchase a helmet.[25]

Attitude and PBC had significantly strong relationships with intention. Intention and PBC in turn had significant relationship with the behavior. According to TPB model by Ajzen,[26] intention to use the helmet and perceived difficulty/ease (PBC) to use the helmet have a direct bearing on helmet-use behavior; PBC and attitude are interrelated to subjective norms; and all the three, namely, PBC, attitude, and subjective norms have an effect on intention to use the helmet and hence indirectly related to helmet-use behavior. In this study, based on regression analysis, even though motorcyclist's attitude compared to subjective norms and PBC was the most important predictor of the helmet-use intention, PBC maintained its unique effect by explaining an additional 11% change in the helmet-use behavior. Although attitude was the strongest predictor of the helmet-use intention, PBC has also been as equally strong as the attitude in predicting the helmet-use intention. Ali *et al*. and Aghamolaei *et al*., in Iran has found PBC as the most important predictor of the helmet-use intention nearly similar to the current study.[16,27] However, in a study done by Lajunen and Rasanen found subjective norms as the most important predictor of helmet-use intention which is contradictory to the present study.[28] The contrast may be because majority of the respondents were adolescents who could be easily influenced by the behavior of persons closely related to them (subjective norms), and majority were local residents among whom, the influential effect of family with positive attitude and friends with negative attitude might have got nullified. Previous evidence with substantial empirical support has shown the attitude to influence behavioral intentions.[16,29] Based on the results of the current study, intention and PBC showed a significant relationship with motorcyclists and has corroborative evidence by the study findings of Ali *et al*.[16] Socio-demographic variables in the current study were not significantly associated with the use of helmets. This fact of association between the socio-demographic variables and the use of helmets might be well established in heterogeneous samples.

Nearly, 83% of respondents in the present study had good knowledge and the behavior scores increased as the mean knowledge scores increased ($r = 0.184$; $P = 0.054$), but it was not statistically significant ($P > 0.05$). Kalbandkeri *et al*. had found 99.6% of the female students and 91.1% of the male students had high knowledge which elicits higher proportion compared to current study as they had elicited the knowledge for general road safety measures, which included helmet wearing.[30] Suwannaporn *et al*. in Thailand has noted that 50.2% had average scores of knowledge which is comparable to good knowledge in the present study, as we have categorized it into only two categories of good and bad. The correlation between knowledge scores with practice scores in their study revealed positive direction of significant correlation at $P < 0.05$ which is in correspondence with the current study except for the significance.[31] Rezazadeh *et al*. found no significant relationship between knowledge and attitude and history of accident which is in line with the current study findings.[32]

The current study is one of the very few studies globally which elicit the use of tenets of TPB in the use of helmets,

specifically among the health-care providers. In the present study, application of TPB in the urban Indian context has been successful in revealing the precursors of helmet use among health-care providers. The results add to the existing literature by emphasizing the need for the policy-makers to spread the word on "proper use" of helmets in addition to the compulsory "use" of helmets. It also clarifies that there are certain psychological transformers (attitudes, PBC, and intentions) which need to be deliberately addressed in an intervention to step-up the use of helmets.

This study also has some limitations, namely., generalizability is limited as the participants were selected from only one tertiary health-care institution. The content validity index and content validity ratio values of the questionnaire could not be assessed, as all the necessary criteria – relevancy, clarity, simplicity, and necessity were not assessed.[33] The practices could not be directly assessed due to practical difficulties experienced during the pilot study. In addition to this, the direct observation of the respondents when they start riding a two-wheeler may create a subjective bias or may indirectly encourage them to wear the helmet due to our observation (Hawthorne effect).[34,35]

Conclusions

Road traffic deaths/disabilities due to traumatic brain injuries are preventable to a large extent by the proper use of helmets. The proportion of "proper use" of helmets among the respondents in the present study being 65%, gives an impression that there is a need to stress upon the "proper use" of helmets, besides soliciting the helmet "use" alone through helmet campaigns. Results in relation to TPB variables imply two things – (a) the application of TPB in the urban Indian context has been successful in elucidating precursors of helmet use, (b) designing the helmets considering the constraints such as weight, only full-face helmets with ISI mark, and proper chin straps (c) public health interventions influencing positive attitudes and increasing the awareness and knowledge about the safer helmets might improve the helmet usage among two-wheeler riders in urban India. Increasing the knowledge among the respondents is needed to increase the helmet use.

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Conflicts of interest

There are no conflicts of interest.

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