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CELL PHONE RELATED VIOLATIONS AND MOTORCYCLE ACCIDENTS: A BAYESIAN APPROACH

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Research paper

Abstract: *The effects of cell phone use on motorcycle riders' behaviour are studied in smart city, Bhubaneswar, capital of state odisha, India. Most of motorcycle riders confess using cell phone devices while driving. Moreover, relationship between near miss and accidents has been found with the use of cell phone, reflecting a risk factor for motorcycle riders. This study examines the relationship between such type of behaviours, comprising calling and manipulating the screen, and the frequency of near miss and actual accidents among motorcycle riders. We conducted a web based survey measuring cell phone-specific violations, human errors, near miss and accident to motorcycle riders (N=289; age range; 18-60).We hypothesized that the relationship between cell phone use and near miss would be explained by an increase in the number of human errors committed, thus increasing the likelihood of being involved in near miss. Moreover, we hypothesized that near miss will predict actual accidents. Outcomes of path analysis showed that cell phone-specific violations predicted accidents throughout their consecutive effects on human errors and near miss only in the subsample of men. These findings offer an explanation of how cell phone use contributes to increase the likelihood of getting involved in near miss and actual accidents. The current study builds a path model explaining how cell phone-specific violations lead to more near miss among motorcycle riders.*

Key words: *cell phone-specific violations; human errors; near miss; accidents; motorcycle riders safety*

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1. Introduction

Motorcycles are a popular means of transport worldwide, although they can serve different purposes in different world regions. In high-income countries, they are often used for leisure or recreation, whereas they are commonly used for transporting people and goods in low- and middle-income countries (Organization for Economic Cooperation and Development/International Transport Forum, 2015). Most motorcycles in high-income countries are high-powered (over 250 cc), representing over 50% of the motorcycles fleet in North American and European countries compared to 5% in Southeast Asia (WHO, 2017). Within Southeast Asia, the proportion of motorcycle fatalities is much higher in Vietnam, Malaysia, Cambodia, and Thailand, at 58, 58, 70, and 73%, respectively (Abdul Manan et al., 2013; Ngo et al., 2012; WHO, 2015). Since 2010, the proportion of motorcycle fatalities has remained stable in most world regions (WHO, 2015), suggesting that motorcycle accidents continue to be a global safety issue. Among a number of factors contributing to motorcycle accidents, risk-taking behaviours have been found to be an important contributor (Lin & Kraus, 2009). Thus, there has been a growing body of literature investigating risky riding behaviours of motorcycle riders in high-income countries (Moskal et al., 2012; Stephens et al., 2017) as well as in low- and middle-income countries (Roehler et al., 2015; Tongklao et al., 2016; Vu & Shimizu, 2007).

For example, in a study in Hanoi, Vietnam, Vu & Shimizu, (2007) found that habits and intentions were strong predictors of risk-taking behaviours such as speeding, running red lights, and reckless overtaking. A study in Malaysia reported a high prevalence of street racing under the influence of alcohol and stunt riding (Wong, 2011). In Indonesia, Susilo et al. (2015) found that young adults and students were more likely to violate traffic regulations while examining a range of traffic violations among motorcycle riders Though cell phone use while driving a car has been a subject of much research (Backer-Grndahl & Sagberg, 2011; Beck & Watters, 2016; Harrison, 2011; Ismeik et al., 2015; McEvoy et al., 2005; Zhou et al,. 2012), mobile phone use while riding a motorcycle has only been investigated in recent research. It was observed that the prevalence of cell phone use while riding in 3 Mexican cities was 0.64% (Perez-Nunez et al., 2013) compared to 8.66% in Hanoi, Vietnam (Truong et al.,2016). Self-reported prevalence of cell phone use while riding, at any time rather than a specific time of observation, was much higher. About 40% of high school students in Vientiane, Laos (Phommachanh et al., 2017), and nearly 81% of university students in Hanoi and Ho Chi Minh City reported using a mobile phone while riding a motorcycle (Truong et al., 2017). Effects of gender, risk perceptions, and social networks on cell phone use while riding have also been highlighted (De Gruyter et al., 2017; Truong et al., 2017,Long et al.,2019). Cell phone use while riding can also be affected by situational factors. (Truong et al.,2016).

The high prevalence of cellphone use while motorcycle riders reported in previous research conveys a clear message about the generalized presence of such practices.

2. Literature Review

A number of studies have further explored associations between risk-taking behaviours and crash involvement given their importance to the identification of interventions and priorities. Using French crash data, Moskal et al. (2012) found that bike riders who were males, did not wear a helmet, or exceeded the alcohol concentration limit had a higher risk of being involved in a crash." In a survey of motorcycle riders in New South Wales, Australia, Stephens et al. (2017) showed that riders performing stunt behaviours and speed violations were more likely to be involved in a accident and close-accident, respectively. "According to a study of schoolchildren in India, tailgating and aggressive attitudes toward other motorcycle riders were associated with accident involvement" (Rathinam et al., 2007). "It was found in Taipei, Taiwan, that female motorcycle riders or riders with a higher tendency to engage in risky riding behaviours were more likely to be involved in a accident (Chang & Yeh,2007). A recent study in France suggested that female riders were less likely to be involved in injured accidents and particularly fatal accidents, however (Coquelet et al., 2018). In a study of fatal motorcycle accidents in Cambodia, Roehler et al. (2015) identified that speeding and drink riding were major contributing factors to motorcycle fatalities. A study of risky behaviours among students in Thailand reported that not wearing a helmet, speeding, and riding under the influence of alcohol were associated with motorcycle injuries (Tongklao et al., 2016).

Though the associations between a range of risk-taking behaviours and motorcycle accident involvement have been extensively investigated, little is understood about accident involvement among motorcycle riders who use a cell phone while riding. This understanding is particularly important in regions such as Southeast Asia where motorcycling is the dominant transport mode coupled with high prevalence of cell phone use while riding" (Phommachanh et al., 2017; Truong et al., 2017). "To address the research gap, this article investigates crash involvement and severity among motorcycle riders with risky riding behaviours, particularly cell phone use while riding. Data from a survey of university students' risky riding behaviours in Vietnam are utilized for the investigation because Vietnam has bike-dominated traffic (NTSC 2015; WHO, 2015) and young adults are more likely to engage in risky riding behaviours (Chang & Yeh, 2007; Truong et al.,2016).Traditionally, traffic accidents have been associated with human, road, environmental and vehicle factors (Bucsuházy et al., 2020). Human behaviour has been reported as the main contributing factor in 95% of bike accidents (Petridou & Moustaki, 2000; Sheykhfard et al., 2020).

In Vietnam, motorcycles contribute to around 95% of over 43 million registered vehicles and the vast majority of motorcycle are powered with an engine of less than 150 cc (NTSC, 2015; WHO,2017). Motorcycle riding is particularly important for mobility of young adults; most young adults aged 21–30 years old (58–77%) possess a motorcycle (Tran, 2013) and many students (40%) use one for travel to university (Ohmori et al., 2011). In 2014, Vietnam had over 25,000 reported traffic accidents and about 9,000 fatalities (NTSC, 2015). Motorcycle riders were involved in more than 70% of traffic accidents (Hung et al., 2008; Truong et al., 2016) and contributed to about 58% of traffic fatalities (Ngo et al., 2012). Traffic regulations in Vietnam specify penalties for risky riding behaviours such as not wearing a helmet, speeding, drink riding, running red lights, and using a cell phone or portable music device while riding. However, though helmet use has been well reported (Hung et al., 2008;Marco et al.,2019), little information is available about the compliance levels for other risk-taking behaviours.

According to the previous definitions, cellphone behaviors on the motorcycles can be considered violations given that, even if not all the countries' road rules officially ban them, they are deliberate deviations of the safe practice. All in all, even though the body of research on motorcycle riders' cellphone use is growing, there is need for more research on motorcycle riders to further untangle how–and to what extent – this type of violations affects human error because use of motorcycles (two wheelers) is very high in Bhubaneswar.

Based on the previously reported findings and the stated need for more research, we establish a hypothesized path model in which cellphone -specific violations will be positively associated with human errors (Hypothesis 1) and near miss (hypothesis 2). We also hypothesize that errors will be positively associated with near near miss (Hypothesis 3).To address this research gap, we hypothesized that close accidents will predict actual accidents (Hypothesis 4).

In a nutshell, we have hypothesized a model (see Figure 1) in which cellphone-specific violations and human errors predict near miss. In turn, near miss were hypothesized to predict actual accidents. Thus, we have posed that cellphone specific violations and human errors will indirectly increase the likelihood of actual accidents by raising the likelihood of occurrence of near miss. Therefore, we hypothesize that near miss will mediate the effect of cellphone-specific violations and human errors on actual accidents (Hypothesis 5). Moreover, we have also proposed that cellphone-specific violations will enhance the probability of committing human errors, and this at the same time will increase the likelihood of being involved in near miss." In addition, since we have also posed that accidents will be predicted by near miss, we hypothesize a serial mediation model in which human errors will mediate the effect of cellphone-specific violations on near miss, and these will act as a mediator between human errors and the occurrence of accidents (Hypothesis 6). "Figure 1 displays the hypothesized path model. Hypothesis 5 encompasses all the paths between cell phone-specific violations and accidents (i.e., those of H1, H2, H3, and H4), whereas Hypothesis 6 includes those between human errors and accidents (i.e., those of H3 and H4).

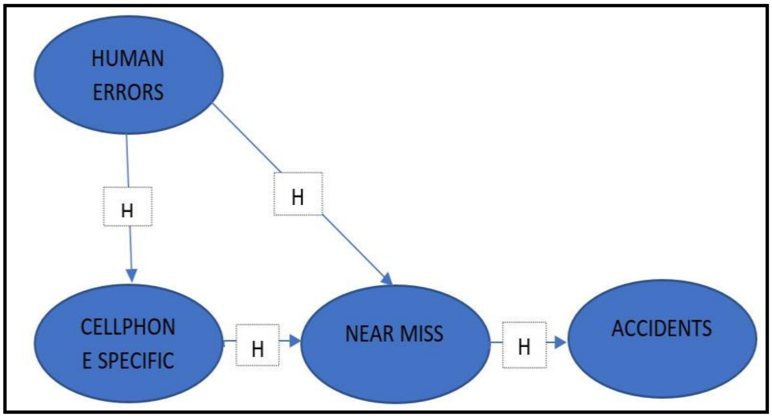

Figure 1. Conceptual Model of the Study (Hypothesized path model)

3. Methodology

Data were collected from October15, 2019 to December 30, 2019 through a self-reported online questionnaire at Bhubaneswar, Capital of Odisha, India. To reach a wide variety of participants with different demographics characteristics and from different locations in Bhubaneswar, the questionnaire was disseminated through the web. We found the motorcycle riders associations' websites and social media groups. Social media groups with fewer than 500 participants were discarded. We contacted in total 40 groups and 25 websites. To reach the selected targets two methods were used: (a) firstly, the link to the questionnaire was directly posted on groups' walls or on websites bulletin boards if available; (b) secondly, an email was written to the website administrators, kindly asking to advertise the questionnaire directly on their website, through their social media channels or inside their newsletter.

3.1 Descriptive Statistics

A total of 462 participants responded the questionnaire. After considering only those participants that had filled out the items for age, sex, and acknowledged to use the motorcycle at least once a week, the remaining sample comprised 289 (62.5%) participants. From these, 175 (60.5%) were male, 114 (39.4%) were female. The age of the participants ranged from age 18 to 60 years. The mean for female was 36.08 (*SD* = 14.42), the mean for male was 44.20 (*SD* 13.83), whereas the general mean value was 41.56 (*SD*= 14.42).

Among these participants, 31 (10.7%) of them used the motorcycle once a week, 31 (10.7%) used it twice, other 34 (11.6%) participants using motorcycles three times a week, 30 (10.3%) did so four times, 42 (14.5%) of them used motorcycles five times a week, and the remaining 121 (41.8%) participants used the motorcycles six or more times per week. Moreover, regarding the frequency of use in comparison with other means of transportation, 48.2% of the participants reported to use the motorcycles as a primary mode of transportation.

3.1.1. Cell phone specific violations."

To measure cell phone -specific violations, we used a 5-item self-reported scale based on Chataway et al.(2014) scale on distracted used motorcycles. We asked participants to state the perceived frequency with which they undertook behaviours, such as checking the phone while using motorcycles or texting messages. The frequency was expressed by using a 5-point Likert-type scale (ranging from 1=*never to 5=always;* assuming that "always" entails "as long as there is the possibility to do so" and not "continuously and all the time"). "Table 1 shows the item and subscale structure of the questionnaire, as well as some descriptive and reliability values.

Table1. Descriptive statistics of the unsafe motorcycle rider behaviours.

Subscales	*M*	*SD*	Med	α
Cell phone-specific violations				0.880
Use a Cell phone to look for information or itineraries on the Internet.	1.52	0.87	1	
Use a Cell phone to send text messages.	1.43	0.82	1	
Use a Cell phone to read text messages.	1.62	0.86	1	
Use the Cell phone to respond a call.	1.95	0.98	2	
Use the Cell phone to call someone.	1.78	0.96	1	
Human Errors				0.672
Abruptly brake in order to avoid/dodge a vehicle.	2.59	0.92	3	
Abruptly swerve to avoid a bus or truck that turns right.	1.72	0.85	2	
Be grazed or hit by a cycle.	1.08	0.34	1	
Almost hit a pedestrian while you were turning right.	1.52	0.75	1	
Not sight a vehicle merging from a next street.	1.94	0.74	2	
Realize late that you have neglected a traffic red light.	1.34	0.62	1	
Doubt about who has preference in a roundabout.	1.34	0.68	1	

3.1.2. Human Errors.

To measure errors, we administered a 7-item scale based on those featured in the Driver Behavior Questionnaire (DBQ) (Sakashita et al., 2014) and the Adolescent motorcycling Behavior Questionnaire (AMBQ) (De Waard et al., 2014), adapting the former ones to the context of cycling. This scale had been previously used by Puchades et al.(2018). The items asked participants to state the frequency with which they undertook such behaviors by using a 5-point Likert-type scale (ranging from 1= *never* to 5=*always*). Table 1 shows the seven items and subscale structure of the questionnaire, as well as some descriptive and reliability values.

3.1.3. Near miss and accidents.

To obtain a measure of near miss and accidents, we used two items. Regarding the item measuring near miss: 'In this past year, have you been about to get involved in an accident (either with other road users or a single accident) while you were using your motorcycle?' (0=no, it never happened to me, 1=once, 2=twice, 3= three times, 4=four or more). The item measuring accidents was 'In your whole life, have you ever had an accident (either with other road users or a single crash) while you were driving your motorcycle?' (1=No, it never happened to me, 2=Yes, but I did not get hurt, 3=Yes, I got injured and I went to emergency services to get checked, 4=Yes, I got injured and after being checked I got hospitalized). To finally obtain three categories, the last two replies were merged into one category that represented accidents involving injuries.

4. Statistical analysis

SPSS version 23 and analysis of a moment structures(AMOS) were used for statistical analysis. Different stages were adopted for analysis of the data. First, correlation coefficients among the key variables were calculated. The magnitude of effect sizes of correlation coefficients was evaluated according to Cohen's (1988) guidelines for interpreting the magnitude of correlation coefficients." Specifically, correlation coefficients of .10 are "small," correlation coefficients of .30 are "medium," and correlation coefficients of .50 are "large" in terms of magnitude of effect sizes. "Second, we employed path analysis to test mediations, as well as direct effects, because it allowed us to estimate a model that constrains several direct effects to zero (e.g., an eventual direct effect of cell phone -specific violations on accidents, thereby, letting us test our hypotheses without the need of testing a saturated model (Hayes, 2013)."Provided that two endogenous variables of our model (i.e., near miss and accidents) are ordinal, we applied Bayesian estimation, AMOS' approach to addressing ordered-categorical data in SEM models (Byrne, 2010; Skrondal & Rabe-Hesketh, 2005).

5. Results

The participants that had not been involved in any motorcycle accident were 112 (38.7%), whereas 106 (36.6%) suffered at least one accident but did not get injured, and 81 (28.0%) of them had been involved in a motorcycle accident in which they got injured." The number of participants that had not suffered a near miss was 103 (35.3%), and 72 (24.9%) of them had indeed been involved in one. "Of those that had been involved in more than one close accidents, 44 (15.2%) participants had suffered two, 28 (9.6%) three, and 42 (14.5%) of them suffered four or more.

Ten (3.4%) cases had at least one missing value, and 12 (4.0%) values were missing among all the variables measured. Since the percentage of missing values is not higher of 5%, it can be considered as irrelevant (Schafer, 1999). Table 1 displays the subscale items of the unsafe motorcycle rider behaviors questionnaire along with their Mean and Standard Deviation values." As it can be seen, the cellphone -specific violation and human error reported as most frequent were "Use the cellphone to respond a call" and "Abruptly break in order to avoid/dodge a vehicle," respectively. Computation of Cronbach alpha has been done for all items by using the reliability command of SPSS software and its value are reflected in Table-1.

5.1. Unsafe motorcycle riding behaviours effect on near miss and accidents

Table 2 displays the Spearman bivariate correlations between the key variables studied as well as the descriptive statistics. We employed Spearman's rho due after the Shapiro–Wilk test results suggested the non-normal distribution (i.e., $p < .001$) of all the variables in the model. Human errors correlated with cellphone-specific violations ($p < 0.01$) and with near miss ($p < 0.01$). This allows us to continue to test the hypothesized model.

Table 2. Descriptive statistics and variable intercorrelations

Factors	M	SD	Range	1	2	3	4
1. Human errors	1.64	0.42	1–5	–	0.19**	0.31**	0.00
2. Cellphone-specific violations	1.63	0.75	1–5		-	0.05	0
3. near miss	1.33	1.38	–			-	24**
4. Accidents	0.81	0.76	–				-

"*Note*: *Correlations are significant at $p < 0.05$ (2-tailed),

**Correlations are significant at $p < 0.01$ (2-tailed).

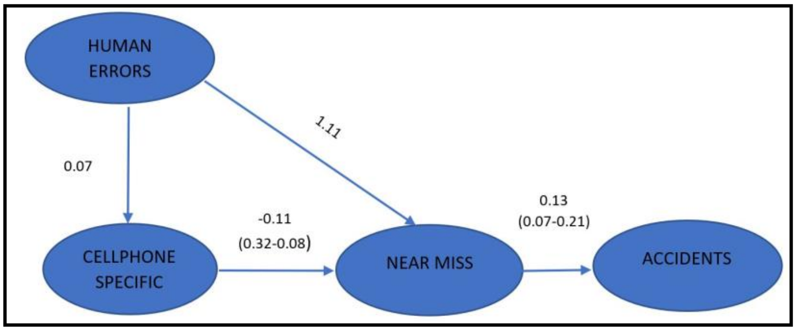

Figure 2. Path model with Bayesian estimates

Regarding the hypothesised model, Figure 2 shows the Bayesian estimates for each path. Cell phone -specific violations predicted human errors (Hypothesis 1) but not near miss (Hypothesis 2), whereas human errors did predict near miss (Hypothesis 3). In turn, near miss predicted actual accidents (Hypothesis 4). Mediation analysis showed that close accidents were mediating the effect of human errors on accidents (Bayesian estimate = 0.085, 95% confidence interval [CI] [0.043, 0.134]; Hypothesis 5). Furthermore, cell phone-specific violations predicted accidents throughout its consecutive effects on human errors and near miss (Bayesian estimate=0.013, 95% CI [0.003, 0.026]; Hypothesis 6).

We performed a gender comparison of the path model and found differences between males and females. The subsamples of male and female participants were of 175 and 114 participants, respectively. Whereas the path estimates found in the general sample were confirmed for the subsample of male participants, we found that in the female subsample, cell phone-specific violations did not predict human errors (Bayesian estimate=.043, 95% CI [0.055, 0.144]), and near miss did not predict accidents (Bayesian estimate=.100, 95% CI [0.013, 0.213]). Moreover, we also found that the estimate of the path between human errors and near miss is lower for females Bayesian estimate=.672, 95% CI [0.181, 1.155]) than for males (Bayesian estimate= 1.583, 95% CI [1.051, 2.112]). We give possible explanations for this in the discussion.

6. Discussion

The objectives of the current study were to examine the impact of cellphone-specific violations and human errors on the likelihood of near miss as well as the indirect effect of such behaviors on actual accidents among motorcycle riders. Moreover, it also aimed to unveil any gender differences in the relationships between the unsafe behaviors"(i.e., cellphone-specific violations and human errors) and the hazardous outcomes (i.e., close accidents and accidents).

It is important to note that, differently from previous studies, our findings focused on cellphone -specific violations as a distinct type of violation, whereas other research had differentiated between more common and exceptional violations (e.g., Feenstra et al., 2011). The rationale for this was that, as previously explained, such type of violations was thought to increase error occurrence by its effect on visual detection and perception. In addition, we wanted to examine whether such behaviors were indeed predicting human errors and near miss or, due to eventual compensatory behaviors (Goldenbeld et al., 2012) they were not associated.

Path analyses confirmed all the hypotheses except for Hypothesis 2, that is, cellphone-specific violations did not directly predict near miss. Nevertheless, it did predict human errors (Hypothesis 1) in the general sample, thus bringing about the point that cellphone-specific violations may indeed involve more unsafe behaviors dependent on information processing, instead of leading to more compensatory behaviors. Nevertheless, there is still the need to explore whether this relationship between cellphone-specific violations and errors is also due to a confounding variable such as motorcycle rider's safety concerns. This way, motorcycle riders less concerned about safety could be committing more human errors and using more frequently the cellphone while motorcycle riding. Errors predicted near miss, and these, accidents. Our data only partially supported Hypothesis 5 because there was no direct effect from cellphone -specific violations on near miss, impeding an indirect effect of the former on accidents unless considering the role of human errors.

Moreover, the results confirm a mediation effect proposed in Hypothesis 6, which explains the effect of cellphone-specific violations on accidents throughout human errors and near miss. These findings differ from those of Feenstra et al. (2011) according to which human errors and violations (common and exceptional) were directly predicting near miss. In our study, only human errors predicted near miss frequency. Moreover, they found exceptional violations to predict accident severity and human errors to predict accident frequency, whereas we did not find significant correlations between any unsafe motorcycle riding behaviors (i.e., human errors and cellphone -specific violations) and accidents. Twisk et al. (2015) found errors, but not violations themselves, to predict accidents, thus concurring with our findings. Nevertheless, it is worth noting main differences between these previous studies and our research. We conducted the study among adults and not adolescents, thus, age differences could be explaining some of the differences in findings.

Moreover, we have found gender differences in the effects of cellphone-specific violations on errors and that of near miss on accidents. That is, the results found in the general sample were confirmed for men, whereas cellphone-specific violations did not predict human errors and neither near miss did predict accidents in the female subsample." Cellphone-specific violations not predicting human errors in the female subsample could be due to gender differences in perception and attention."We offer two possible sets of explanations next: one theoretical and another one concerning statistical artefact. On the one hand, previous research in psychology of individual differences has found that women are quicker in identifying and discriminating objects visually, have a wider peripheral vision, and are more likely to estimate situations as risky (Ellis et al., 2008). Moreover, Feenstra et al. (2011) found that boys tended to engage in riskier behaviors, thus suggesting that women might adopt a less risky approach to motorcycle riding and, therefore, might undertake compensatory behaviors while committing cellphone-specific violations. This could diminish the effect of using cellphone while motorcycle riding on the human errors committed. A possible explanation for the fact that near miss did not predict accidents in the female subsample can be found in the smaller prediction of near miss by human errors. This can be interpreted as near miss being more dependent on variables other than human error in women. Thus, the frequency of hazardous outcomes such as near miss, and accidents by extension, is not related to human error, perhaps due to women's eventual less risky approach to motorcycle riding derived from their higher likelihood of estimating a situation as risky in comparison to men (Ellis et al., 2008).

It is important to note that, differently from previous studies, our findings focused on cell phone-specific violations as a distinct type of violation, whereas other research had differentiated between more common and exceptional violations (e.g., Feenstra et al., 2011). The rationale for this was that, as previously explained, such type of violations was thought to increase error occurrence by its effect on visual detection and perception. In addition, we wanted to examine whether such behaviours were indeed predicting errors and near miss or, due to eventual compensatory behaviours (Goldenbeld et al., 2012) they were not associated.

Fewer risk-taking behaviors could be reducing the motorcycle riders' own influence on their accident frequency, leaving it up to other road users' behaviors, and therefore conditioning the occurrence of near miss and accidents to eventual and more random encounters with other distracted or irresponsible road users. On the other hand, a possible explanation to the lack of association in the female subsample could be due to a lack of statistical power provided a not big enough subsample size. Even though there is no single answer about whether a sample is large enough to conduct SEM, a common rule of thumb is that there should be 20 observations per parameter that needs to be estimated in the model (Kline, 2016). Therefore, with 12 parameters to be estimated in our model, both subsample sizes are too small to obtain adequate statistical power. Thus, not finding an association between cellphone -specific violations and human errors, and near miss and accidents could be due to the relatively small subsample size. Thus, more research with bigger samples is needed to clarify whether these differences exist or are due to statistical artefact.

7. Limitations

There are some limitations to this study. On the one hand, we used a self-reported questionnaire to measure unsafe motorcycle rider behaviors and safety outcomes (i.e., near miss and accidents). This entails two limitations: (1) memories of accidents and near miss (e.g., Chapman & Underwood, 2000), as well as those of unsafe behaviors that do not depend on conscious control (i.e., errors), may not be accurate according to previous findings (Bradburn et al., 1987; Twisk et al., 2015)." Previous research suggests that an estimated 80% of the near miss may be forgotten after 2 weeks of the event (Chapman & Underwood, 2000). "Moreover, (2) common method variance (CMV), which refers to the amount of variance attributable to the use of the same method to measure related variables (Podsakoff et al.,2003), constitutes a limitation to our study given that we measured all the variables using self-reported questionnaires. On the other hand, online surveys advertised on websites might involve self-selection bias and, therefore, the resulting sample might not be representative of the whole population of motorcycle rider.

8. Conclusion

This research has numerous societal and practical implications from which we have concluded regarding future research needs. Cellphone -specific violations is introduced in the model and conceptualized them as a type of violation that is affecting the occurrence of unsafe behaviors relying on human errors in men, but not in women. "Furthermore, for men, we have found them to anticipate near miss and accidents through an indirect effect. This entails that cellphone-specific violations might have an effect on other unsafe behaviors and, therefore, offers a broader understanding of how such behaviors end up leading to eventual accidents. That nevertheless, there might be some confounding variables that could explain the effect of cellphone-specific violations on human errors such as motorcycle rider's safety concerns.

Our findings suggest that cellphone -specific violations appear to contribute to the frequency of errors while motorcycle riding among men. Furthermore, both human errors and cellphone-specific violations predict accidents throughout an indirect effect on near miss. Finally, these findings contribute to examine possible gender factors that can moderate the relationship between unsafe motorcycle riding behaviours and accident risk.

In conclusion, this study has highlighted a number of relationship between near miss and accidents by motorcycle riders, in particular the use of cell phones while riding. The findings suggest a number of key challenges for road safety in Bhubaneswar, India, not least the relatively high rate of accident involvement associated with cell phone use while riding a motorcycle. Addressing these challenges is an important task given the dominance of motorcycle use in Bhubaneswar, India and their increasing numbers each year.

The findings of this study provide solid evidence on safety issues of cell phone use while riding a motorcycle, which should be utilized in educational programs and publicity campaigns. Given the relatively high near miss and accidents associated with this behaviour, stronger police enforcement efforts should also be prioritized. Despite some limitations, the study still provides a significant contribution to understanding cell phone related specific violations in developing countries by helping decision-makers to define safety strategies to minimize motorcycle riders' near miss and accidents. In further stages of this research, a survey could be conducted to validate its findings. Using mixed-methods analysis is also recommended for comparing various results and providing valuable lessons on developing a more sophisticated framework. Apart from various factors, some prominent factors like individual and environmental factors may be considered for future research.

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