Investigation of Human Safety Based on Pedestrian Perceptions Associated to Silent Nature of Electric Vehicle

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Investigation of Human Safety Based on Pedestrian Perceptions Associated to Silent Nature of Electric Vehicle

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Abstract: Urbanization in addition to employ of green technology has boosted the use of electric vehicles in the cities. Since electric vehicles are free from exhaust gases, there would be an improvement in environmental conditions; however, an unintentional upcoming risk is observed due to the silent feature of electric vehicles. Similarly, the rising trend of accidents causes major injury or even permanent disability which is strongly associated with human health and global safety. This study attempts to address three extensive objectives. Is human health risk associated with the silent nature of electric vehicles from the pedestrian's gender perspective? Is the safety of pedestrians depending upon the distance traveled by them? How the age group is responsible for any fatal or accidents? Quantitative primary data were collected from 401 pedestrian respondents through an extensive questionnaire survey carried out in Mumbai, India. The hypothesis is evaluated to justify the human health risk associated with the low noise of electric vehicles based on their technical response. In addition to ANOVA, a nonparametric tool was used to analyze perceived risk in the sense of human health. Utilizing the ground level essential information obtained from the road users, the authors have investigated the key risk associated with electric vehicles. The results showed that nominal/severe accidents may cause injury to pedestrians and thereafter it leads to temporary or permanent disability; thereby it is a foremost important condition for road users to identify the presence of electric vehicles while walking on the road. The study indicates that human safety is closely linked to the safe travel of pedestrians. The quiet nature of electric vehicles are difficult for a pedestrian to identify their presence on the road which is an alarming situation for the possibility of accidents, however, there is no significant difference between the people (road users) who travel a short or long distance in a day. It is the foremost requirement to recognize the level of consequence in the context of accidents to improve the global health.

Keywords: Electric vehicles, Human Health, Pedestrian safety, Road Traffic Accidents

1. Introduction

Walking is a fundamental and common method of transport in all social orders the world over. Almost every trip starts and windup with walking. The routine walk may reduce or cure cardiovascular and obesity-related illnesses which are also beneficial for good human health. Unfortunately, in certain circumstances walking can bring out amplify the risk of road traffic crashes and/or injury[1)]. Developing nations in Asia are right now confronted with issues, for example, expanding urbanization and requirements for more safety and luxurious travel to enjoy a standard life pattern. Indian cities are flattering more spirited worldwide especially in three key areas: Aerospace, Defense, Transport and Support Service. Vehicles mobility, without any doubt, is the key element of transport systems. A good transport and support service primarily depends on safety and a specified time frame. Vehicle safety and accident control in today's fast life scenario is one of the real challenges of developed and developing countries[2)–5)]. According to the World Health Organization, road accidents exterminate around 1.35 million populace per year, and it is computed as the 8th leading root of death for the society of different ages[5)]. A report from the Ministry of Road Transport and Highways Transport Research Wing revealed that around 464910 unfortunate incidences of road accidents were reported during 2017 in which 470975 persons suffered from an injury[6)]. The most suffered persons during the year 2017 were pedestrians from which about 20457 persons lost their lives. The annual numbers of cases of pedestrian death were increased by 4711 from the year 2016 to 2017[6)]. The accident cases from India for the

year 2017 are shown in figure 1. Controlling the rising trend of accidents are alarming situations for automobile community scientists.

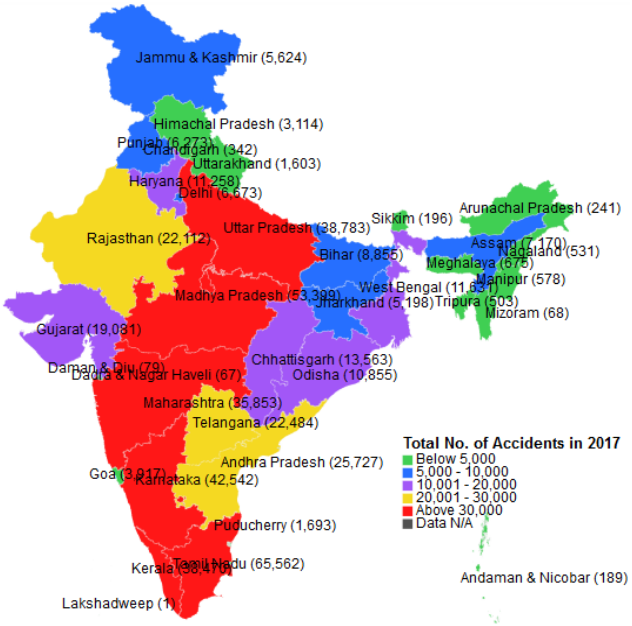

Fig.1: Indian state wise accidents cases in year 2017 [6)]

Similarly, the traffic in urban regions like Mumbai, Delhi, Bengaluru, Pune in India is ascending and up. The heavy traffic increases fuel consumption as a result of increment in carbon dioxide emissions, outdoor pollution as well as noise pollution. Traffic noise is one of the significant origins of noise pollution in urban areas which leads to certain health hazards like cardiovascular disorders, sleep disturbances, hypertension, high-stress levels, and many more. In quest of this, electric vehicles are the most trusted vehicles, well known for zero-emission and noiseless vehicles[7)]. Among all types of vehicles, electric vehicles have pinched attention as an eco-friendly vehicle since the majority of petrol or diesel vehicles emit harmful flue gases which are dangerous to human health. To boost the utilization of electric vehicles and eco-friendly transportation, the Government of India has already announced the National Electric Mobility Mission Plan (NEMMP) 2020[8)]. The key highlights of electric vehicle (EV) from the urban zone perspective emphasizes on environment friendly along with low maintenance vehicles; however, the new public health hazard is emerging because of the quiet running condition of electric vehicles. As the electric vehicles run at a low noise level, there would be the possibility of accidents due to lack of recognition for the presence of the vehicle. Accordingly, it is essential to concentrate on the factors causing vehicle accidents in the urban region of India to enhance global health and safety.

Ministry of Road Transport and Highways Transport Research Wing is constantly improving the road safety standards through road safety strategy based on 4 ‘E’s viz. Education, Engineering (both of roads and vehicles), Enforcement, and Emergency Care. However, since human health is strongly associated with safe travel, deaths from street vehicle accidents have expanded to 1.35 million every year across the globe[5)]. Road traffic injury is presently the main source of death for kids and youth aged 5–29 years. Annually, more than 10 million people injured/disabled which may affect their healthy life either temporarily or long-lasting with major organ replacement/surgery, therefore, the causes of accidents needs to be focused straight away.

To address this research gap, the authors planned to acquire the primary road level data through an extensive questionnaire survey, conducted among 401 pedestrians. Information acquired from the detailed overview is used in this work, to assess the possibility of risk and safety in the context of the quiet nature of electric vehicles. From a pedestrian’s perspective, to identify possible retrofit alternatives and to prioritize safety measures, a quantitative approach (Likert scale) is used with hypothesis analysis. Analyzed accident pattern from India (data from Road Accidents in India – 2017) and associated fatal is also examined wherein two incidence sources like pedestrian attention at the crossing of road and driver’s mistakes are sought to be studies for the reduced number of accidents and safe riding to adhere global health. Outcomes of this work can also be utilized by the researchers to evaluate the impacts of the current mobility of electric vehicles and to design new vehicle control advanced braking system for the safety of road users to reduce the risk of accidents in the urban sectors.

2. Literature Review

Globally, over 10 million people per year have been affected by injury or disability while 270000 (annually) have succumbed to the accidents so far[5)]. In numerous studies for accidents and safety aspects, moreover, the demographic and socio-economical factors, the age group of drivers are also found responsible for increased accidents. Considering the predictable possibility of human accident and death, various safety policy and standards like the antilock braking system, seat belt has been implemented across the globe to ensure control over the progression rate of accidents. Since then, continuous research has been focused to advance the control of vehicles and safety for pedestrians along with traveling passengers. A study from the United States elaborates the health risk associated with pedestrians due to the destruction of mobile phones causes accidents[9)]. Pedestrian safety is considered as a foremost health problem as well as value engineering[10)]. It is evaluated with pedestrian walking time, their personal characteristics, and level of anxiety which could be an aid for planning and urban design procession in the city of Auburn, Alabama, USA[11)]. The level of risk was also evaluated in Germany considering 404 numbers of real-world accident cases with statistical analysis[12)].

Furthermore, the road traffic injuries from driver's perspectives were investigated by Hasselberg which shows that there is no significant difference from born location aspects, but socio-economical difference causes the accidents significantly among worker families and salaried[13]. Kendrick focused on the prevention of child pedestrian accidents (aged 0-11 years). The investigation shows a considerably elevated rate of accidents in deprived areas[14].

Within the Asian region, the relationship among traffic safety, pedestrian perception and risk perception were explored with the aid of questionnaire survey in Vietnam. The study reveals that the significant predictors from pedestrian behaviors are careless driving of others, violating traffic rule in various situations and ignorance of speed limits may root the unwanted fatal[15]. Moonaghi et al. examined factors influencing road traffic accidents from a truck driver's perspective in Iran and concluded that the inability to control the stress consequences of road accidents[16]. The reason for road traffic accidents could be various such as driver's mistake, engine fault, driver fatigue, over-speed, and many more. Researchers emphasize identifying causes for accidents using the Q factor analytical method taking into consideration driver's mental patterns and assessed that the interaction between the mental patterns of drivers and their actions is an important theme that should be taken into consideration in the future study[17].

Specifically in India, such studies are not noticed or are without a doubt, exceptionally restricted, and the greater part of such investigations concentrated on road traffic accidents in Indian cities[18),19], noise prediction models for Mumbai region[20], green house gas emission[21] in Mumbai Metropolitan Region (MMR), Mumbai urban transport planning and many more. Goswami and Sonowal exposed the accident cases at Dibrugarh city, Assam, India with the intention to know the probable time period of accidents and season[19]. The accidents are closely related to socioeconomic groups wherein the maximum number of death and fatal were observed from low socioeconomic groups[3]. Around 1374 road traffic accidents are observing in a day from India in which nearly 400 deaths noticed continuing alarming serious public health concern[18]. Agarwal elaborates on the challenges and issues due to the high density of people living in the Mumbai Metropolitan Region (MMR), Author highlights the issues and concerns related to urban transport[22]. In fact, traveling with absolute safety is a huge challenge for people living in Mumbai region. Singh assessed the possibility of the worsening situation of accidents and fatal in India and commented that thereby the foremost need of control of accidents and it is possible to cross the figure of 250000 by the year 2025[23].

Literature review reveals that road traffic accident is the upcoming most serious fact in the context of human health; however, the globalization and mobility of vehicle cannot be stopped or neglected. The population of Mumbai city in India has already crossed the 20 million figure, what's more, for the remainder of the zones in the nation populaces are likewise expanding quickly. The government of India has already declared the green vehicle policy 2020[8], also, electric vehicles are pollution free and noiseless in running conditions. In quest of this, electric vehicles are becoming more popular nowadays. Considering the present traffic scenario and road constraints, there is an extreme need for evaluation of safety for pedestrians which may helpful for next policymakers. Therefore, the author's primary intention is to evaluate the safety of pedestrians in the Mumbai Metropolitan Region (MMR) which may help to improve the human health standards and safety.

3. Data and Methods

3.1 Study Area

India is one of the fastest developing nations in which around 31 percent of the populace lives in the city territories. Mumbai is the most populated city in India and considered a financial and business hub of India. Mumbai Metropolitan Region (MMR) covers a zone of 4355 sq km and has 20 metropolitan nearby bodies. Developing over a length of time, the number of inhabitants in MMR India has additionally expanded quickly. Around a large number of people walked in a day at different areas from the city zone and a considerable lot of them experienced minor or significant occurrences in rush hour gridlock or on-street while walking. Essentially the electric vehicles are getting famous due to their quiet nature as well as pollution-free nature. However, the silent nature of such vehicles is tricky to identify the presence at traffic locations especially in Mumbai Metropolitan Region where heavy traffic is observed every day. As a result, the authors have selected the Mumbai Metropolitan Region as shown in figure 2 to collect the primary data through an extensive questionnaire survey.

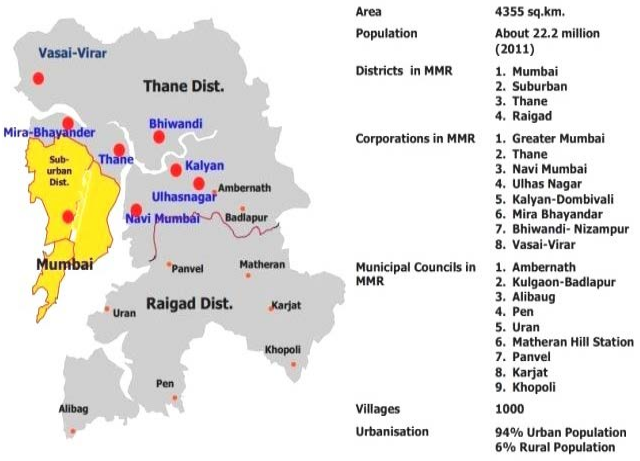

Fig.2: Sample sites and study area

3.2 Sample Data

This investigation was led in the urban communities of Mumbai Metropolitan Region (MMR), India during year 2019-2020. Slovin's formula at the 95% confidence level with ±5% margin of error was employed to decide the sample size for the pedestrian survey. A random sampling technique was used to acquire data from respondents. A total of 401 pedestrians reported their perceptions anonymously. Figure 3 shows key attributes of the surveyed pedestrians. In order to avoid any ambiguity about our research, the purpose of this study communicated them very initially.

3.3 Methodological Approach

The spot interview was directed to procure specialized information through an extensive questionnaire survey. The various locations like Mumbai, Thane, Kalyan-Dombivli, Navi Mumbai, Mira-Bhayandar, Bhiwandi-Nizampur, Ulhasnagar, Vasai-Virar, Panvel was selected for the pedestrians response. Their responses were carefully examined for further analysis. The interview questions were arranged depends on the past researcher's investigations. The interview questions were segmented into three sections. The first section was intended for demographic characteristics of pedestrians like age, profession, gender, time, location. The Likert scale of 6 points along with the nominal scale (yes/no) was employed in the second section with 13 items as shown in Table 1. The third section emphasizes the characteristics of risk, crushes, and incidences. Furthermore, the participants were asked about the possibility of risk, incidences, and related perceptions. The three various hypotheses (H_0-Null) were formulated based on the section stated above to evaluate the risk associated with pedestrians in the context of electric vehicles.

H_0: The perceived risk for quiet EVs is not associated with the gender of pedestrians.

H_1: The perceived risk for quiet EVs is not different with the distance traveled by pedestrians.

H_2: The age group of pedestrians has no impact on the perceived risk of silent EVs.

Since the data from respondents are ordinal in nature, the nonparametric test like the chi-square test was employed to examine the goodness of fit in the context of human health and injury.

What's more, the authors employed the ANOVA approach to evaluate significant factors related to gender, age, and distance traveled by pedestrians. The perceived risk is evaluated based on information composed from numerous factors as shown in figure 3.

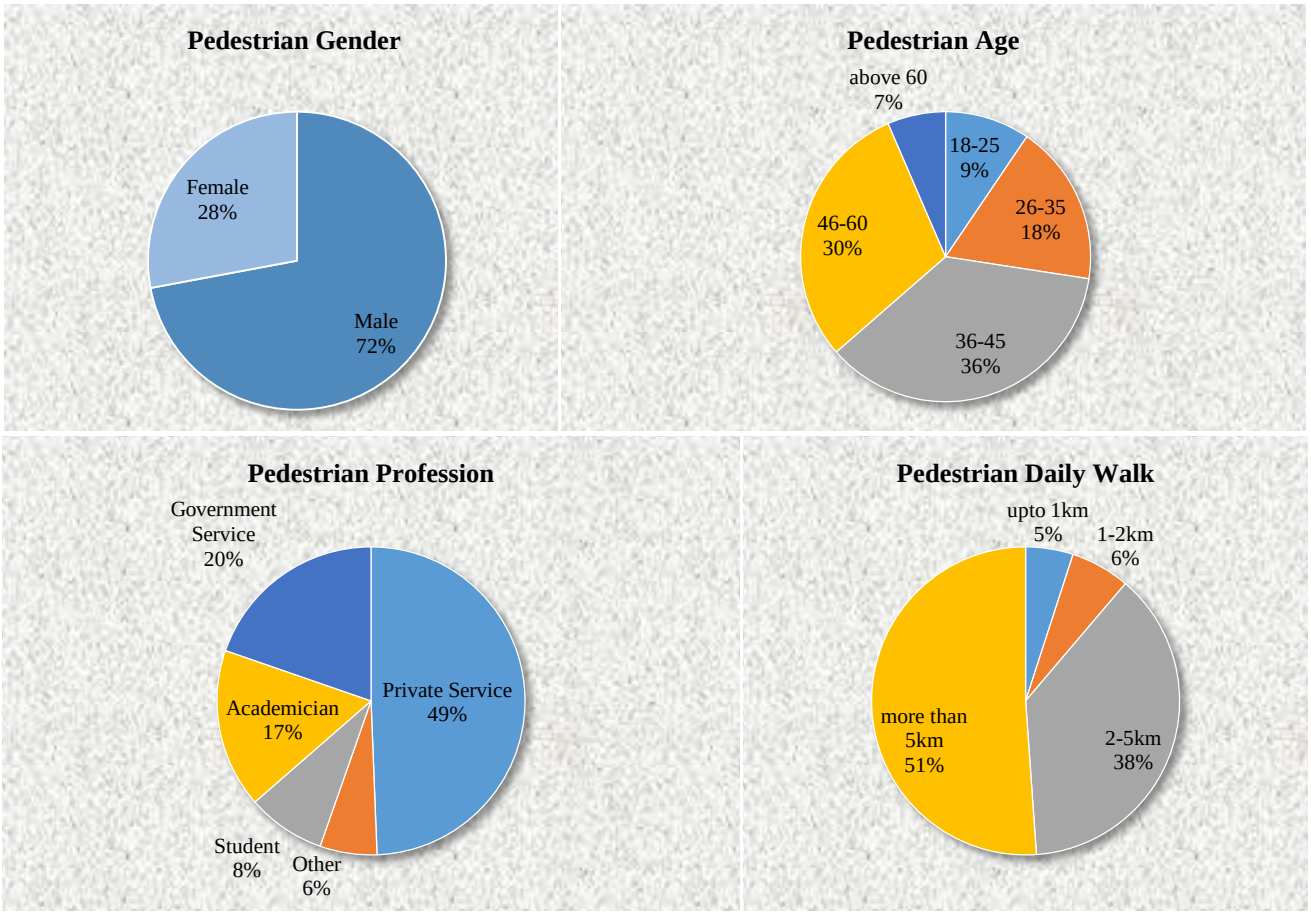

Fig.3: Key attributes of the surveyed pedestrians

Table 1 - Distribution of items administered to pedestrian

Aspects Evaluated	Description	No. of Items	Degree of scale
Safety of Pedestrian	Assessment of safety aspects	3	Grade from 1 "very strongly disagree" to 6 "very strongly agree"
Low Noise Level	Assessment of the effect of low noise level	3	
Need for Improvement	To identify the critical characteristics for control	2	
Evaluation of the Electric Vehicle	To identify crushes, incidents and overall assessment	5	Yes or No
	Total	13	

4. Results and Discussion

4.1 Pedestrian Insight on the Level of Risk

Anonymous extensive questionnaire surveys are able to assemble reliable information about risk perception and safety among the pedestrians of this analysis. The present study was an attempt to assess the risk associated with the use of electric vehicles from pedestrian perspectives. As our research tends to focus on the key concept of safety for human beings especially for pedestrians, the expansion of the concept of risk perception permitted us to study pedestrian's outlook in more detail. In our study, the majority of participants agreed with the term of moderate risk associated with the use of electric vehicles for the state of affairs that could be generated by the low noise or noiseless operations of EVs. Since the presence of EVs is difficult to identify, the unintentional incidence may take place while walking on the road. In Table 2, the results of the interviewed responses of the pedestrians/road users have been collected according to low noise level, comfort, time, and safety of the pedestrian. Our results are nearly in line with the previous researcher's study, however, some new recommendations regarding the unique noiseless characteristics were identified such as the necessity of smart control of a vehicle to avoid accidents/any incidence, new tracking system of EVs to accommodate any emergency service, smart indicators in traffic to recognize the existence of EVs. Almost more than 50% of pedestrians have had a regular walk of more than 5km in a day; consequently, safety is the foremost importance for good human health.

Table 2. The Pedestrian's Perception related to Low Noise Level, Comfort, Time and Safety of Pedestrian

Aspects	Pedestrian's response based on following questions	Percentage of agreement	Mean	SD
A) Safety	1) Additional attention is required if electric vehicle passing close by you?	86	4.74	1.41
	2) The noiseless drive of electric vehicle causes the mishaps possibilities?	60	3.62	1.50
	3) I think, low noise of vehicle is the significant root for heavy traffic in metropolitan area.	52	3.34	1.65
B) Low Noise Level	4) Electric vehicle is tricky for walkers to hear?	81	4.64	1.48
	5) Noiseless operation of electric vehicle is potentially risky?	63	3.92	1.57
	6) A silence nature of EVs is accommodating the noise pollution level.	78	4.68	1.56
C) Need	7) Improvement of key components in regard to advanced vehicle control framework will be useful to control accident related cases and improves safety to road users.	63	3.87	1.73
	8) Electric vehicle require additional anonymous sound to introduce its identity?	74	4.21	1.53

Low noise emission could be new unique characteristics of EVs. It has been focused here with the intention of examining the perception of road users from heavy traffic zone at MMR. The result shows that around 86% of road users highlight the need for extra attention when EV passes nearby from them. Moreover, the majority of respondents pointed out the potential risk of EVs in terms of noiseless operations. Many respondents (60% altogether) do not deny that any possibility of a mishap, specifically, 52% of respondents proposed that low noise could be a reason for heavy traffic in the city and 81% of respondents thought EVs are trickier to identify their presence accordingly. Consequently, the role of additional anonymous sound (sound indicator) to introduce its identity was emphasized by most respondents (74%). Some (253) respondents even noted the requirement of a smart/intelligent control system for EVs by recognizing any unfortunate situations to avoid any mishap. Further, the perception of pedestrian is shown in figure 4.

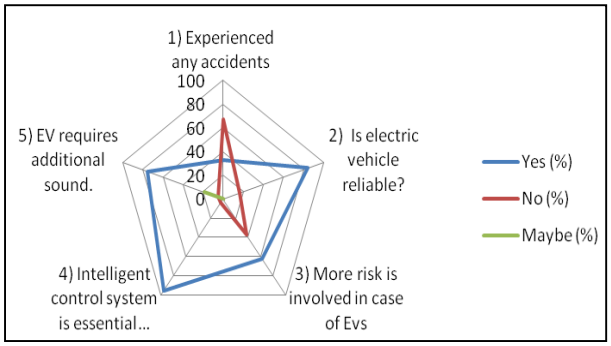

Fig.4: Pedestrian's perception based on their experience

In relation to recent research conducted for driver's perceptions by Pardo-Ferreira et al. (2020), our pedestrians perceived that their attention to compensate for the special effects of the low noise of the EVs is somewhat higher[24]. In line with this, they revealed that their safety concern is greater and thereby remarkable addition of worry and concerns for pedestrians/road users. Similarly, driver's perception was also studied in Germany and results indicate the increase in safety with great driving experience[25]. The results also showed that nominal/severe accidents may cause injury to pedestrians and thereafter it leads to temporary or permanent disability; thereby it is a foremost important condition for road users to identify the presence of electric vehicles while walking on the road. There is a near connection between mental workload and driving efficiency thereby affects the driving performance[26]. By this means, Although EVs could save fossil fuel[27] and free from pollution which is essential for green paradox[28], the risk of accidents cannot be neglected which is strongly associated to human health[29].

4.2 Evaluation of Hypotheses

To assess the significance of age group, gender and distance traveled; the authors have extended the study with a nonparametric test like the chi-square test to compare whether the perceived risk due to the low noise of EVs differed with age group, gender, and distance of traveled by pedestrians. The results show that perceived risk does not differ with gender of pedestrian C-measured=0.8783, C-critical=3.84 at 0.05 level of significance. The perceived risk is not significant with distance of travel by pedestrians C-measured=1.3664, C-critical=7.815at 0.05 level of significance. Also there is no relation among age group of pedestrians in terms of perceived risk associated to quiet nature of electric vehicles C-measured=1.5344, C-critical=9.488 at 0.05 level of significance. Table 3 shows the detailed evaluation of potential risk associated to EV based on pedestrian's perception. It recommends strategic city development[30, 31] for safety.

Table3. Evaluation of potential risk associated to EV based on Pedestrian's perception

Aspects	**Group**	**Yes (risk agreement)**	**No (risk not agreement)**	**Total**	**Chi-Square Value**
		Observed frequency (Expected frequency)	Observed frequency (Expected frequency)		
A) Pedestrian Gender	Male	75 (70.94)	37 (41.06)	112	0.8783
	Female	179 (183.06)	110 (105.94)	289	
B) Distance travelled by pedestrians	Upto 1km	15 (12.67)	5 (7.33)	20	1.3664
	1-2km	15 (15.83)	10 (9.16)	25	
	2-5km	96 (95.64)	55 (55.35)	151	
	Above 5km	128 (129.85)	77 (75.15)	205	
C) Pedestrian Age group	18-25	25 (24.07)	13 (13.93)	38	1.5344
	26-35	46 (45.60)	26 (26.39)	72	
	36-45	94 (91.84)	51 (53.15)	145	
	46-60	71 (76.01)	49 (43.99)	120	
	Above 60 years	18 (16.47)	8 (9.53)	26	

The comparative evaluation of perceived risk based on perceptions of pedestrian gender is shown in figure 5. It was observed that the perceived risk is much more in case of female road users than male. Furthermore, to realize the perceived risk agreement based on age of road users, the response obtained from survey based on age of pedestrian are shown in figure 6. Finally, authors considered distance walked by them in order to investigate the possibility of perceived risk based on distance of walk as shown in figure 7.

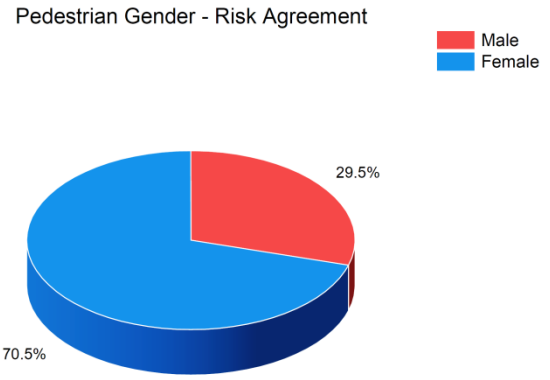

Fig.5: Pedestrian's Perception based on their gender

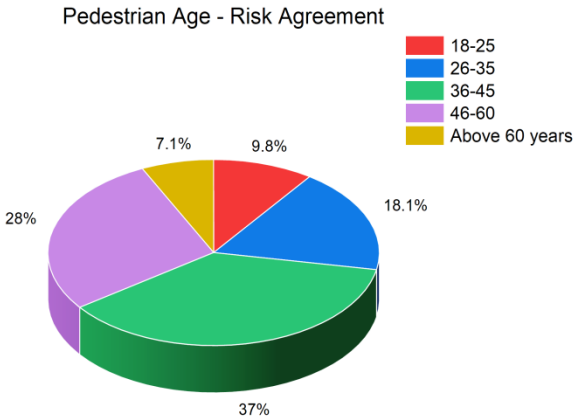

Fig.6: Pedestrian's Perception based on their age

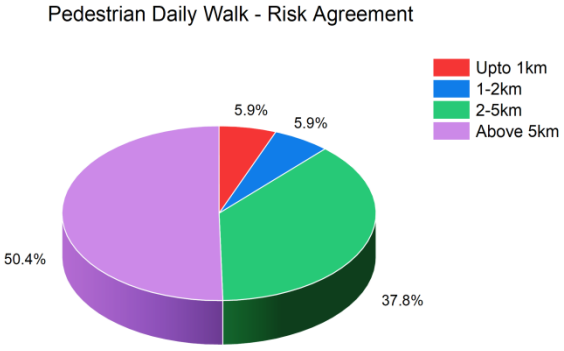

Fig.7: Pedestrian's Perception based on their daily walk

4.3 ANOVA Results

Analysis of variance (ANOVA) is a combination of statistical models used to evaluate the discrepancies between two or more independent variables and their associated measures. The importance of F-value would be to reveal each factor's contribution to the response variable. Besides, the P-value is a probability which elaborates the confirmation to reject the null. The variance study (ANOVA) was undertaken to assess the gender effect of pedestrians, age groups, and distances travelled by them. The detailed results obtained from comprehensive study are as shown in table 4.

Table 4. Evaluation of potential risk based on ANOVA results

Factor	F	P-value	F crit
Gender	0.067339	0.795385	3.864870
Distance	1.437533	0.231347	2.627384
Age	0.428272	0.788227	2.394476

4.4 Discussion

New special features of EVs may be low noise emission. It was evaluated here in order to determine the view of road users as they experience every day in actual circumstances. Overall, the findings of this analysis are consistent with prior investigations [14, 24, 25]. Although the results obtained in our study is somewhat similar to previous, there were some perception differences among pedestrians. These changes can be attributed to our sample's diverse characteristics, such as different areas of study, behavioral context, larger sample size, and fear/reluctance to express true feelings.

The results obtained from both studies shows the good similarity among findings related to perceived risk of pedestrians. The findings of the chi-square test reveal that pedestrians' perceptions of perceived risk are unaffected by their gender(C-measured=0.8783, C-critical=3.84 at 0.05 level of significance). In this regards, we adopted ANOVA technique to validate the results and it shows the same interpretations in context of perceived risk (F=0.067339<Fcrit). As the F measured value from gender analysis is less than F critical, it would be evidence for non significant nature of factors which were selected for study. At the same time C-measured value is less than C-critical which shows that there is no significant difference between age of genders for perceived risk associated to quiet nature of electric vehicles. Moving towards second objective, we elaborate our findings with ANOVA and Chi-square method approach considering distance of walk. The perceived risk of silent EVs is really not diverse from the distance travelled by road users (F=1.437533<Fcrit and C-measured=1.5344, C-critical=9.488 at 0.05 level of significance). Finally, no evidence was recorded for perceived risk associated with quiet running nature of electric vehicles

considering the different age group of pedestrians (F=1.437533<F-measured, and C-measured=1.5344, C-critical=9.488). The implications of these results for traffic control, road safety, and public health are important.

Kendrick (1993) focused on prevention of pedestrian accidents considering age factor 0-11 years in 573 children accidents cases[14], thereby to examine the important factors relevant to age group, and we looked at the views of people of various ages. Since our research involved pedestrians over the age of 18, there was no discernible gap in risk among the categories. The walking time is also considerable factor for various fatal. Since darkness is closely associated with negative emotions, adequate streetlights are essential for promoting sense of contentment[11]. To further explore the impact of distances walking by pedestrians, our study has been expanded with daily distance walked by people. Although, the strong evidence related to distance covered by pedestrian walk was not identified in context of perceived risk due to silent nature of electric vehicles, many participants express their views with possibility of increment in perceived risk with distance. The numerous findings from previous research adhere with the safety concerns in regards to noiseless operations of electric vehicle[7, 24, 25]. Thereby, the results of our study may thus be appropriate, particularly in view of the Asian zone.

In compliance with Sandberg et al. (2010), authors contend that applying artificial noise to EVs can only be seen as one of the many possible safety steps that could be used to solve the problem of quiet cars[32], however, the research related to intelligent control of electric vehicle could enhance the safety for road users. We hope that extending our emphasis to include a range of possible safety solutions would help electric vehicles achieve their maximum potential. As one of the most important sources of noise emissions in urban areas is road transportation[20], the electric vehicles would be the best alternate to reduce noise emissions if certain safety solution is introduced in EVs.

The outcomes of this study may contribute to substantial implementations of urban architecture and planning, but respondents would be highly likely to be affected by their personal knowledge and background experience of the location. To investigate safety expectations in context of electric vehicles and developed environments in the future, various models can be used, such as qualitative techniques or preference modeling approaches.

5. Conclusion

This study was a bit of a beginning effort to assess the risk involved in electric vehicles with their noiseless characteristics. This work was challenging since it was the first of its sort; studies on accidents related to electric vehicles, especially in India, are rare. Consequently, it was very difficult to analyze the consequences of this study to those of different investigations, despite the fact that this could fill in as a benchmark and open up roads for additional exploration in this field.

This investigation had three goals to achieve and through the extensive questionnaire survey analysis, we accomplished the destinations one by one. This study investigated the risk associated with the quiet nature of electric vehicle by road users in the Mumbai Metropolitan Region of India. It was found that there is no significant difference in risk between male and female pedestrians, however; the moderate risk is associated due to the noiseless nature of EVs. Secondly, the level of risk for quiet EVs is not associated with the distance traveled by pedestrians whereas additional attention is compulsory while walking on the road subjected to traffic with electric vehicles. Similarly, the risk for quiet EVs is not associated with the age group of pedestrians; however old pedestrians who have low vision/blindness are in much trouble.

Moreover, additional training should be provided to EV drivers to avoid any future incidences as the pedestrians are in trouble to hear the presence of EV on road. This will not only help to reduce accidence/ incidence but also improve the confidence of drivers for safe travel. As noted, the pedestrian did not consider this risk as much seriously; global health safety could not be improved without it. Since most of the participants (63%) reported the need for a smart control system for upcoming EVs; it will boost the safety and more popularity of EVs across the globe. Therefore, the current study may contribute to recognizing the hidden challenges for upcoming EVs as well as helps to minimize the accidents trends. To improve human health and safety in the country, the novel intelligent system should be incorporated with every electric vehicle to enhance pedestrian safety. Last but not least, this research will help to define an attractive safety policy for electric vehicles with safety and comfort for society.

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