ANALYSIS OF RISK BEHAVIOUR OF A BRAZILIAN DRIVERS SAMPLE

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ABSTRACT

The objective of this paper was to conduct a survey, using a questionnaire, about the Brazilian driver risky behavior and analyze it. This questionnaire was implemented in October 2009 and achieved 192 drivers of different age groups. It contains questions of open and closed types, with the use of semantic scale, arranged to better meet the research needs. The questionnaire is divided into five parts. The first refers to the driver identification (gender, age, time of driver license, education level, and city). The second part was asked which of the behaviors listed in item the answerer practices while driving. In third part was asked to carry out a pair wise comparison between risky behaviors while driving, indicating which would be more risky (talking on the phone, talking on the phone with voice mail, looking at advertisements and billboards, operating the stereo, sending and reading text messages, and talking with passengers in the car). In the fourth part the driver responds to questions that characterize aggressive or risky attitudes in traffic (traffic tickets received in the last two years, traffic accidents involvement, seat belts use, alcohol and driving, speed limit respect, travelled distance, number of hours spent driving, the importance of cellular phone and attitudes when receiving text messages while driving). The fifth part consists in risk attitudes ordinance (drunk driving, driving talking on the phone, driving reading or receiving text messages). The results show consistence with official statistics, which was made by the respondent' stratification by gender and later comparison of accidents, risk behavior and exposure level. That indicates that using this kind of survey could be a tool to draw measures and took decisions by police makers in road safety.

Keywords: driver behavior, risk, questionnaire

1. INTRODUCTION

According to data provided by OEI(2007), ABRAMET(2007), and DENATRAN (2005), the accident general numbers in Brazil for the year of 2005 are: 36,000 fatalities, 515,000 injured people (about 1/5 with permanent disabilities), 385,000 accidents with injuries (82% in urban areas and 18% in the highways), 1 million of accidents, 208 accidents with injuries per 100,000 inhabitants, 91 accidents with injuries per 10,000 vehicles, 279 victims per 100,000 inhabitants, 122 victims per 10,000 vehicles, 19 deaths per 100,000 inhabitants, and 85 deaths per 10,000 vehicles. Traffic accidents occupied the 7th position among the ten main death causes in 2004, with a rate of 19.6 deaths per 100,000 inhabitants. Considering the male population, the road traffic accidents occupied the 4th place (32.4 deaths per 100,000 inhabitants).

The literature describes that the human factor, singly, is responsible for 65% of the accidents and, in interaction with factors related to environment and vehicle, human factor is responsible for 95% of occurrences. Many authors discuss the difficulty of changing behavior based on the premise that it is the human beings nature to commit mistakes. For this reason, the environment and the vehicle should be designed so that on the occurrence of errors, its consequences were minimized (Ogden, 1996).

Other behavioral theories suggest that humans tend to adapt their behavior to risky situations. This is, when the subjective perception of risk is increased the individual would have a more secure behavior; when perception is impaired, individuals would have a more aggressive and unsafe behavior. Therefore, some scholars point out that improvements in road and vehicle conditions induce individuals to have more unsafe behaviors. In this sense, only measures (continuous and permanent) that increase the subjective risky perception would have long-term impact on the accidents number reduction (Wilde, 1994).

However, to find out which measures should be taken into consideration, in order to increase this perception, individuals risky behavior knowledge is necessary. Official statistics do not always have data that can provide such a measurement, roughly, only allows the risky groups stratification by age, gender and transportation mode. Thus, the investigation of such attitudes, which may lead to an accident, is extremely difficult. Nevertheless, questionnaire studies are one of the most common instruments to investigate behavioral aspects (Evans, 2004).

Besides the driving task for itself, the driver has to deal with an increasing variety of in-vehicle tasks. Due to technological advance, many electronic devices are being incorporated to the automobiles internal environment. Although these devices produce an obvious interference on the driving performance, their effects on safety are not well known yet. Moreover, drivers seem not to be conscious about the influence of in-vehicle distracting actions on their risk. Horrey and Lesch (2007) suggest that drivers did not strategically adapt their performance of in-vehicle tasks based on their knowledge of the roadway. Jointly, there was no systematic tendency for drivers to target the areas of reduced demands in their decisions to initiate in-vehicle activities. Similarly, the same drivers elected to distract

themselves after starting their trip, rather than use the opportunity to perform the activities before the trip beginning.

Based on this, the objective of this paper is to describe the results of a survey about the Brazilian driver risky behavior and analyze it by means of a questionnaire. It contains questions of opened and closed types, with the use of semantic scale, arranged to better meet the research needs. The motivation for this research is grounded on the lack of information about the Brazilian driver behavior. At this stage the research is local, but based on this preliminary result, a broader researcher will be made, encompassing all regions of Brazil.

A secondary objective is have an overview about driver behavior related to the use of cell phone while driving, included send and text messaging. In Brazil accordingly to ANATEL (2009) have around 152 million of cell phones, what reach almost 80% of the population.

2. METHOD

2.1 Scenery

The method consisted in applying a questionnaire directed to Brazilian driver behavior. A total number of 192 questionnaires were applied in the city of Bauru for undergraduate students and some other people involved with the academic community. Most of the respondents were from the cities of Bauru (39.8%), Botucatu (30.1%) and Dois Córregos (13.4%), located according to Figure 1.

Figure 1 – São Paulo and the respondent`s cities location

Table 1 contains some characteristics of the mentioned cities: population, fleet, traffic fatalities and GDP *per capita*.

Table 1 – Respondents` cities characteristics

City	Population	Vehicle Fleet	Traffic fatalities (2007)***	GDP *per capita*

	(2009)*	(2009)**	Men	Women	*(2007)**
Bauru	359,429	185,717	46	15	R$ 15,233
Botucatu	130,348	62,912	16	8	R$ 19,054
Dois Córregos	26,040	10,591	2	0	R$ 13,343

*IBGE – Instituto Brasileiro de Geografia e Estatística (R$ = Brazilian Reais)

**DENATRAN – Departamento Nacional de Trânsito

***Ministério da Saúde – DATASUS

2.2 Questionnaire structure and content

The questionnaire is divided into five parts. The first refers to the driver identification (gender, age, time of driver license, education level, and city). The second (part A) is related to attitudes that drivers commonly do in traffic and it was put prior to the part B, just to know their attitudes before asking them, in the third (part B), to carry out a pairwise comparison between risky behaviors while driving indicating which would be more at risk. These risk behavior, were select by 5 specialist in road safety, namely are: talking on hand-held cell phone, talking on hands free cell phone, looking at advertisements and billboards, operating the stereo, sending and reading text messages, and talking with passengers in the car. In the fourth (part C) the driver responds to questions that characterize aggressive or risky attitudes in traffic (fines received in the last two years, traffic accidents involvement, seat belts usage, alcohol and driving, speed limit respect, travelled distance, number of hours spent driving, the importance of cellular phone and attitudes when receiving text messages while driving). The fifth (part D) consists in risky attitudes ordinance (drunk driving, driving talking on the phone, driving sending or reading text messages). It should be noted that the questionnaire contains questions with the function of checking its internal consistency, in order to increase the reliability of the collected information. The questionnaire is shown in Figures 2 and 3.

Two tests were performed before the real survey. The first to identify missing questions, lack of alternatives to chose, and potential mistakes. The other consisted in a simplified pairwise comparison (with three items) performed twice, with the same individuals, to verify if the ordination would keep the same after some period of time (one week) and if the order of the item influences the results. In other words, it was test if the order of the item randomly set, have influence in the way that people answered to the questionnaire. The ordination was the same in both occasions and the resultant scale factors were very similar. This give us an indication that the order of the item randomly set did not make significant change in the way that responded will answer.

The method of pairwise comparison is used in the scientific study of preferences, attitudes, voting systems, social choice, public choice. The pairwise comparison generally refers to any process of comparing entities in pairs to judge which of each pair is preferred, or has a greater amount of some quantitative property. The pairwise comparasion was made using the methodology from Saaty (1999).

Escola de Engenharia de São Carlos

Traffic Behavior Survey

Age: _____ **Gender:** **F** ☐ **M** ☐

Driver license time: _____

City: _____

Educational level: E.S. ☐ H.S. ☐ C.I. ☐ C.C. ☐

E.S.= Elementary School H.M.= High School C.I= College Incomplete C.C.= College Complete

Instructions:
Please, answer the following questions according to the statement directions and mark the answer that is closest to your reality.
There is not right ou wrong answer!

Part A) Mark which of these behavior do you perform while driving:

1)	Listenning to music	☐	6)	Reading text messages	☐
2)	Looking at pedestrians	☐	7)	Sending text messages	☐
3)	Talking to car passengers	☐	8)	Operating the stereo	☐
4)	Talking in hands-free cell phone	☐	9)	Talking in handheld cell phone	☐
5)	Looking at advertisements/billboards	☐	10)	Drinking beverages (of any type)	☐

Part B) Mark, in the pairwise comparison, which option, in your opinion, presents the higher risk if performed while driving:

1)	Operating the stereo	☐	12)	Talking in hands-free cell phone	☐
	Sending text messages	☐		Reading text messages	☐
2)	Talking in handheld cell phone	☐	13)	Operating the stereo	☐
	Operating the stereo	☐		Talking to car passengers	☐
3)	Talking to car passengers	☐	14)	Talking in handheld cell phone	☐
	Sending text messages	☐		Sending text messages	☐
4)	Talking in handheld cell phone	☐	15)	Operating the stereo	☐
	Talking to car passengers	☐		Reading text messages	☐
5)	Reading text messages	☐	16)	Looking at advertisements/billboards	☐
	Sending text messages	☐		Sending text messages	☐
6)	Talking in handheld cell phone	☐	17)	Talking in handheld cell phone	☐
	Reading text messages	☐		Talking in hands-free cell phone	☐
7)	Talking in hands-free cell phone	☐	18)	Looking at advertisements/billboards	☐
	Looking at advertisements/billboards	☐		Reading text messages	☐
8)	Looking at advertisements/billboards	☐	19)	Talking in hands-free cell phone	☐
	Talking to car passengers	☐		Talking to car passengers	☐
9)	Talking in hands-free cell phone	☐	20)	Talking to car passengers	☐
	Sending text messages	☐		Reading text messages	☐
10)	Operating the stereo	☐	21)	Talking in handheld cell phone	☐
	Looking at advertisements/billboards	☐		Looking at advertisements/billboards	☐
11)	Talking in hands-free cell phone	☐			
	Operating the stereo	☐			

Part C) Answer the questions bellow:

1) Did you envolve yourself in some traffic accident (as the driver)?
Not ☐ Yes ☐ If yes, how many? ☐

2) Did you receive a fine in the last two years?
Not ☐ Yes ☐ If yes, how many? ☐

3) Do you wear the seat belt?
Always ☐ Occasionally ☐ Rarely ☐ Never ☐

4) Do you demand that the rear seat passengers use the seat belt?
Not ☐ Yes ☐

5) Do you drive after drinking alcohol?
Frequently ☐ Occasionally ☐ Rarely ☐ Never ☐

Continue on the other side

Figure 2– Page 1 of the questionnaire

6) Do you drive over the speed limit?
Frequently ☐ Occasionally ☐ Rarely ☐ Never ☐

7) Daily, how many kilometers do you drive (in average)?

8) How many kilometers do you drive per year?

9) How much time do you spend driving in a typicall day?

10) For you, the cell phone is:
Essential ☐ Important ☐ Few importante ☐ I don`t use* ☐
* If you don`t use a cell phone, do not answer questions 11 and 12.

11) When receiving a text message while driving, do you:
☐ Read and answer immediately
☐ Only read and answer later
☐ Stop the vehicle to read

12) In which of these situations would you fell safer sending a text message?
☐ Slow traffic
☐ Normal traffic
☐ In a highway
☐ None

13) Do you consider yourself a/an:
☐ Very bad driver
☐ Bad driver
☐ Average driver
☐ Good driver
☐ Very good driver

14) Mark the frequency that you drive weekly:
Everyday ☐ 2-3 days ☐ 1 day ☐ Less than a day ☐

Part D) Ordinate the following attitudes according to the risk, being the first with higler risk and the last with smaller risk, in your opinion:

1) Drinking and driving ☐
2) Driving while talking on the cell phone ☐
3) Driving while reading text messages ☐
4) Driving while sending text messages ☐
5) Driving over speed ☐

Thank you very much for your contribution!

Figure 3 – Page 2 of the questionnaire

3. RESULTS AND DATA ANALYSIS

The respondents' average age was 27 years old; they have about 8 years of driver license, with no significant differences by gender; and 89 were woman and 103 were man. Most of them are undergraduate students (64%).

In accordance with the expected, some attitudes are extremely common among Brazilians while they are driving. It includes talking to car passengers, listening to music, observing pedestrians, operating the stereo, and looking at publicity. Regarding to attitudes accordingly with specialist with more risk while driving, almost a half of the drivers said that they talk on the cell phone; 29% said they use to drink alcoholically or not alcoholically beverages; 18% read text messages; and 11% also use to send it. As we have seen, the cell phone became a popular device and its use during the driving task is habitual. This result is shown in Figure 3.

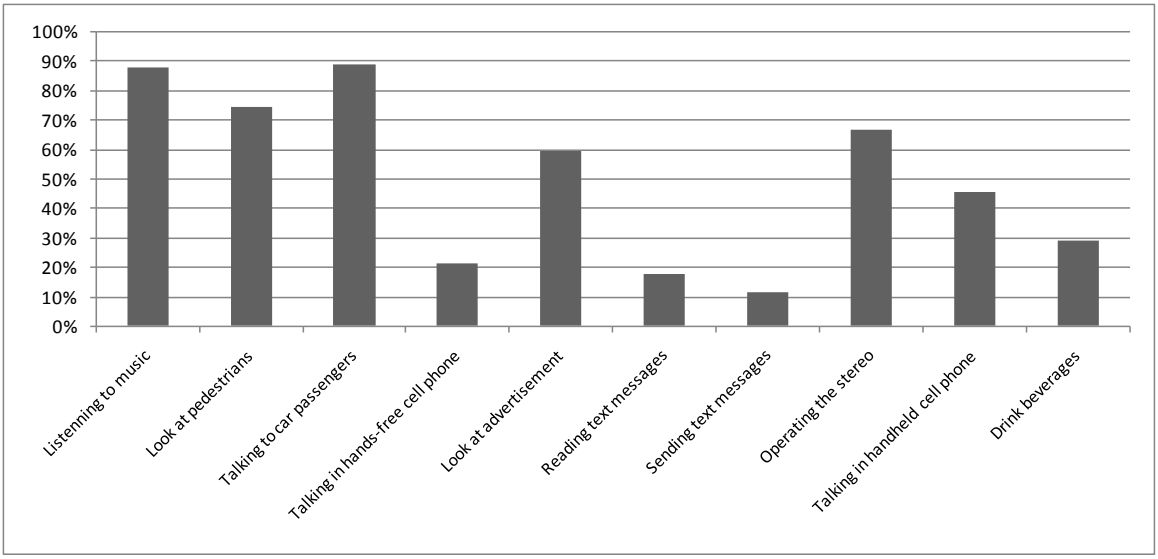

Figure 3. Percentage of behaviour practiced while driving.

Some behaviours should coop to infer the safety culture level of a group. Included on that is the involvement in traffic accidents, the number of fines, the usage of seat belt, the alcohol consumption, and the speed limit obedience. To know these behaviours is important, because it should help to draw measures to raise awareness about these risk attitudes while driving. Figure 4 shows the average percentage of alcohol consumption for general sample, men and women. Figure 5 shows the average percentage of speeding for general sample, men and women. Considering the seat belt wearing, there is no significant difference between male and female behavior. Figure 6 shows the average percentage for seat belt usage, general sample, men and women. Figure 7 shows the importance of cell phone for general sample, men and women.

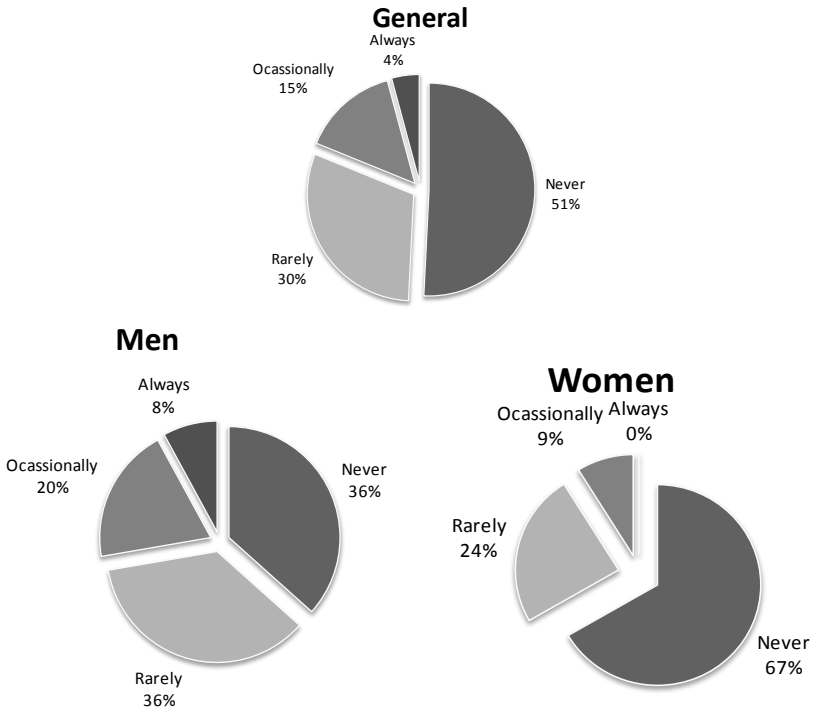

Figure 4 – Average general, men and women drinking and driving behaviour.

Conversely, women tend to be more prudent on the alcohol consumption issue, while only 36% of men said that never drink and drive, around 67% of women said the same. Also 8% of the men said that they always drinking and driving against 0% of the women.

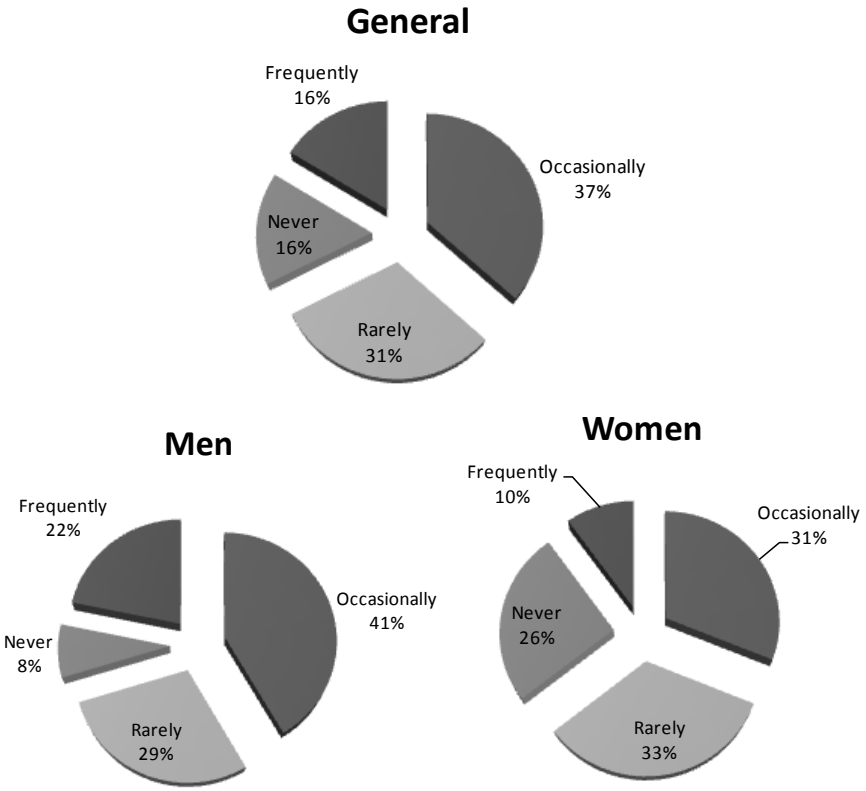

Figure 5 – Average general, men and women speeding behavior.

Furthermore, speeding is more recurrent for men; whereas 61% of women never or rarely drive over the speed limit, against 37% of men; and 23% of men always drive over the speed limit against 10% of the women. However, the research did not ask how much the over speed the limit

These two behaviors drinking and driving and speeding are more frequent in men what appear in the Brazilian official statistics of death in traffic, men correspond to 82 % of deaths and traffic accident is the fourth main cause of death and the second cause of violent death, loose only by homicides. For women they are 18% of the deaths in traffic, and this cause of death does not figure in the top ten causes of death for women, MS (2009). In the cities analyzed the 26% of deaths are women and 74% are men, which is roughly close to the national figures.

Thus, the preliminary result of this questionnaire appears to be consistent with the measure behavior and profile of road risk in traffic by women and men. However, it is only an indication and do not represent cause and consequence, for do that more accurate exam must be done.

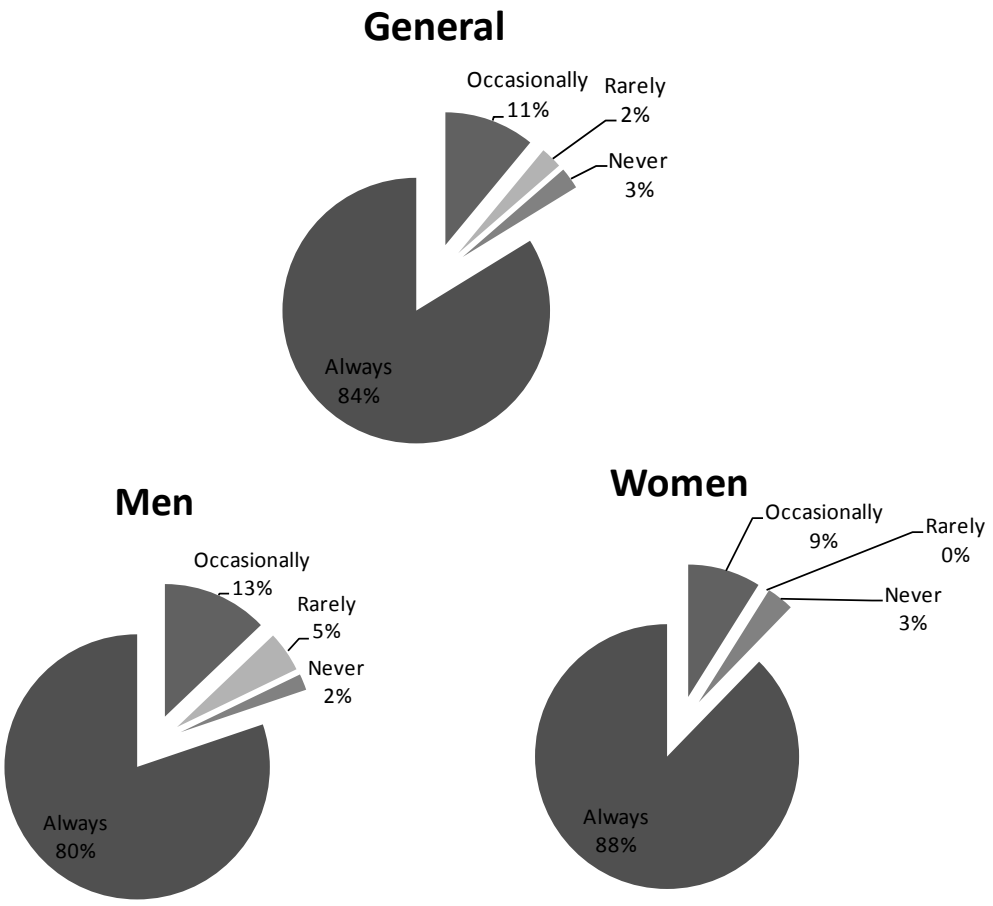

Figure 6 – Average general, men and women seat belt behavior.

In Figure 6 we have almost the same figures for men and women. Although women wear 88% of the time the seat belt against 80% of the men; and women that never wear seat belt were 3% against 2% of the men. It also asked to the respondent if they demand the passenger cars to wear the seat belt. Only 23 respondents said that demand the use of seat belt by passengers, it was 12%. And 14 were women, 61% of those respondents. Those figures demonstrate that campaigns and enforcement of seat belt use among drivers is making progress, but the campaigns should now be focus in the use of seat belt among passengers in the cars. Some respondents did know that is mandatory the use of seat belt in passengers inside the vehicle and the risks.

The Figure 7 shows the importance of cell phone in daily life. For 41% of men the cell phone is essential against 33% for women, and 37% for general sample. For 5% of women does not use cell phone at all, against 1% of the men, and 3% of general. The other figures are quite similar for both genders. Crossing information for those who said that use cell phone while drive, for the majority of them 56% the cell phone is essential against 48% in general sample, and for 95% of them the cell phone is important and essential against 85% in general sample. It is an indication that for those who use cell phone while driving the cell

phone has a greater importance. This could be a start point to thinking about campaigns to raise awareness for this kind of risk behavior while drive.

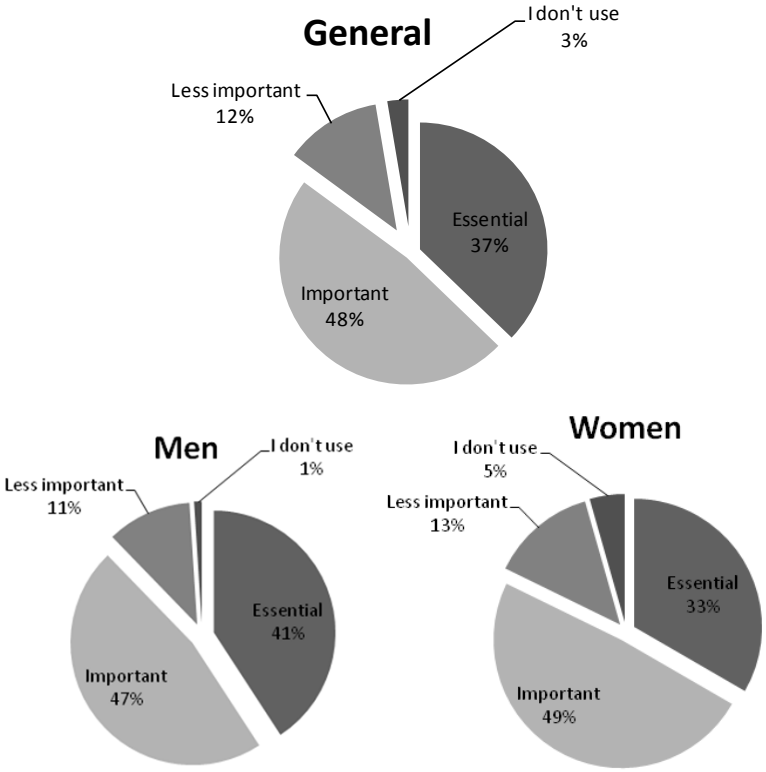

Figure 7 – Average general, men and women cell phone importance.

Questions about exposition level (travelled distance) were included in the questionnaire. This information was obtained by two different approaches. One consisted in asking directly to the respondent how many kilometers he/she uses to travel per year. The other consisted in calculating the same information through answers about daily travelled distance and frequency of days that the individual drives per week. Both data were compared and the values that differed more than 5,000km (to more or less) were excluded from the analysis.

Obviously, incomplete data were also eliminated. For this reason, from 192 questionnaires applied, only the information from 80 could be used for estimating the travelled distance. Figure8 shows the deviation values of the comparison between the two data sources mentioned.

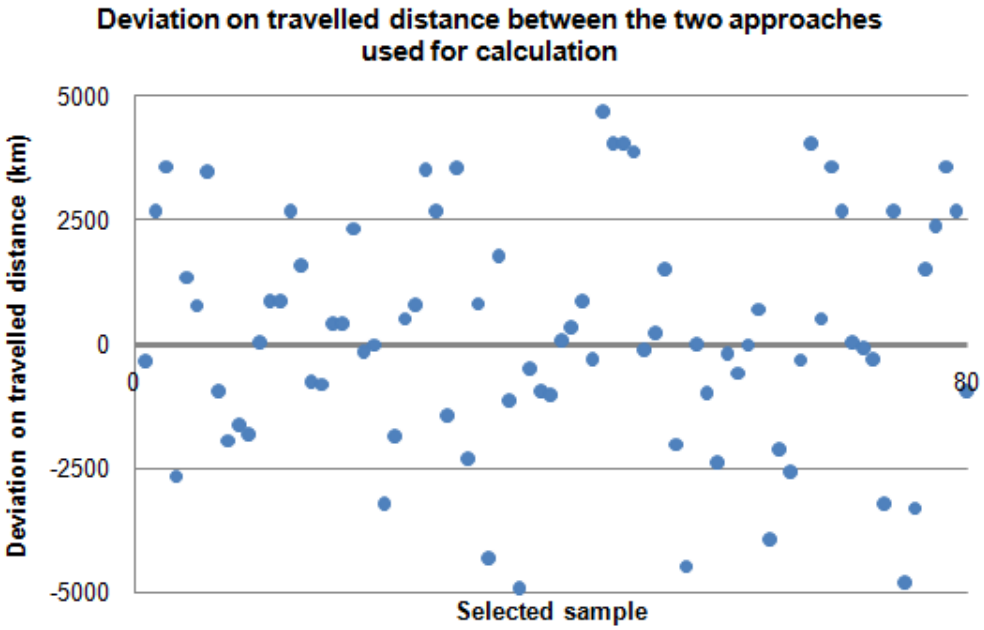

Figure 8 – Deviation values of the comparison between the two data sources mentioned

An average travelled distance value was used to calculate the indexes. In Figure 9 one can observe the travelled distance for the general sample and for both genders. As expected, men are more exposed to risk, 13% in relation to the total selected sample and almost 40% in relation to women. It's important to say that daily and annual distances were collected with the purpose of verifying the answer's consistence.

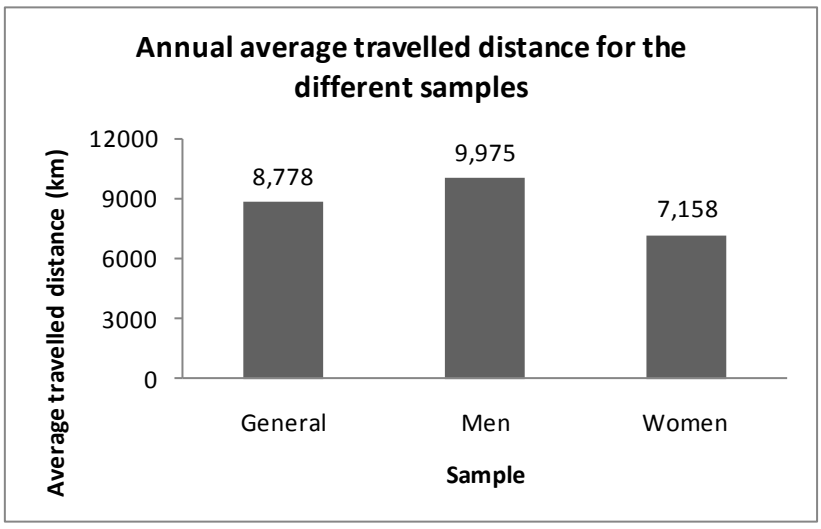

Figure 9 – Annual average travelled distances

Other exposition factor, the daily travelled time, is shown in Figure 10. These data also confirm the fact of men being more exposed to the risk in comparison to women, with an exposition 76% higher considering the time travelled. Also the average daily travelled time is higher to men than to women in 76%, as show in Figure 10. That is men drive more and stay more time in traffic than women.

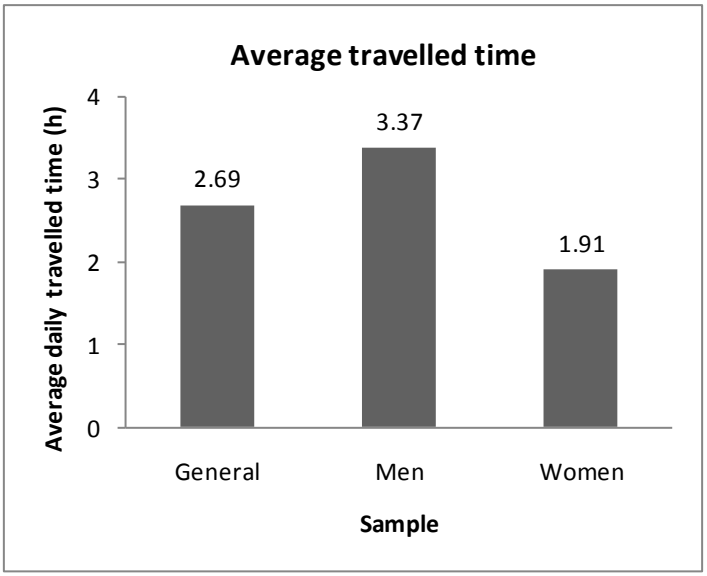

Figure 10 – Average daily travelled time (h)

Female's more cautious conduct is also expressed by the smaller accidents and fines rate. Even though the exposition to risky of men is higher than the one for women, the accidents and fines frequency for the first is also higher. Figure 11 exhibits the accident and fine rates taking into account the distance travelled (in billion kilometers) by the two genders since they are licensed drivers. As can be observed, accidents rate for men is 26.4 times higher and fines rate 50% higher than women's. It is also interesting to notice that the relation accidents/fine to women is 0.13 and for men is 23.4. It should be of interest in future studies to analysis more in depth this relation. What kind of infraction women are doing and why they have more fines than accidents by billion of kilometer travelled?

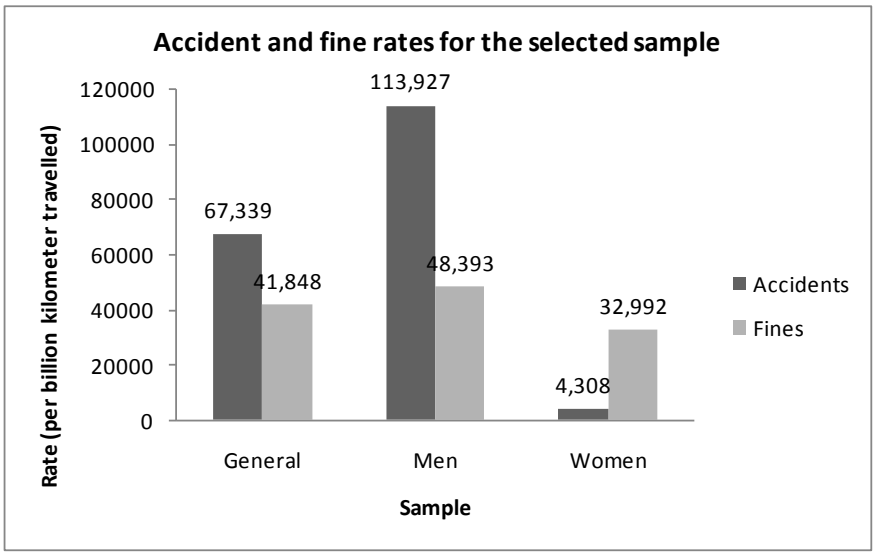

Figure 11 – Accident and fine rates (per 10^9km travelled) for the selected sample

The pairwise comparison performed at the third part of the questionnaire, in which seven risky behaviors have been compared, the resultant ranking is described in Table 2.

Table 2 – Pairwise comparison resultant ranking

Ordination	Risky behavior	Adjusted scale
1º	Sending text message	2.161
2º	Reading text messages	1.110
3º	Talking on the cell phone	0.414
4º	Looking at advertisings	-0.096
5º	Operating the stereo	-0.170
6º	Talking on the cell phone hands free	-0.568
7º	Talking with car passengers	-1.403

The resultant ordination seems to have some relation with the most common behaviors while driving at the country. In other words, drivers do not consider dangerous customary activities that they often use to perform. In agreement with this idea, texting while driving is not a widespread habit among Brazilians yet (although this practice is increasing), probably the reason for the first and second positions attributed, respectively, to sending and reading text messages. At the same time, other activities, as looking at advertisings, operating the stereo, talking in no-handled cellular phones, and talking with car passengers are undoubtedly very frequent actions for Brazilian drivers, that is because they were considered less dangerous.

In the fifth part Inquired people were asked to make other ordination. It was asked, to the respondents made an ordination of five risky behaviors, that they think it have more risk while driving, being the first the more risky. In their opinion, drinking and driving was placed first, followed by speeding, texting while driving (sending and reading, respectively), and talking on the cell phone. According to Table 3, drinking and driving was pointed as the most risky behavior, by 87% of the drivers. In second place, according to risk, is speeding, with the indication of almost 50% of the respondents. Sending and reading text messages are, respectively, in third and fourth place. In the last position, considered the less risky situation, is talking on the cell phone.

Table 3 – Ordination of risky activities while driving

Ordination	1º	2º	3º	4º	5º
Driving under alcohol influence	**87.6%**	6.5%	1.6%	1.1%	3.2%
Driving talking on the cell phone	1.6%	2.7%	8.6%	25.3%	**61.8%**
Driving reading text messages	0.0%	15.1%	20.4%	**48.4%**	16.1%
Driving sending text messages	6.5%	28.0%	**51.6%**	8.1%	5.9%
Speeding	4.3%	**47.8%**	17.7%	17.2%	12.9%

In the second semester of 2008 a new law establishes zero tolerance of alcohol while driving, and had an increase in governmental and media campaigns about the risk of drive under the influence of alcohol and also in the enforcement and distribution 10,000 breathalyzer to Road Police. This could explain that drinking under influence of alcohol appears in first place, and could be an indication of the influence of public campaigns in raise awareness in the population. However, with this figures is not possible assure that, because this kind of survey must be made before and after educational campaigns took place. But this

"indication" must be test in future works of this kind. Another question is if the campaigns raise the awareness should it also modified the risk behavior?

The questionnaire internal coherence was also tested, by separating drivers who had at least one accident and one fine during the last two years. In comparison to an average driver, these apparently more reckless drivers assumed a reckless behavior too. The following items summarize this finding for reckless drivers:

- Seat belt permanent use decreased 10.5%;
- Drivers ratio requiring the rear seat passenger to wear the seat belt declined 33.8%;
- The percentage of drivers who never or rarely drink and drive fell from 81% to 50%;
- The percentage of drivers who never or rarely exceed the speed limit reduced from 41% to 25%;
- When receiving a text message, the percentage of individuals who read and answer, immediately, doubled;
- The percentage of people who assumed to feel safer sending a text message in a highway is more than four times higher.

4. FINAL CONSIDERATIONS

The questionnaire was applied in regional scale and do not encompass the entire Brazilian population. The implication of this fact is that the results cannot be generalized to the overall population. However, the survey was a tentative to demonstrate the utility of this kind of survey in the field of road safety, a tool to be use to help decision and policy makers to draw measures and evaluated these measures. Furthermore, the results presented here could give indications about the profile of Brazilian driver behavior.

Also the results show coherence with official statistics about high risk behavior among men and their fatalities in traffic if we compare with women. As the average age of the respondents were around of 27 years old, further consideration over stratification of age behavior could not be addressed here.

In addition, the results indicates a different behavior between drivers that were classified as reckless driver (1 accident and 1 fine at least in the last two years) and regular drives. In order words, indicates that reckless driver have more risk behavior.

Some questions were raise in this paper could be a start point for future researches in this area. The authors would like to thank all people that make this research possible.

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