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Determinants of crashes in the context of a high-fatality road country: analysis of the role of human behavior and the role of urban factors in the case of Libya

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Abstract

Despite having only 54% of the world's vehicle fleet, low- and middle-income countries account for 93% of fatalities. The African continent suffers from a very high mortality rate from road accidents; 26.6 deaths per 100,000 inhabitants, i.e. almost three times more than in Europe. Investigating the case of Libya is very important, hence its statistics show the negative situation of road safety in the country. The aim of this paper is to assess the root causes of road crashes. Using a survey addressed to drivers, we have tried to investigate whether this risk and negative statistics are explained by driver's behavior or spatial factors of urban traffic accident and geomatric. The results show the existence of two groups of behavior; a first class assuming the important human role in road crashes, a second class highlights the importance of urban design regarding tremendous inefficiencies. In the absence of responsible behavior, urban design and regulatory system must ensure an environment that will limit accidents and reduce their root causes. In this sense the implementation of a systemic approach is very important in the case of Libya.

Keywords: Low-income country, road accident, behavior, urban design, discriminant analysis.

1. Introduction

The systemic approach of analysis proposed by Ladrière (1957) stipulates that a system is the result of a set of units in mutual interrelationships linked by a system of relations, in dynamic interaction, organized according to a goal, and constituting an organized global unit of interrelations between elements, actions or individuals. Road safety is an issue that must be analyzed through a systemic global approach that analyzes the interaction between human behavior and its environment towards a goal of safety, fluidity, and inclusion. Combining these factors requires the implementation of synergy factors between mobility objectives, safety, speed, and spatial analysis of urban environments. The worldwide road accident toll averages 3,700 fatalities each day, which shows the complexity of this problem in the face of ever-increasing mobility needs. Shredding the basic determinants of these accidents and analyzing their interaction are two important paths of research.

In this paper we analyze the case of a country with a high level of road injuries, our aim is to investigate whether this state is explained by driver's behavior or urban factors using a qualitative approach. For this end, a first part will present road accident causes in the case of low- and middle-income countries, a second part will investigate the context of Libya. Empirical approach and results are presented in the third part.

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2. Determinant of road accident in the case of low-and middle-income countries

Road urban safety in low- and middle-income countries is considered as a critical issue to be solved since the need of mobility in these countries is growing. Haydari and al (2019) using a holistic approach based on the Safe Systems framework and the framework for the UN Decade of Action for Road Safety 2021-2030, they have identified ten focus area from engineering to social, legal and health issues. Understanding road crashes in these countries is very challenging since all the identified components still insufficient (education, infrastructure, health system ...). The World bank explains the major cause of inefficient policies in these countries by insufficient information and limited used approach that cannot improve and decrease the high level of crashes. Safe system guide seeks to divide this challenging issue into different pillars as follow:

a. Road safety management activity: clear strategy with efficient legal framework.
b. Safe roads and roadsides: road audit and clustering.
c. Safe speeds: infrastructure and legal framework concordance.
d. Safe vehicles: registration, norms.
e. Safe road users: seat belt, drinking, smartphone, speed.
f. Post-crash care: health coverage and procedure.

By assessing the statistics of these countries, the table below shows the state of these identified pillars in low- and middle-income countries:

Table 1. low- and middle-income countries profile for pillars of safe system

Feature	Statistics
Road crashes	More than 19.63million deaths and serious injuries
Economic cost	1.7 trillion dollars and over 6.5 percent of GDP
Funding lead agency	Less than 3/4
National road safety strategy and safety target	Only a half
Systemic approach	Absent
Audit or star rating for safety of new roads	Only ¾ of countries
Investment to upgrade high-risk locations	Only 2/3 of countries
National speed limit law	Inefficient and above recommendation
Vehicle inspection	70%, very few countries are compliant with United Nations vehicle safety regulations.
Seat belt law	90% but not covering all occupants
Blood alcohol content test BAC	¾-countries and random test.

Feature	Statistics
Number to alert medical staff	¾ countries
Trauma registry system	68%
Education system	Few number

Source: Low- and Middle-income Country Profiles – World Bank Group
https://trl.co.uk/sites/default/files/PR058.pdf

Wegman (2017) describes this safe system approach as a pro-active, but its likelihood of achievement is not equalized in all the region. Low- and middle-income countries can't simply copy the existent best practices due to many deficiencies and absence for basic management road safety. Moving toward a systematic approach need to understand firstly the role of each factor and its importance, secondly links and relationship between these factors can be correctly presented to draw finally the real image of road safety in these countries.

3. Road accident in the context of Libya

According to WHO statistics, Libya records the highest level of road risk in Africa. Based on the country's profile, the safe system pillars are far from being achieved.

Despite the fact that Libya has its Lead agency, systemic approach is not applied. The following limits must be tackled:

Table 2. Libya road safety profile-pillars of safe system

Feature	Statistics
Road length	56683 km
Road accident	1928 (2020)
Fatalities	2249 (2020)
Estimated fatalities 100000 population	26.10 (regarding a continent value of 26.6) (2016)
Cost of fatalities and serious injuries	2.28 billion usd (2016)
Registered vehicles	56465 (Switzerland only 223 fatality with 71182) (2016)
Audit and rating for roads	absent
Infrastructure and speed management investment needed	3.25 billion usd (economic benefit 40.74 billion usd
GAP in speed system law	Urban roads (+20km/h)-rural

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Feature	Statistics
	roads (+15km/h)-motorways (+10km/h)
Narrowing	absent
Horizontal deflection	absent
Block and restrict access	absent
Vehicle safety regulation-94-95: frontal side and impact	absent
Vehicle safety regulation-78: motorcycle anti-lock braking system	absent
Vehicle safety regulation -127: pedestrian protection	absent
Vehicle safety regulation-140: electronic stability control	absent
Vehicle safety regulation-16-14: seat belts and anchorages	absent
Import age limit	5 years
Periodic inspection	No
Motorcycle age restriction	absent
Helmet law	yes
Helmet standard	absent
Specific education program	absent
Training	Insufficient and limited

Source: Global road safety facility and WB-Country profile 2018 and national statistics for 2020.

Few studies have tried to investigate the determinants of road crashes in Libya based on lack of data and regular recording of statistics. Despite the fact of the existence of lead agency, its role still limited under the influence of the actual instability of the country

4. Exploring the root causes of road accidents in Libya: an empirical assessment

The aim of this section is to assess and evaluate the determinant and root causes of road accident in Libya. For this end our empirical approach is based on a survey assessment addressed to wide variety

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of people in Libya (101 people). Our aim is to assess if road accidents are caused by drivers' errors, perception, and behavior or by spatial factors of urban traffic accident and geomatic. Our approach is aligned with the work of Yang Xing, Chen Lv and Dongpu Cao (2020) explaining the role of human's behavior and decision-making process in driving quality, and the work of Karacasu, Ergül and Yavuz (2014).

Hypothesis:

H 1: Traffic crashes and accident are caused by drivers' errors.

H 2: Urban design quality and control impact the level of road injuries.

5. Survey and data collection:

The method of date collection and the choice of vector of survey's transmission is considered as an important step toward and efficient empirical assessment. We have distributed our survey using two methods: face to face interview and online distribution[1]. Since our survey seeks to collect the opinion and data of all driver's categories in the Libyan society the used language was the Arabic, accessible language for all the levels of people's education.

5.1 The survey organization:

The organization of the survey must correctly present the needed information to be concluded after specific approach. Our survey uses multiple choice questions and some open questions; 39 items has been divided into specific sections, from general information to more specific information about factors and contributors that can explain root causes of traffic injuries in the case of Libya.

Section 1: personal information: from question number 1 to question number 7: this section investigates different personal factors linked to the drivers like age, gender, profession, level of education and health situation.

Section 2: vehicle information: from question number 8 to question number 12: this section investigates the general situation of the used vehicle of the interviewee.

Section 3: driving habits information: from question number 13 to question number 21: this section summarizes the habits of the drivers in term of using smartphones, seat belt and other factors that can negatively impact the level of concentration.

Section 4: speed: question 22 and 23.

Section 5: traffic violation and road risks: questions 24, 25 and 26.

Section 6: reaction in case of road accident: questions 27 to 32.

Section 7: control and awareness factors: from question 33 to question 39.

Reliability test

A reliability test of the different measurement scales through the **Crombach Alpha** parameter (equal to 0.94 in our case) confirmed the internal coherence of the questionnaire. Indeed, referring to the work of Nunnally (1978), the value found exceeds the validation threshold of 0.70 demonstrated by the author, we can proceed at this level to the generation and interpretation of the results.

Descriptive analyses:

Our sample is composed by 101 respondents, they are 61.8% male, the most important trench of age is from 31 years to 57 years (72.6%), 93% of them have a good education level, 45.1% work in the private sector. Descriptive data shows that more than half of used vehicles are between 6 and 15 years old, with a significant proportion of cars older than 25 years (17.6%).

Regularity of vehicle maintenance and insurance:

The distribution of the answers stipulates that half of the interviewees control their vehicle only when necessary, the preventive behavior is very limited. The same goes for changing tires. In spite of this lack of maintenance and regular control, the respondents stipulate that before long trips, drivers check the car and do not rely on the services of a professional. despite the high accident rate, a good number of interviewees do not see the usefulness of insurance against these risks (24%), a value that denotes the negligent culture of road hazards and partly explains this high accident rate.

Driving habits information:

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Our sample stipulates that 21.6% travel more than 2000km per month, which normally indicates a good respect and a good mastery of the road, 36.3% of them consider the usefulness of wearing seatbelts only on the highway. 56% say they do not respect the red light in case of emergency.

Speed:

The declared speed used outside the city is 110 to 130km/h (37.3%) (more than 130km 8.8%). Inside the cities 38.3% drive at a speed between 50 and 60km/h, which again corroborates with the WHO report and the GAP of speed concluded in relation to the international standard.

Traffic violation and road risks

Traffic violations are explained by speeding, the use of phones and parking in restricted areas. Despite the fact that the respondents affirmed in large part the non-utility and respect of seat belt wearing, the cited causes of violation do not present this reason which proves the non-enforcement of the law of seat belt wearing and the lack of effective control in this sense.

Road risks are presented as follow:

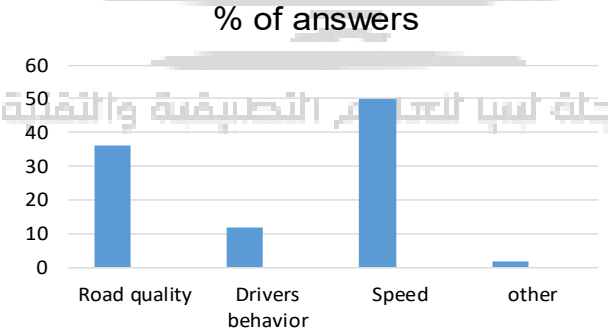

Figure 1. Road risks

36.3% believe that road accidents are caused by the quality of the roads, 50% recognize the importance of speeding but do not classify it with the category of driver behavior.

Reaction in case of road accident

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The answers stipulate 75% have had an accident. In case of accident, amicable solutions are preferred, 73.5% announce that they forgive the 2nd party involved in the accident, without referring to the insurance companies. This finding indicates the bias rate of the statistics related to road accidents in Libya when standard information channels are not applied.

Control and awareness factors

61.8% report disrespectful behavior of police officers at road checkpoints.

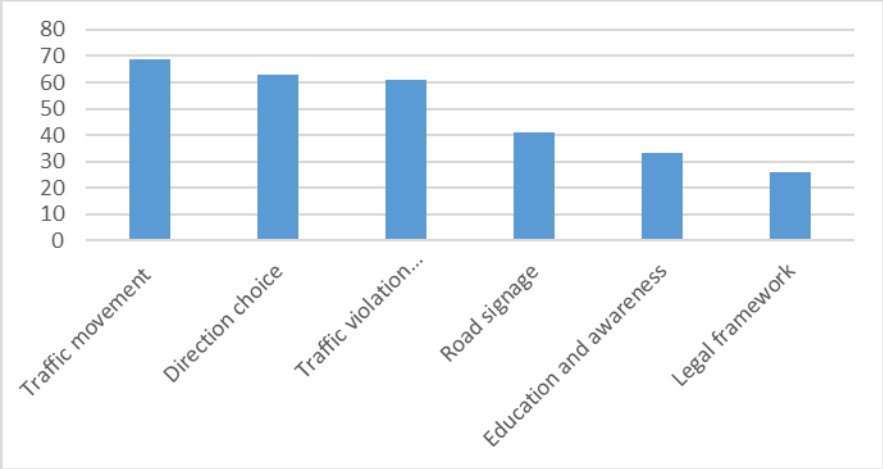

Figure 2. Road checkpoints

2.1 Subheadings

Subheadings should be as the above heading "2.1 Subheadings". They should start at the left-hand margin on a separate line.

3. Tables, Figures and Equations

To insert "Tables" or "Figures", please paste the data as stated below. All tables and figures must be given sequential numbers (1, 2, 3, etc.) and have a caption placed below the figure and above the table, using 8pt font and please make use of the specified style "caption" from the drop-down menu of style categories

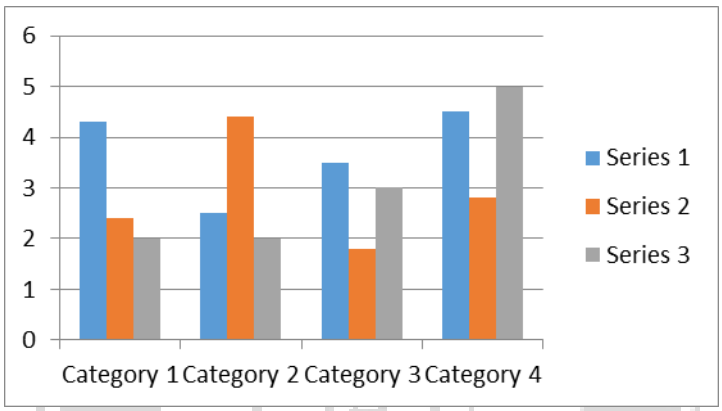

Fig.3 Distribution

Table 1 Margin specifications

1	TDL	1000
2	FRT	2000
3	EFG	3000

$$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k} \qquad (1)$$

NOTES TO AUTHORS:

You must follow the style below to refer to reference, figure, table or equation.

Eq. 1 shows the relation between A and B.
Fig. 1explains the disribution of G.
The result is shown in Table 1.
All the listed refrences should be refered to it throughout the document as follows [2].

4. Conclusion

Conclude your work here.

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