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A scientific study to determine the level of traffic safety application in Khartoum State - Sudan

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ABSTRACT: *Traffic safety is a set of traffic programmes, plans and regulations that prevent the occurrence of traffic accidents or limit their serious effects, and it consists of main elements: the human element, the vehicle and the road. The questionnaire's axes are focused on the extent to which traffic safety conditions are applied to the vehicle, the road, and the human behavior of road users in the state of Khartoum. The questionnaire was analyzed by the statistical analysis program, and the study found the shortcomings in the application of traffic safety in the state of Khartoum and the identification of dangerous elements that are not applied in all elements of traffic safety.*

KEYWORDS: *Traffic Safety, Accidents, vehicle, road, Sudan, Khartoum*

I. INTRODUCTION

Traffic safety - in its broad sense - aims to adopt all plans, programs, traffic regulations, and preventive measures to reduce or prevent the occurrence of traffic accidents in order to ensure the safety of people and their belongings and to preserve the security of the people and their human and economic components [1-3].

Vehicle safety is increasingly critical to the prevention of crashes and has been shown to contribute to substantial reductions in the number of deaths and serious injuries resulting from road traffic crashes. Features such as electronic stability control and advance braking are examples of vehicle safety standards that can prevent a crash from occurring or reduce the severity of injuries. Despite these potential benefits, not all new and used vehicles are required to implement internationally recognized safety standards.

Since the society in Sudan - Khartoum state is suffering like all other societies of the problem of high rates of road accidents and the resulting incidents of human and economic losses. And it became traffic accidents represent a most significant issues and problems faced by the residents of the state of Khartoum. The state of Khartoum occupied the highest level of Sudan for road accidents; the rate of accidents has reached to about 53.9% of which occurs in all states of Sudan.

The increasing volume of traffic on the roads within the state of Khartoum led to the emergence of some special problems not appropriate engineering design of some elements of traffic safety and private road network in Khartoum state to serve the emerging demand traffic smoothly and safely. Perhaps one of the most important elements that became a need to evaluate and update are some of the traffic safety of some of the main roads

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sectors in Khartoum state elements, and field surveys, and traffic accidents statistics showed the seriousness of these elements.

II. LITRATURE SURVEY

A framework for relating the series of events in a road crash to the categories of crash contributing factors is the Haddon Matrix, there are three different types of factors that contribute to road crashes: a) Human Factors b) Vehicle Factors and c) Roadway/Environment Factors.2 Roadway Factors include roadway and roadside design elements. According to the Highway Safety Manual (HSM) of the American Association of State Highway and Transportation Officials (AASHTO), three percent (3%) of road crashes are due to only roadway factors, but thirty four percent (34%) of road crashes are a combination of roadway factors and other factors (Figure 1).

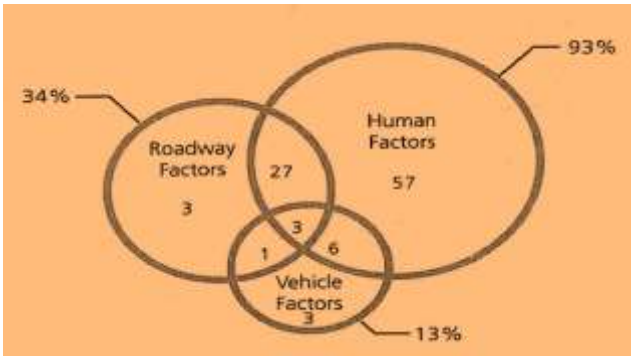


Figure.1 Contributing factors to Vehicular Crashes *(Source: AASHTO)*

The number of road traffic deaths continues to rise steadily, reaching 1.35 million in 2016 (Figure 2). However, the rate of death relative to the size of the world's population has remained constant. When considered in the context of the increasing global population and rapid motorization that has taken place over the same period, this suggests that existing road safety efforts may have mitigated the situation from getting worse. However, it also indicates that progress to realise Sustainable Development Goal (SDG) target 3.6 – which calls for a 50% reduction in the number of road traffic deaths by 2020 – remains far from sufficient [4 - 7].

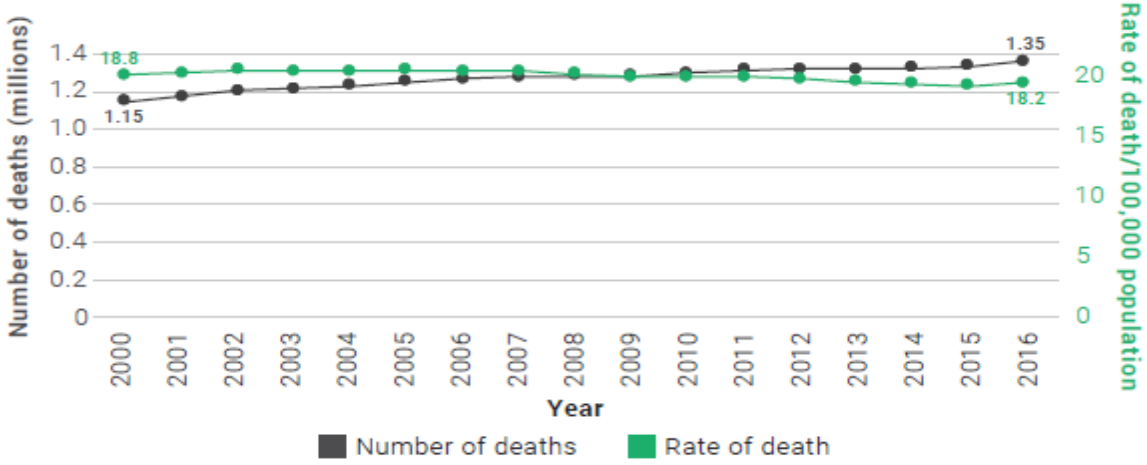


Figure.2 Number and rate of road traffic death per 100,000 populations: 2000–2016

As progress is made in the prevention and control of infectious diseases, the relative contribution of deaths from non-communicable diseases and injuries has increased. Road traffic injuries are the eighth leading cause of death

for all age groups. More people now die as a result of road traffic injuries than from HIV/AIDS, tuberculosis or diarrhoeal diseases. Road traffic injuries are currently the leading cause of death for children and young adults aged 5–29 years, signaling a need for a shift in the current child and adolescent health agenda which, to date, has largely neglected road safety [8 - 13].

Enacting and enforcing legislation on key behavioral risk factors including speed, drink-driving and failing to use motorcycle helmets, seat-belts and child restraints are critical components of an integrated strategy to prevent road traffic deaths. Currently, 123 countries, representing nearly six billion people, have laws that meet best practice for at least one of the five key behavioral risk factors [14 - 16].
Since 2014, 22 additional countries have amended their laws on one or more key risk factors to bring them in line with best practice, covering a potential additional one billion people or 14% of the world's population [6].

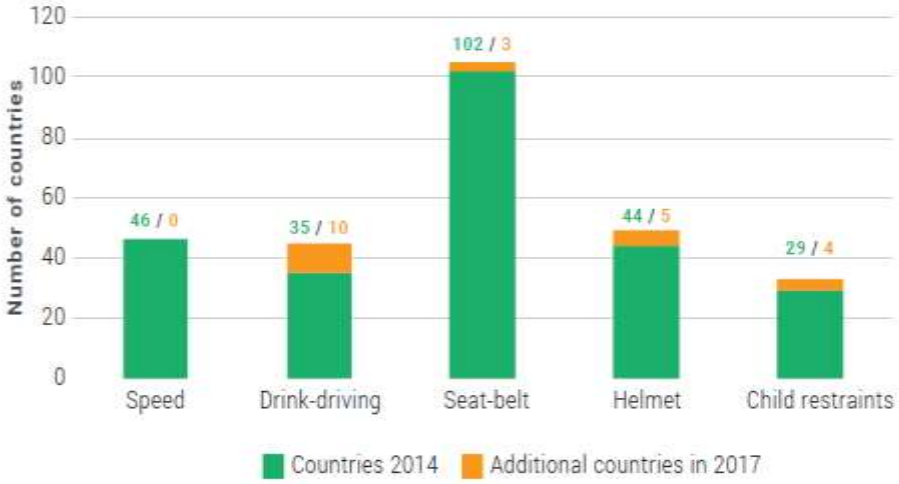


Figure.3 Countries with laws meeting best practice on 5 risk factors, 2014, 2017

Top Causes of Car Accidents

The 25 Leading Causes of Accidents on the Road;

Distracted Driving, Speeding, Drunk Driving, Reckless Driving, Rain, Running Red Lights, Running Stop Signs, Teenage Drivers, Night Driving, Design Defects, Unsafe Lane Changes, Wrong-Way Driving, Improper Turns, Tailgating, Driving Under the Influence of Drugs, Ice, Snow, Potholes, Drowsy Driving, Tire Blowouts, Fog, Deadly Curves, Animal Crossings and Street Racing

Top Ten Tips to Avoid an Accident

If you follow these common sense steps, you will be taking the most important steps to ensuring you avoid an accident.

Develop the right attitude about driving, Get as much supervised practice driving as possible, ALWAYS wear your safety belt, Underage drinking and drug use is illegal, Limit your passengers, Keep it slow and safe for starters, Train for poor weather conditions, Cell phones are for emergency use only on the road and Drive a safe vehicle.

III. METHODOLOGY

The study methodology was based on the following:

- Collecting information related to the number of traffic accidents and the traffic safety elements associated with them in the state of Khartoum - Sudan.

Table.1 Traffic Accident in Sudan (2016/2020)

Year	Death	Serious	Injury	Drinking	Damage	Total	(%)
2011	821	3663	4665	270	33017	42436	10.49
2012	768	3058	4651	245	32902	41624	10.29
2013	377	3010	4605	253	32210	40455	10.00
2014	709	2928	4351	298	31970	40256	9.95
2015	747	2808	4659	295	31802	40311	9.97
2016	736	2986	5346	140	28683	37891	9.37
2017	830	3299	4749	115	31436	40429	10.00
2018	855	3278	4634	130	34066	42963	10.62
2019	908	2904	3756	182	36735	44485	11.00
2020	815	2373	2503	129	27799	33619	8.31
Total	**7566**	**30307**	**43919**	**2057**	**320620**	**404469**	**100.00**

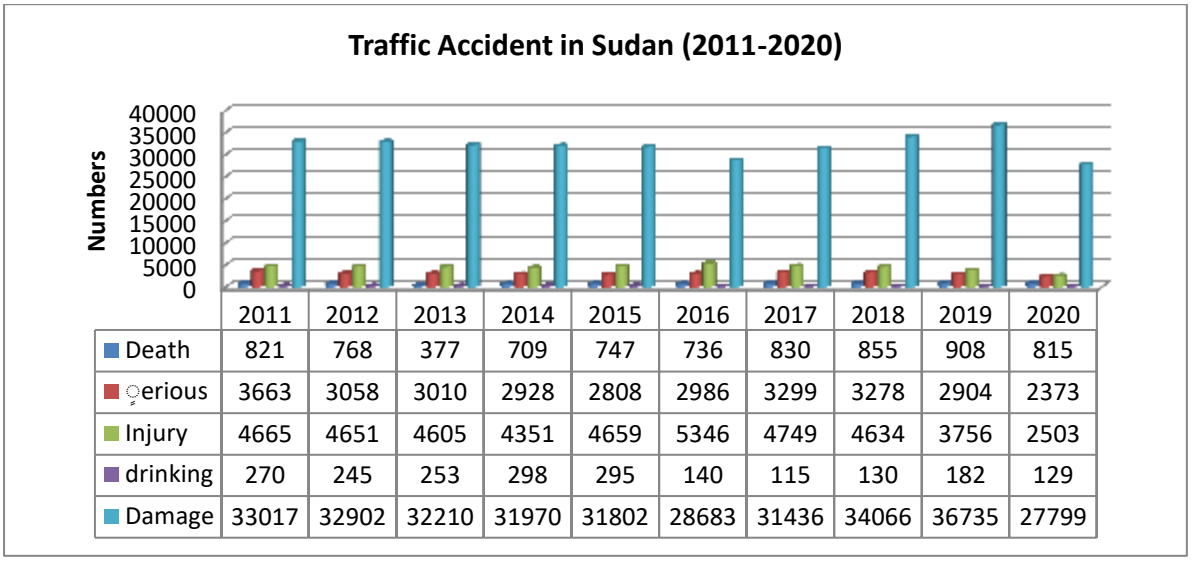


Figure.4 Traffic Accident in Sudan (2016/2020)

Table .2 Traffic accident rates by type of accident per 100,000 people in Sudan (2016/2020)

Year	Deaths per 100,000 people	Serious per 100,000 people	Injury per 100,000 people
2016	18.06	19.55	23.10
2017	20.36	21.60	20.52
2018	20.98	21.46	20.02
2019	22.28	19.01	16.23
2020	8.15	23.70	25.03

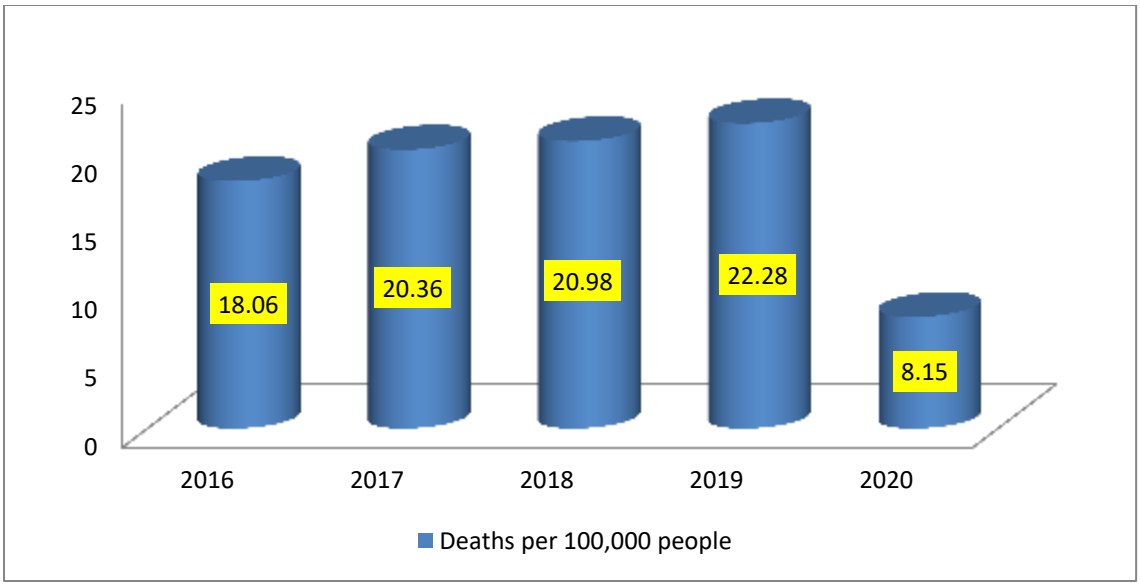


Figure .5 Traffic accident rates by type of accident per 100,000 people in Sudan (2016/2020)

Table No.3 Causes of traffic accidents in Sudan (2019/2020)

	Careless driving	High speed	Wrong overtaking	Exceeding the red light	tire burst	Technical error	Other
2020	335	180	228	32	1	0	126
2019	285	121	223	24	25	0	137

- Design, distribution and analysis of a questionnaire on the extent of traffic safety application in the state of Khartoum.

  A number of 250 questionnaires were distributed to different segments of society in the Sudanese society in the state of Khartoum, and 232 questionnaires were filled out. The questionnaire included three axes:
- The first axis, which is about personal information (name (optional), gender, age, educational level, do you own or drive a vehicle.
- The second axis: an axis related to measuring the application of traffic safety on the person, the vehicle, or the road itself.
- The third axis: general questions related to evaluating the level of traffic culture in Sudanese society.
- Evaluating the level of traffic safety application in Khartoum State.

IV. ANALYSIS OF RESULTS

General Information's

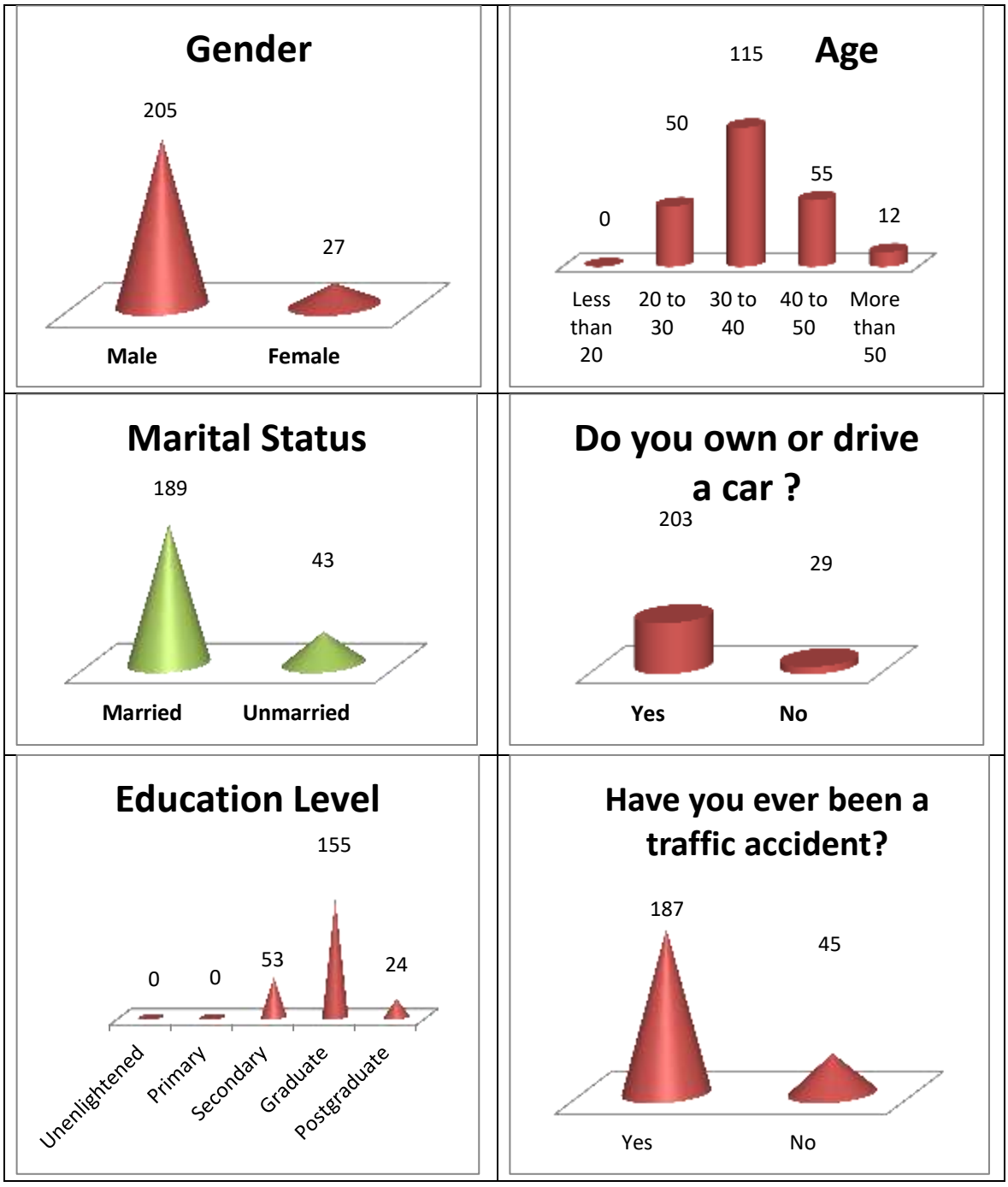


Figure.6 General Information's

Application of traffic safety (Vehicle)

The questionnaire results of the Application of traffic safety – Vehicle, were shoed in the Fig.7 we find a percentage of 100 % of the targeted sample they have a Seat belt, Brakes and the handbrake work well, Mirrors (right, left, and center), Spare wheel and Hag and the key wheel. A percentage of 97 % they have Interior door locks, 95 % they have Signals (right, left, huzer, long, short), 95 % they have Internal indicators (for fuel, heat, oil, speedometer, etc. ....). we also find that 100% of the targeted sample they don't have Fire-resistant mattresses, Door locking systems in the case of the coup, 98% they don't have Child seats, 97% they don't have hand lamp (Flashlight), 95% they don't have Airbags.

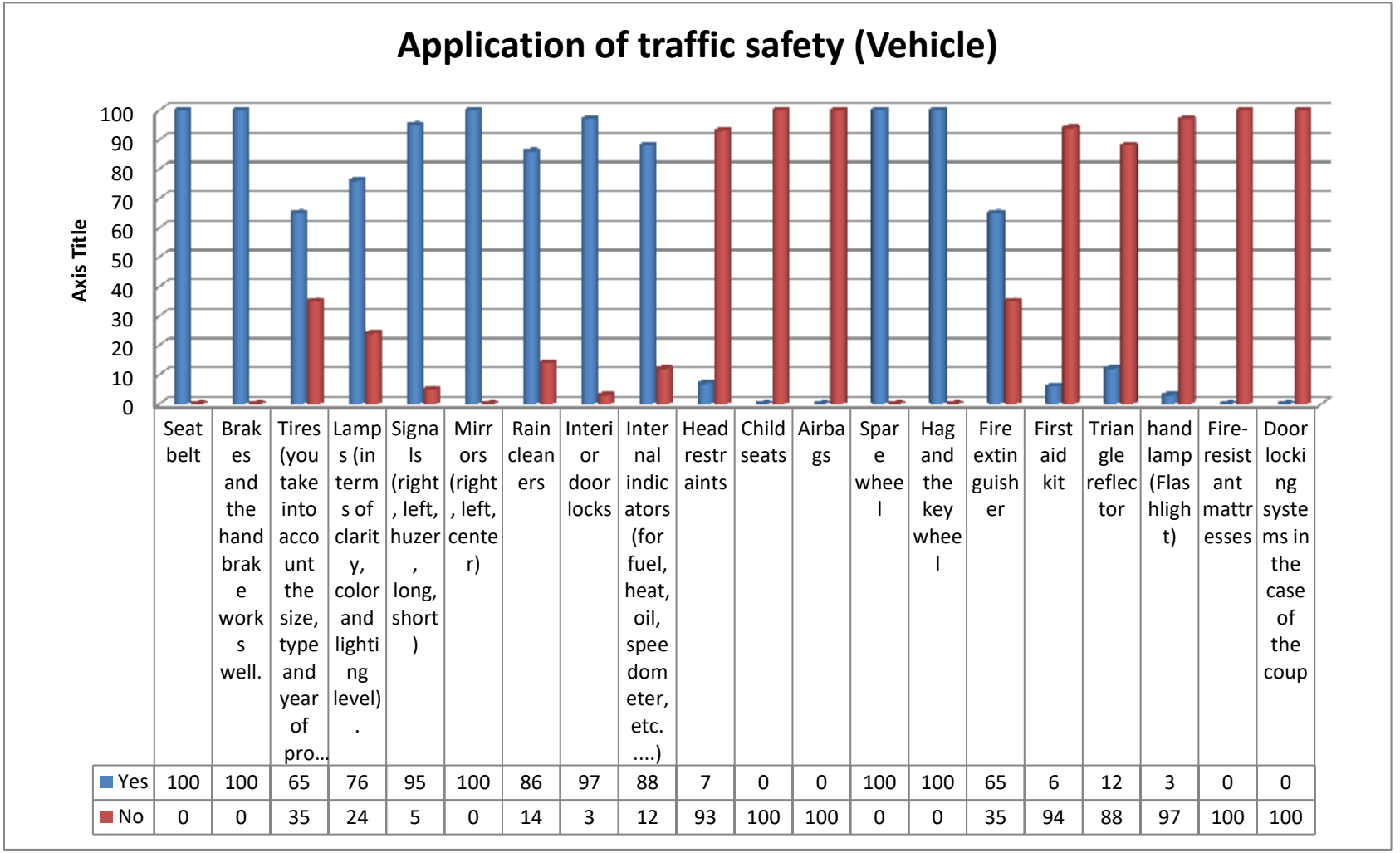
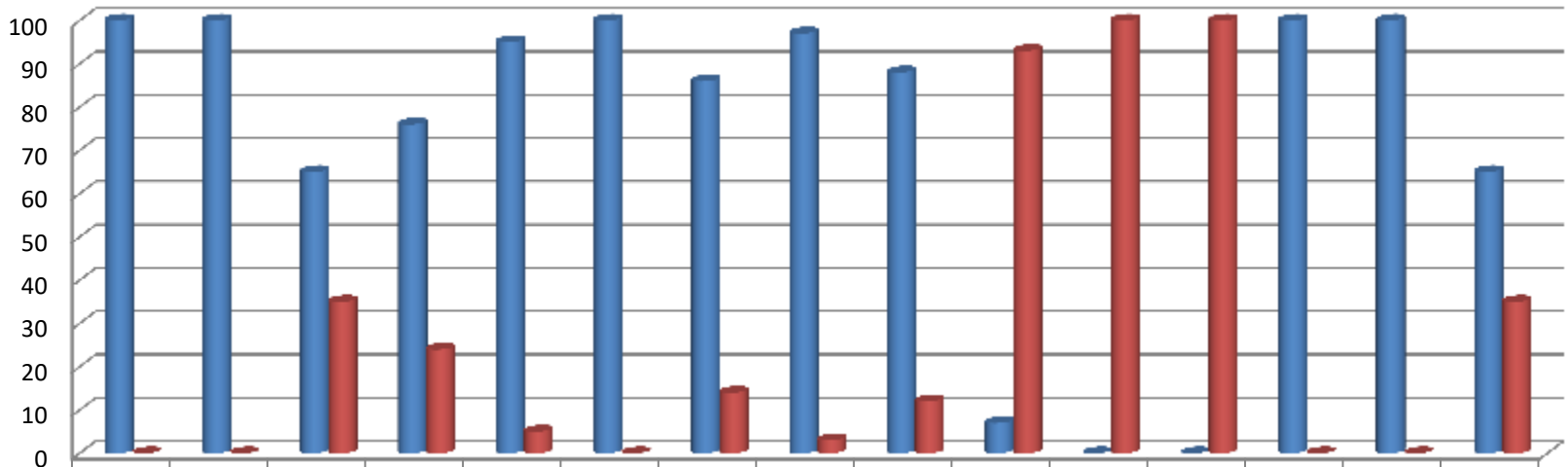


Figure.7 Application of traffic safety (Vehicle)

Application of traffic safety (Streets)

The questionnaire results the Application of traffic safety – Road, were shoed in the Fig.8 we find a percentage of 100 % of the targeted sample they say that these items are not available; Width of roads inadequate, Number of traffic lanes is enough to traffic in coming and going, here adequate night lighting, There are roundabout and it's well designed and there are lines crossing for pedestrians at intersections. 97% they say their shoulder to stop cars in the event of malfunctions or for a ride and get off. 95% they say the right of way enough for future expansion. We also find that 100% of the targeted sample they say the traffic signs are available in all the streets and There are traffic lights at all intersections and it's well designed.

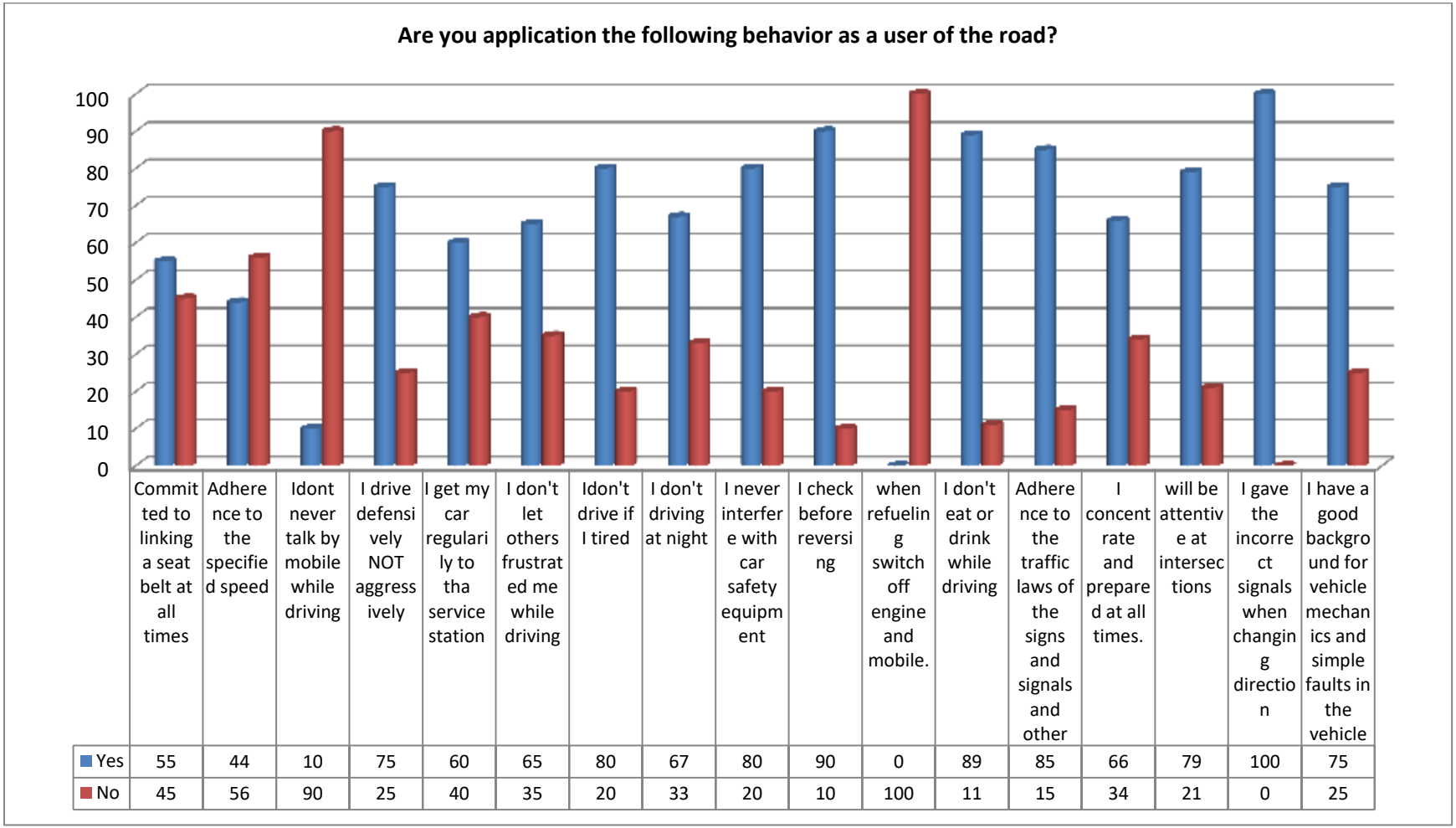


	Width of roads inadequate (lane greater than 3.5 meters).	Number of traffic lanes is enough to traffic in coming and going.	There are median to separate traffic from each other	There are side protection bars in sharp curves	Right of Way enough for future expansion	There adequate night lighting	There edges determine the width of the road (Curb)	Their shoulder to stop cars in the event of malfunctions or for a ride and get off	IThere Slope longitudinal and transverse on the roads to divert rain from the road surface	There drain longitudinal rainwater	Traffic signs are available in all the streets	There are traffic lights at all intersections and it's well designed	There are roundabout and it's well designed	There are lines crossing for pedestrians at intersections	Are good routes and is not defective holes and cracks and other
Yes	100	100	65	76	95	100	86	97	88	7	0	0	100	100	65
No	0	0	35	24	5	0	14	3	12	93	100	100	0	0	35

Figure.8 Application of traffic safety (Streets)

The behavior of road users

The questionnaire results the behavior of road user, were shoed in the Fig.9 we find a percentage of 100 % of the targeted sample they say; I gave the incorrect signals when changing direction, 90% of the targeted samples they say I check before reversing, 89% of the targeted samples they say I don't eat or drink while driving, . We also find that 100% of the targeted samples they say when refueling switch off engine and mobile. 90% of the targeted samples they say never talk by mobile while driving.



	Committed to linking a seat belt at all times	Adherence to the specified speed	Idont never talk by mobile while driving	I drive defensively NOT aggressively	I get my car regularily to tha service station	I don't let others frustrated me while driving	Idon't drive if I tired	I don't driving at night	I never interfere with car safety equipment	I check before reversing	when refueling switch off engine and mobile.	I don't eat or drink while driving	Adherence to the traffic laws of the signs and signals and other	I concentrate and prepared at all times.	will be attentive at intersections	I gave the incorrect signals when changing direction	I have a good background for vehicle mechanics and simple faults in the vehicle
Yes	55	44	10	75	60	65	80	67	80	90	0	89	85	66	79	100	75
No	45	56	90	25	40	35	20	33	20	10	100	11	15	34	21	0	25

Figure.9. The behavior of road use

V. CONCLUSION

From the results of the study, the following conclusions were obtained:

- The most important causes of traffic accidents that cause death in Sudan (2020) are Careless driving 37.1%, Wrong overtaking 25.3%, and high speed (20.0%).
- The extent of the traffic safety application - vehicle according to questionnaire results; we find a percentage of 100 % of the targeted sample they have a Seat belt, Brakes and the handbrake work well, Mirrors (right, left, and center), Spare wheel and Hag and the key wheel. A percentage of 97 % they have Interior door locks, 95 % they have Signals (right, left, huzer, long, short), 95 % they have Internal indicators (for fuel, heat, oil, speedometer, etc. ....). we also find that 100% of the targeted sample they don't have Fire-resistant mattresses, Door locking systems in the case of the coup, 98% they don't have Child seats, 97% they don't have hand lamp (Flashlight), 95% they don't have Airbags.
- The extent of the traffic safety application - Street according to questionnaire results; we find a percentage of 100 % of the targeted sample they say that these items are not available; Width of roads inadequate, Number of traffic lanes is enough to traffic in coming and going, here adequate night lighting, There are roundabout and it's well designed and there are lines crossing for pedestrians at intersections. 97% they say their shoulder to stop cars in the event of malfunctions or for a ride and get off. 95% they say the right of way enough for future expansion. We also find that 100% of the targeted sample they say the traffic signs are available in all the streets and There are traffic lights at all intersections and it's well designed.
- The behavior of road user according to questionnaire results; we find a percentage of 100 % of the targeted sample they say; I gave the incorrect signals when changing direction, 90% of the targeted samples they say I check before reversing, 89% of the targeted samples they say I don't eat or drink while driving, . We also find that 100% of the targeted samples they say when refueling switch off engine and mobile. 90% of the targeted samples they say never talk by mobile while driving.

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