Clinical evaluation and outcomes of children ≤10 years old involved in road traffic accidents presenting to Chris Hani Baragwanath Academic Hospital.

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine

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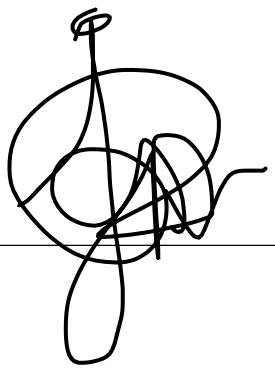
DECLARATION

I Jo-Anne Carreira, declare that this research report is my own, unaided work. It is being submitted for the Degree of Master of Medicine in Surgery at the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any other degree or examination at any other University.



27th Day of May 2020 in Johannesburg

DEDICATION:

Dedicated to all the children injured in road traffic accidents everyday – May we learn, as a community, to take better care of our children.

ABSTRACT

Background:

Road traffic injuries are a leading cause of injury and death globally, particularly amongst children. Pedestrians are most often injured, particularly in middle and low income countries. The epidemiology, patterns and severity of injuries of children involved in road traffic accidents in our community are hard to come by.

Objectives:

The aim of the study was to evaluate the aetiological spectrum, injury characteristics and treatment outcome of paediatric patients involved in road traffic accidents, presenting to a Gauteng Tertiary Hospital in Soweto , Chris Hani Baragwanath Academic Hospital. This research was conducted over 7 months 11 days (20/08/2017 to 31/03/2018).

Methods:

All patients under the age of 10 years seen at Chris Hani Baragwanath Academic Hospital casualty, having been involved in a road traffic accident of any kind were included in the study. A data sheet in the form of a questionnaire was completed by the doctors caring for the children, recording various statistics such as: age, gender, mechanism, class of vehicle, adult accompaniment, restrained, clinical presentation, investigations and procedures as well as the injuries sustained.

Results:

The study was conducted over the period from 20/08/2017 to 31/03/2018. A total of 156 patients' data was included. The ages ranged from 13 days to 10 years with 65% of the children being male. Pedestrian vehicle accidents accounted for 78.8% (123/156) of the injuries with 60.8% of the children involved being unaccompanied by an adult. Motor vehicle accidents accounted for 19.2% (30/156) of the injuries with 92% of the children in the vehicles being unrestrained. Of the children who were included, 73.2% (112/153) of them had X-rays and 44.4% required CT scan, the majority being CT Brain for suspected head injuries. Soft tissue injuries were sustained by the majority of the patients (78.9%), followed by head (39.7%) and then limb (16%) injuries. Children accompanied by adults when involved in PVAs were significantly less likely to obtain a head injury when compared to unaccompanied children (p

= 0.037). Only 12% of patients required surgical intervention, with 42% of the surgeries being for orthopaedic injuries.

Conclusion:

This study demonstrates that there is an overwhelming lack of use of child restraints for children travelling as passengers in vehicles. It also shows an inadequacy of supervision of the young children on and around the roads.

This study supports other evidence in suggesting that the paediatric population involved in RTAs are largely injured as pedestrians. We showed, similarly to obtained literature, that males tend to be involved in more RTAs than females. The majority of injuries sustained were soft tissue injuries followed by head injuries.

ACKNOWLEDGEMENTS

This Masters project took a number of years to complete. Time is a difficult thing to come by whilst managing a general surgery registrar post, as well as being a wife and mother.

I am forever grateful to my own mother for her unwavering support and immense help with this project. And to my husband for his patience.

Special thanks to Prof Deirdre Kruger – without your continued encouragement and assistance, I doubt this would have been possible.

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LIST OF ABBREVIATIONS

Abd - Abdominal

CHBAH – Chris Hani Baragwanath Academic Hospital

CT – Computerized Tomography scan

GCS – Glasgow Coma Score

ICU – Intensive care unit

Max/Fac – Maxillo-facial surgery

MRC – Medical Research Council

MVA – Motor vehicle accident

Orthos- Orthopaedic surgeon

PVA – Pedestrian vehicle accident

RTA – Road traffic accidents

SAH – Subarachnoid haemorrhage

SD – Standard deviation

SDH - Sub Dural Haemorrhage

SSG – Split skin graft

STI – Soft tissue injury

WHO – World Health Organisation

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CHAPTER 1. INTRODUCTION

1.1 Background

Road traffic accidents (RTAs) are a major and growing cause of death, injury and hospitalisation worldwide. According to the WHO approximately 1.35 million people die each year as a result of RTAs and more than 90% of these deaths occur in the low- and middle-income countries of the African and Eastern Mediterranean regions. (1) Specifically, WHO data published in 2018 showed that RTA fatalities in South Africa reached 14,507 for the year 2016. (1) These numbers show that South Africa is a country that is greatly affected by RTAs

The Medical Research Council found that RTAs were the 9th leading cause of death in children under the age of 5 years in South Africa in the year 2000 and were the leading cause of death in that same year for children between the ages of 5-14 years. This was twice the global rate that year. (2) However, there is a lack of statistics regarding non-fatal injuries in children involved in RTAs.

In an international study, including 11 countries, on patterns of injury in children, Peclet et al. identified trauma as the leading cause of death for children over 1 year of age. Injuries sustained by motor-vehicle accident occupants and pedestrians account for the greatest number of these trauma deaths and continues to be a leading cause of death and disability for children. (3)

A retrospective study by Pretorius et al. (2009) documented admissions to the paediatric orthopaedic ward at Chris Hani Baragwanath Academic Hospital (CHBAH) over a 3 year period and showed that 13,4% of the total admissions to their paediatric orthopaedic ward of children under 14 years was due to RTAs. Patients between the ages of 4 and 8 years old had highest frequency of injuries sustained in RTAs. In contrast, a study from the UK found that RTAs accounted for only 7% of paediatric fractures; half the incidence reported of the Soweto population. (4)

The WHO reported that 11% of all injuries that occur to children on the roads occur on public roads and can result in fatality or a significant life changing injury. They showed that head injuries occurred in 23% of all transport related child injuries, these can result in long term disability that will place a large burden on the family as well as the community of the injured child. In low-income and middle-income countries the proportion of children injured as

pedestrians ranges from 30% to 40%. (5) A multitude of studies also showed that the majority of these injuries were sustained by boys. (2,4,5,7,9,10,12,13)

The exact epidemiology regarding RTA injuries in the South African paediatric population is unknown. There is a paucity of published data regarding this patient population in the lower income South African environment. As a result, the statistics, patterns and severity of injuries, as well as the outcomes of children involved in road traffic accidents are hard to come by. Therefore, this study aimed to evaluate the injury characteristics and management of paediatric patients involved in RTAs in our local population. Knowing these statistics will assist in gaining a better understanding of these preventable injuries in order to move forward with intervention strategies to curb the number of children being injured on the roads. The "Promotion of a Childsafe South Africa" study highlights that injury of children is a major public health problem and that there should be more focus on awareness and education to the communities and parents regarding this "neglected childhood killer disease". (6)

1.2 Aim & Objectives

The aim of the study was to evaluate the etiological spectrum, injury characteristics, radiological investigations and treatment of paediatric patients involved in road traffic accidents, presenting to a Gauteng Tertiary Hospital in Soweto, namely Chris Hani Baragwanath Academic Hospital (CHBAH).

The study objectives were:

- To determine the demographics and clinical characteristics of paediatric patients presenting to CHBAH after being involved in a road traffic related accident.
- To determine the mechanism and extent of the sustained injuries.
- To report on the following outcomes
    - Patient admission to ward or intensive care
    - Investigations the child underwent
    - Patients requiring surgery
    - Additional speciality consultation

CHAPTER 2. METHODS

2.1 Patient selection

A prospective, descriptive, hospital-based study was conducted from 20/08/2017 to 31/03/2018, (7 months, 11 days). All patients that were 10 years old and under, seen in the surgical emergency department at CHBAH having been involved in a Road traffic accident, were included in the study. These patients were identified on arrival by the history given of having been involved in an accident on or around the road.

2.2 Data acquisition

All the data was collected on a data sheet, in the form of a questionnaire (Appendix 2), which was completed by doctors caring for the patients at various levels. Initially the casualty doctor would identify the patient as having been involved in a RTA and then refer to paediatric surgeons to assess and manage the child further. The paediatric surgical doctors would subsequently fill out the questionnaires. The record review was anonymised to protect patient confidentiality. Each record was assigned a unique study number and no identifying data was included.

2.3 Ethical approval

Ethical approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (clearance number M160451). Permission was obtained from the CHBAH Clinical executive officer to conduct the research. Informed consent was obtained from the child's caregiver or parent, as soon as he/she was available, according to the standards set out by the legislation in South Africa and under the guidelines and standards of the ethics committee of the University of the Witwatersrand.

2.4 Statistical analyses

All identifiable patient data was coded and study data recorded using a data collection sheet (Appendix 2). The data were captured into a Microsoft Excel spreadsheet and then imported into the STATA suit of analytical software (Version 14.0). Descriptive statistics on continuous variables were reported as medians and interquartile ranges due to the nonparametric nature of the data, whereas categorical data are reported and frequencies and proportions. Chi-Squared

or Fishers' exact tests and Mann-Whitney U/Kruskal-Wallis tests were performed as appropriate, with a p-value ≤0.05 regarded as significant. Where significant, odds ratios and 95% confidence interval of the odds ratios were reported to determine effect size.

CHAPTER 3.

RESULTS

A total of 156 patients were included in the study, with the age ranging from 13 days to 10 years (Table 1). The mean age (± SD) was 4.8 (2.5) years and 65% of the patients were males. As seen in Table 1, the majority of the study patients were involved in pedestrian vehicle accidents (PVA) – 78.8% followed by 19.2% involved in MVAs and 1.9% involved in bicycle accidents. Most of the vehicles involved in the RTAs were private vehicles for both MVAs and PVAs, with the remaining 16.5% being public transport in the form of taxis.

Alarmingly, 92% of the children involved in MVAs were unrestrained and 60.8% of children involved in PVAs were unaccompanied by an adult at the time of the accident (Figure 1). An adult was defined as a person aged 16 years or older.

The majority (73.2%) of the patients had X-rays and 44.3% had CT scans (Table 1). Only 4.4% (n = 7/156) of children required intubation and 75.8% of the children presented with a Glasgow Coma Score (GCS) < 9. The majority of study patients were admitted (97.4%), of which 95.4% were admitted to the paediatric surgical ward and 4.6% admitted to the intensive care unit (ICU).

Table 2 shows the main admission diagnosis of soft tissue injury (STI) in 78.9% of children, followed by head injury in 39.7%. The STIs were further classified into abrasions (66.1%) , lacerations (22.9%), haematomas (16.9%) and degloving injuries (5.8%). Also, 8.5% of the patients had both lacerations and abrasions. Chest injuries accounted for 9% of the injuries (n=14), with diagnoses of rib fractures, lung contusions and pneumothoraces. Only 6.4% of study patients sustained abdominal injuries with one child sustaining a bladder rupture. Of the 16% of patient with limb injuries, 76% had fractures. No statistical significant differences were seen between the injuries sustained and the mechanism of injury, whilst none of the MVA patients had a chest or abdominal injury in this study (Table 2; Figure 2). In the PVA group we found that the rate of head injuries was significantly higher in the group of children unaccompanied by an adult (44.4%) when compared to those being accompanied (20.7%; p = 0.037).

Only 12.2% of the patients required surgery, which was distributed between orthopaedic interventions (42.1%) and debridement or Split skin graft (SSG) of wounds (47.4%) Neurosurgery took one patient to theatre for an intracranial procedure and 1 tracheostomy was performed (Table 3). Other specialities were consulted for 35.3% of the patients with

orthopaedic surgeons being the most consulted (41.8%), followed closely by the neurosurgeons (40.0%) and then maxilla-facial department (7.3%). In this study only 2.5% were discharged from casualty.

Table 1. Patient characteristics, mechanisms of injury and investigations among ≤ 10yr old participants involved in road traffic accidents.

Variable	All Patients (n=156)
Age (±SD), years	4.8 (±2.5yrs)
Gender, n (%)	
Male	101 (65%)
Female	55 (35%)
GCS, n (%)	154/156 (98.7%)
3 - 8	9/154 (5.8%)
9 - 15	147/154 (95.5%)
Mechanism, n (%)	
PVA	123 (78.8%)
MVA	30 (19.2%)
Bicycle	3 (1.9%)
Vehicle, n (%)	
Private	74 (64.3%)
Taxi	19 (16.5%)
Van	13 (12.2%)
Truck	3 (2.6%)
Bicycle	3 (2.6%)
Bus	1 (0.9%)
Motorbike	1 (0.9%)
Unknown	41 (26%)
Intubated, n (%)	7 (4.4%)
X Rays, n (%)	112/153 (73.2%)
Chest	88 (57.5%)
Abdomen	3 (1.7%)
Pelvis	37 (24.2%)
Limb	41 (26.8%)
CT scans, n (%)	69 (44.2%)
Brain	66 (95.7%)
C-Spine	12 (17.4%)
Chest	3 (4.3%)
Abdomen	7 (10.1%)
Panscan	2 (2.9%)
Admission, n (%)	152 (97.4%)
Ward	145 (95.4%)
ICU	7 (4.6%)

***Abbreviations*: GCS, Glascow coma score; MVA, motor vehicle accident; PVA, Pedestrian vehicle accident; ICU, intensive care unit.**

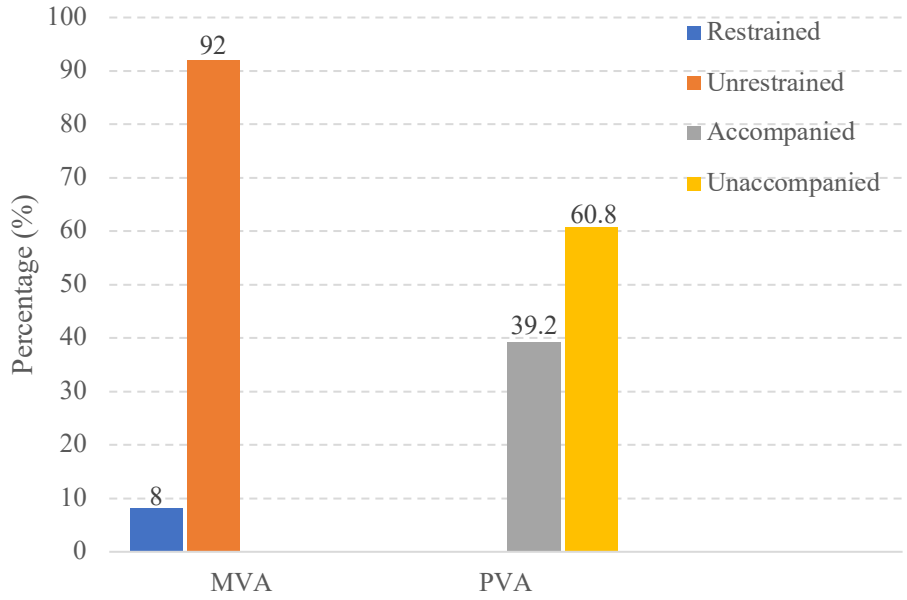

Figure 1. Conditions of Mechanism of injury among ≤ 10yr old participants involved in road traffic accidents.

Abbreviations: MVA, motor vehicle accident; PVA, Pedestrian vehicle accident.

Table 2. Injuries sustained according to the mechanism of injury among ≤ 10yr old participants involved in road traffic accidents.

Variable	All Patients (MVA, PVA, Bicycle; n=156)	MVA (n=30)	PVA (n=123)	MVA vs PVA p value
Soft tissue injury, n (%)	123 (78.9%)	23 (76.7%)	97 (78.9%)	0.79
Abrasion	78 (63.4%)			
Laceration	27 (22.0%)			
Haematoma	20 (16.3%)			
Degloving	7 (5.7%)			
Head Injury	62 (39.7%)	13 (43.3%)	48 (39.0%)	0.67
Mild/Concussion	32 (51.6%)			
SAH	10 (16.1%)			
SDH	4 (6.5%)			
Chest Injury	14 (9.0%)	0	14 (11.4%)	0.05
Lung contusion	10 (71.4%)			
Pneumothorax	8 (57.1%)			
Rib fractures	2 (14.3%)			
Abdominal injury	10 (6.4%)	0	10 (8.1%)	0.11
Solid organ injury	5 (83.3%)			
Limb Injury	25 (16.0%)	6 (20.0%)	18 (14.6%)	0.47
Fracture	19 (76%)			

Abbreviations: MVA, motor vehicle accident; PVA, Pedestrian vehicle accident; STI, soft tissue injury; SAH, Sub arachnoid haemorrhage; SDH, sub dural haemorrhage;

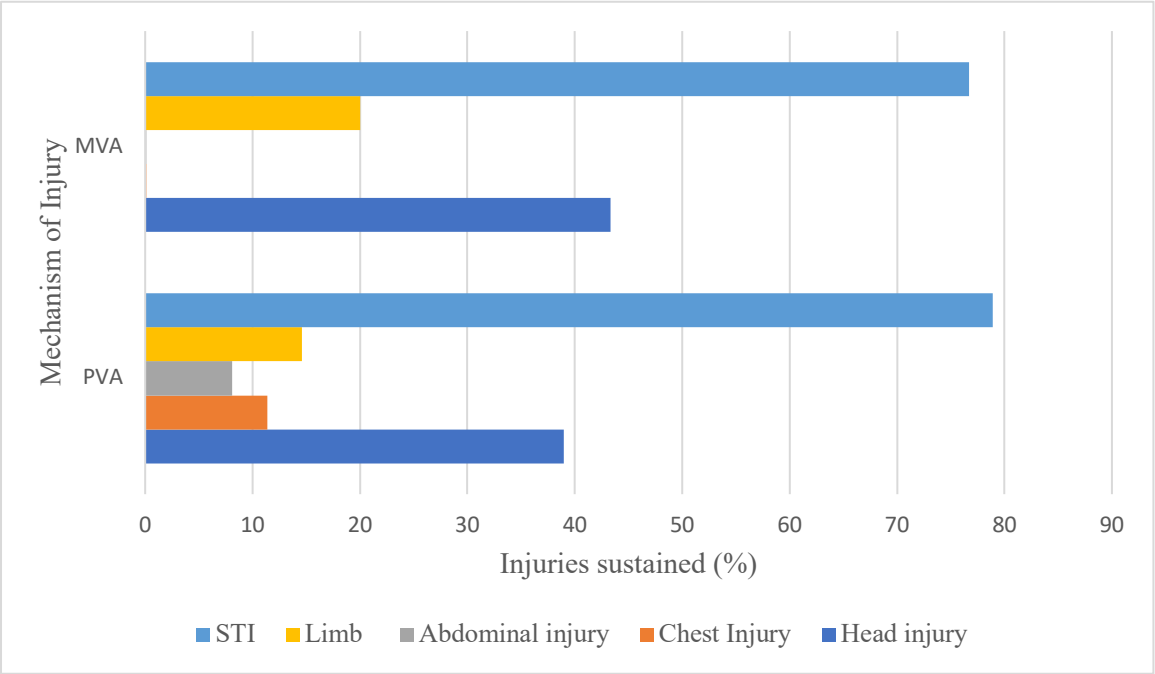

Figure 2. Injuries sustained according to mechanism of injury among ≤ 10yr old participants involved in road traffic accidents.

Abbreviations: MVA, motor vehicle accident; PVA, Pedestrian vehicle accident; STI, soft tissue injury.

Table 3. Surgery and speciality consultations among ≤ 10yr old participants involved in road traffic accidents.

Variable	All Patients (n=156)
Surgery	19 (12.2%)
Debridement/SSG	9 (47.4%)
Orthopaedics	8 (42.1%)
Neurosurgery	1 (5.2%)
Tracheostomy	1 (5.2%)
Speciality consult	
Orthopaedics	23 (41.8%)
Neurosurgery	22 (40.0%)
Maxfac	4 (7.3%)
Other	6 (10.9%)

Abbreviations: SSG, Split skin graft; Maxfac, maxillofacial.

CHAPTER 4. DISCUSSION

In total, 60.8% of children in this current study that were involved in PVAs were not accompanied by a responsible person of 16 years or older. Specifically in the PVA group, we found that the rate of head injuries was significantly higher in the group of children unaccompanied by an adult (44.4%) when compared to those being accompanied (20.7%, p = 0.037).

This is in line with other studies: a study in Malaysia found that parental supervision reduced the risk of children being injured in RTAs by 57% (14); another study in Canada found that lack of parental supervision increased the risk of injury to child pedestrians and cyclists by a factor of 2.6 (15).

This raises many questions regarding the lack of supervision of these young children on and around dangerous roads. One needs to ascertain the level of comprehension and understanding of traffic and road safety of a child aged 10 years or younger. As mentioned in the study by Wallace, & Spry, 2002, "The cognitive processes involved in judgement, decision-making, reasoning and impulse control at that age are rudimentary, thus increasing the vulnerability of children in that age group in the road environment" (16). There is not a pre-determined age at which a child can be said to be safe on and around roads and traffic. Young children are not able to comprehend and react to various traffic situations safely. They also have poor distance judgement and psychomotor abilities (16). Hence there should be supervision of these children when near to roads and traffic where an injury may occur. The mean age of children who were involved in PVAs that were unaccompanied was 5.0 years with a standard deviation of 2.4 while the mean age of children who were involved in PVAs that were accompanied was 4.3 years with a standard deviation of 2.8.

This current study showed that of the children involved in MVAs, 92% were unrestrained in the vehicle. This is higher than statistics shown in other comparable studies. A study in Singapore (21) showed a 63,3% unrestrained rate where as a study in USA, (17) had 2% of the involved children being unrestrained, although they also reported that a further 46% were inappropriately restrained. The mean age of the unrestrained children in MVAs was 4.2 years with a standard deviation of 2.9.

The legislation according to the National Road Traffic Act in South Africa as of 30 April 2015 states that "The driver of a motor vehicle operated on a public road shall ensure that an infant (0-3years) travelling in such a motor vehicle is seated on an appropriate child restraint…" , however this law does not apply to transportation of infants in a "minibus, or bus operating for

reward". The loophole here, is the fact that the community where this current study took place has a paediatric population that uses the local minibus/taxi as their main form of transportation. It also states that children between the ages of 3 and 14 years (or 1,5m tall) must be in a child restraint (car seat) if one is available, and that in the event of no car seat being available, the child should be strapped in with a seatbelt. It goes on to say that "…If no seat belt is available and the vehicle is equipped with a rear seat, the driver must ensure that the child is seated in the rear seat" (18).

There is a notable difference between what the South African law states and what is regarded as best practice worldwide. A safe child restraint needs to be based on the individual child's height, weight and age and cannot be categorised generally. (19) It has been shown that correctly installed and correctly positioned and secured, car seats can reduce infant road accident deaths by 70%. They can reduce deaths rates of children aged 1-4 years by 54% and reduce the incidence of significant injuries sustained by children aged 4-7 years by 59%. (20)

Snowdon et al. (2009) performed a study in Canada that evaluated the effectiveness of booster seat legislation on restraint use in motor vehicles among children aged 4–8 years old. They found that in the provinces with legislation in place, 91.9% of children were restrained, conversely, 84.4% of children in provinces without legislation were restrained. (22) This may indicate that perhaps laws and enforcement of the legislation may contribute to better use of child restraints in motor vehicles.

Soweto is a large township with a low socio-economic status which certainly influences the factors that may contribute to the children walking unaccompanied and travelling in vehicles unrestrained in our local environment. These factors were not investigated in this study. Nevertheless, through our experience in this setting, we believe that lack of adult supervision and adherence to road safety law may reflect lack of finance, lack of education, lack of awareness and lack of law enforcement. These are some of the many variants that contributes to the high number of children being injured on and around the roads in Soweto.

In the local community where the study was conducted, parents are often already at work during the early hours of the morning and until late at night and thus the children are left to travel to and from school on their own. This is a major problem to which a solution is not easy to come by.

There are various programmes being set up for Road Safety. Arrive Alive has "Freddy" the safety character to teach children about road safety. Also, a non-profit organization called

Childsafe and based in Cape Town, strives to create awareness and educate communities about child safety issues including road safety through events and campaigns. There are also Non-Governmental Organisations that arrange drives to collect used car seats that are in working conditions to supply to those in need.

This study reports that in the majority of children involved in RTAs, soft tissue injuries were sustained (78.9%) and a quarter (25.3%) of the children also sustained various cuts and open wounds with the laceration/abrasion rate of 22.9%

The head injury rate in this current study was 39.7% which explains the large number of brain CTs done in the study at 66.7%. With children, especially infants, the head trauma they may suffer may be a great deal more, especially due to the fact that their head region as their head takes up more of their total body weight.

A Global Childhood Unintentional Surveillance Study Survey conducted by WHO (7), which was undertaken in mostly in low- and middle-income countries, of injured children under the age of 12 years showed that, among those suffering road traffic injuries, concussion occurred in 26% and a further 3.2% sustained other head injuries. In comparison to this current study where there was a 20.5% concussion rate. This current study's concussion rate is thus at lower than this reported rate.

There also seems to be a low number of children who sustained fractures or other significant limb injuries, only 25 of the 156 patients sustained fractures (16%) which differs from the study by CJ Pretorius, GB Firth in 2009 (4) which shows that 13.4% of orthopaedic admissions from over a 3 year period were due to RTAs.

This current study showed that 65% of the children involved in the RTAs were boys. This is consistent with numerous other paediatric studies, although not directly comparable due to the fact that our study only included children ≤ 10years of age, that report a higher injury rate in males. This trend appears to continue into adulthood. (3,4,5,7,9,10,12,13). This may be due to the fact that boys display more risk-seeking behaviour in general, and have a greater affinity for competitive behaviour.

A study by Van As et al in 2014 (8) at Red Cross War Memorial Children's Hospital, which included 4690 patients, reported a mean age of children injured in RTAs as 6.3 years and that 40% of the presenting patients with RTA-related injuries were admitted. Where mean ages of children involved in RTAs range between 5 and 11 in the literature (1,4,9,10), we report a mean

age of 4.8 years, which is a younger population group. This could reflect the younger cut-off age of 10 years in the current study.

Globally, children involved in pedestrian accidents, form the largest category of those injured on the roads (2). This was reflected in the current study where 78.8% of the children were involved in PVAs. Nevertheless, the PVA rate is very high when compared to other international studies conducted in large urban cities, such as 28.5% in Singapore (9), 57% in Montreal (12) and 39% in multi-country global childhood unintentional injury surveillance conducted in Bangladesh, Colombia, Egypt and Pakistan (7).

Limitations of the study

Due to the nature of the study requiring casualty doctors, who are working in high volume emergency units, to collect data, a large number of patients with minor injuries, not requiring work up would have been missed. This would explain the 97% admission rate we showed. The full burden of children involved in RTAs was not completely assessed owing to the fact that children who sustained minor, or no injuries at all, may have been attended to at local clinics or not presented to a health care facility at all.

The exclusion of patients presenting to the orthopaedic department is a limitation of this study and as a result the fracture rate may be underestimated. Some patients with isolated limb injuries may have directly been admitted and managed by orthopaedic specialist departments.

Mortality was not investigated in this study and therefore not all RTAs included here are necessarily non-fatal. This would include children who succumbed to their injuries on scene or who were declared dead on arrival.

CHAPTER 5. CONCLUSION

RTAs are a leading cause of injuries and fatalities globally. Particularly in low income areas such as South Africa. Our study shows, along with other literature, that the paediatric population is at risk, specifically of being injured as a pedestrian. A wide variety of injuries are sustained by children on our roads, with the majority being soft tissue injuries followed by head injuries.

A major finding from this study is the lack of adult supervision of children 10 years and younger, on and around our roads in Soweto which, in turn, increases the rate of injuries sustained, specifically head injuries. In addition, the majority of children travelling in vehicles are not being restrained, both in private and public transport. This is something that needs to be addressed in our community.

Our study highlights the need for these outreach and educational programmes to continue to raise awareness and help to reduce the number of children injured on and around our roads.

REFERENCES

1. Global status report on road safety 2018: summary. Geneva: World Health Organization; 2018 (WHO/NMHNVI/18.20). License: CC BY- NC-SA 3.0 IGO, https://www.who.int/violence_injury_prevention/road_safety_status/2018/English-Summary-GSRRS2018.pdf, Last visit: 2020/05/12
2. D Bradshaw, D Bourne, N Nannan. Medical Research Council, "What are the leading causes of death among South African children?" *MRC Policy December 2003,vol 3*
3. MH Peclet, KD Newman, MR Eichelberger, et al. Patterns of injury in children. *Journal of Paediatric Surgery.* 1990 Jan;25(1):85-90.
4. CJ Pretorius, GB Firth (2009) Road traffic accidents and orthopaedic injuries in children. *SA Orthopaedic Journal 12/2009;9(3);65-68*
5. M Peden, K Oyegbite, J Ozanne-Smith et al. World Report on Child Injury Prevention. Geneva: World Health Organization; 2008.
6. AB van As, AJW Millar (2013). From the pursuit of excellence to the quest for significance: Promotion of a Childsafe South Africa. *SAMJ June 2012, Vol102;(6)427-428*
7. AA Hyder, DE Sugerman, P Puvanachandra et al. Global childhood unintentional injury surveillance in four cities in developing countries: a pilot study. *Bulletin of the World Health Organization* 2009;87:345-352. doi: 10.2471/BLT.08.055798
8. Child road traffic crash injuries at the Red Cross War Memorial Children's Hospital in Cape Town, South Africa in 1992, 2002 and 2012, *International Journal of Injury control and Safety Promotion*. 2015;22(4):352-8. doi: 10.1080/17457300.2014.912236. Epub 2014 Jun 4.
9. YY Lee, E Fang, Y Weng et al. Road traffic accidents in children: the 'what', 'how' and 'why'. *Singapore Med J*, 2018 April; 59(4): 210-216
10. Durkin MS, Laraque D, Lubman I, Barlow B. Epidemiology and prevention of traffic injuries to urban children and adolescents. Pediatrics. 1999 Jun;103(6):e74. DOI: 10.1542/peds.103.6.e74.
11. S Burrows, A van Niekerk, L Laflamme. Fatal injuries among urban children in South Africa: risk distribution and potential for reduction; *Bulletin of the World Health Organization* 2010;88:267-272. doi: 10.2471/BLT.09.068486
12. Pless IB, Verreault R, Arsenault L, Frappier JY, Stulginskas J. The epidemiology of road accidents in childhood. Am J Public Health. 1987;77:358–60

13. FP Rivara, M Barber. Demographic analysis of childhood pedestrian injuries. *Pediatrics* 1985 Sep;76(3):375-81
14. Fatimah M, et al. The risk of road traffic accidents among primary school children in Kuala Terengganu. Medical Journal of Malaysia. 1997;52:402–408.
15. IB Pless, R Verreault, S Tenina. A case control study of pedestrian and bicyclist injuries in childhood. *American Journal of Public Health*. 1989; 79:995-998.
16. MS Zeedyk, L Wallace,L Spry. Stop, look, listen, and think? What young children really do when crossing the road. *Accident Analysis and Prevention*. 2002;34:43–50
17. Chen IG, Durbin DR, Elliott MR, Kallan MJ, Winston FK. Trip characteristics of vehicle crashes involving child passengers. Inj Prev. 2005;11:219–24
18. Car Seats for Children and Road Safety in South Africa, Arrive alive website, https://www.arrivealive.co.za/Car-Seats-for-Kids-and-Road-Safety-in-South-Africa, Last visit: 2020/05/14
19. Law vs. best practice in child restraints, Nov 10, 2016, Car Seat Safety, Amie Durocher**,** Creative Director at Safe Ride 4 Kids and certified CPS Tech since 2004
20. S Zaza, DA Sleet, RS Thompson et al. Reviews of evidence regarding interventions to increase use of child safety seats. Am J Prev Med. 2001 Nov;21(4 Suppl):31-47
21. M S Durkin, D Laraque, I Lubman et al. Epidemiology and Prevention of Traffic Injuries to Urban Children and Adolescents; *Pediatrics* June 1999, 103 (6) e74; DOI: 10.1542/peds.103.6.e74
22. Snowdon A, Rothman L, Slater M, Kolga C, Hussein A, Boase P. Howard a. A comparison of booster seat use in Canadian provinces with and without legislation. Inj Prev. 2009;15:230–3. https://doi.org/10.1136/ip.2008.020537. Last visit 07/11/2020

APPENDIX 1: Approved Protocol

Title:

Evaluation of the injury pattern and outcome of paediatric patients involved in road traffic accidents in Soweto

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Introduction:

Background:

According to the WHO approximately 1.24 million people die each year as a result of road traffic accidents (RTA) and more than 90% of these deaths occur in the low- and middle-income countries of the African and Eastern Mediterranean regions.

Injury and violence are the major killers of children throughout the world, responsible for approximately 1 million deaths of children under the age of 18 (WHO Global Burden of Disease 2004) with accidental injuries, including road traffic accidents, accounting for almost 90% of these cases, and the remainder due to violence or maltreatment.

Peclet et al in their article "Patterns of injury in children" - identified trauma as the leading cause of death for children over 1 year of age (1). Injuries sustained by motor-vehicle accident occupants, and pedestrians account for the greatest number of deaths and continue to be a leading cause of death and disability for children. (1)

The latest statistics from Arrive Alive - report 1098 fatalities from RTA from 1 Nov 2011 – 31 March 2012. Although exact, up-to-date statistics are difficult to come by, it has been reported that more than 17 000 people are killed on the roads each year in South Africa and no data is available to show how many of these fatalities were children.

WHO data published in April 2011 showed that RTA deaths in South Africa reached 8 646 or 1, 45% of total deaths. This ranks South Africa number 72 in the world. (2)

According to the South African Injury Mortality Survey of 2009, 2 247 children under the age of five died of non-natural causes in 2009. Of these, 741 were RTA related deaths.

Road traffic deaths therefore made up almost a third of the non-natural, or injury-related, deaths. This translated to just over two children under five dying on the roads every day that year. (3)

The exact epidemiology regarding RTA injuries in the South African paediatric population is not known. There is a paucity of published data regarding this patient population in our local

environment. The statistics, patterns and severity of injuries, as well as the outcomes of children involved in road traffic accidents are hard to come by.

Literature Review:

Trauma is known to be a major burden of disease in SA and children are majorly affected. Research shows that a child growing up in Cape Town is 25 times more likely to be admitted to hospital with an injury than a child growing up in the UK and hence there is a perception that the incidence of RTA-related injuries in the paediatric population in Gauteng is high too, but very little local data is available to support or refute this perception.

This study highlights that injury of children is a major public health problem and that there should be more focus on awareness and education to the communities and parents regarding this "neglected childhood killer disease".

The MRC of South Africa reports that 23% of all deaths in children aged five to 14 years are the result of injury – especially pedestrian injury and passenger injury. In Gauteng, the country's most populated, but geographically smallest province, 1 513 children died in traffic accidents between 2008 and 2011. Of these, 348 were passengers; the remainder were pedestrians. Road traffic injuries accounted for the largest proportion of deaths in the preschool and school age groups. In the children of school going age, traffic-related injuries were the most common type of injury, accounting for half of school age deaths (50.9%) (4)

The MRC also found that RTA's were the 9th leading cause of death in children under the age of 5 in South Africa in the year 2000 and were the leading cause of death in that same year for children between the ages of 5-14 years. This was twice the global rate that year. (4)

A study by Van As et al in 2014 - (5) at Red Cross War Memorial Children's Hospital, which included 4690 patients, found that the mean age of the children injured in RTAs was 6,3 years and that 40% of the patients presenting with RTA related injuries were admitted. Their study showed that the age, gender, cause, place and severity of road traffic related injuries has remained unchanged from 1992 – 2012.

A retrospective study by Pretorius et al. (2009) (6) of documented admissions to the paediatric orthopaedic ward at Chris Hani Baragwanath Academic Hospital, over a three year period, showed that 13,4% of the total admissions to their orthopaedic ward of children under 14 years, was due to road traffic accidents. Patients between the ages of 4 and 8 had highest frequency of injuries sustained in road traffic accidents. Their data compared with that of the UK - found that road traffic accidents in UK accounted for only 7% of paediatric fractures, HALF the incidence of the Soweto population.

AIM:

The aim of the study is to evaluate the aetiological spectrum, injury characteristics and treatment outcome of paediatric patients involved in road traffic accidents, presenting to a Gauteng Tertiary Hospital in Soweto.

The study objectives will be to determine:

- Number of paediatric patients presenting to Chris Hani Baragwanath Academic Hospital (CHBAH) after being involved in a road traffic related accident.
- Age of these paediatric patients
- Gender distribution of these patients
- Mechanisms of the sustained injuries
- Severity of sustained injuries
- Outcome following the accident:
    - Did the patient require admission to ward or intensive care
    - Did the patient require surgery
    - Did the patient require another speciality consultation
    - Death

Study Population:

All patients under the age of 10 years seen at CHBAH having been involved in a Road traffic accident of any kind will be included in the study. Expecting a number of no less than 200 patients to be included in the study. Patient data collection will be collection for a duration of 1 year.

The mortality statistics of the children under 10 who demised in RTAs will be collected from the mortuary for the allocated time frame.

Study design:

Prospective, descriptive, hospital based study.

Data Collection:

A questionnaire to be completed by the admitting and treating doctor

The researcher will train the doctors involved and provide an outline of research questions and parameters

The questionnaire will be pilot studied initially

The questions are depicted below and are based on previous international studies on similar data (Appendix 1)

The variables will be stratified to determine a statistically significant p value with a confidence interval > 95%. Intergroup and intragroup analysis will be done.
The statistical program Statistica will be used to analyse the data once collection is complete. Variables and outcomes will be formatted into various tables and charts to adequately display the information. At all stages of the study, data capturing will be verified by the study supervisor.

Questionnaire Outline:

The datasheet will state details regarding:

- Age and gender
- Mechanism of injury
- Class of vehicle (private, taxi, bicycle etc)
- Restrained or not
- Accompanied by an adult or not
- Clinical presentations
- Injuries sustained
- Investigations done
- Procedure followed – including discharge, admission, surgery, ICU admission etc.

Consent:

Informed consent will be obtained from the child's caregiver or parent, according to the standards set out by the legislation in South Africa and under the guidelines and standards of the ethics committee of the University of the Witwatersrand.
This consent shall be obtained as soon as the legal guardian of the child is available.
A data collection tool in the form of a questionnaire will be filled out by the doctor who sees the patient initially and then by any doctor who sees the child subsequently.

Ethics:

In terms of ethical issues faced during this study:
Only folder numbers and not names will be used in this study, and therefore confidentiality will be upheld.
An application for ethics approval will be obtained from the Human Research Ethics Committee (HREC) of the University of the Witwatersrand.

In terms of beneficence, this study should assist us in determining the burden of road traffic related injuries to children and assist in creating awareness to the community about this potentially preventable cause of morbidity and mortality.

In terms of maleficence, no harm will come to any patients involved in this study.

It is an inexpensive study and will provide health care professionals with data and statistics that are currently not available in this population of patients.

Approximate timeline:

PROCESS			Aug-Sep 2015	Oct 2015	Feb2016-Feb 2017	Mar 2017	July 2017	Aug 2017
Project idea	X							
Literature review	X	X						
Prepare protocol		X	X					
Protocol deadline				26 Oct 2015				
Protocol assessment				18 Nov 2015				
Ethics application								
Collecting data					x			
Data analysis						x	x	
Writing up - thesis						x	x	x
Writing up – paper								x

Potential problems:

- Time period for data collection - 1 year
- Consent if no family member available –Consent will be taken during admission– if not given will be documented and patient excluded from study

References:

1. MH Peclet, KD Newman, MR Eichelberger, CS Gotshell, PC Guzzetta, KD Anderson, VF Garcia, JG Randolph, Bowman LM. Patterns of injury in children. *Journal of Paediatric Surgery. 1990 Jan;25(1):85-90*
2. World Health Organization, W. (2008). World report on child injury prevention. *Geneva, Switzerland*, 1–212. http://doi.org/10.1136/ip.2007.018143

3. Matzopoulos, R., Prinsloo, M., Bradshaw, D., Pillay-van Wyk, V., Gwebushe, N., Mathews, S. Abrahams, N. (2013). *The Injury Mortality Survey: A national study of injury mortality levels and causes in South Africa in 2009*.
4. D Bradshaw, D Bourne, N Nannan. Medical Research Council, "What are the leading causes of death among South African children?" *MRC Policy December 2003,vol 3*
5. AB van As, AJW Millar (2013). From the pursuit of excellence to the quest for significance: Promotion of a Childsafe South Africa. *SAMJ June 2012, Vol102;(6)427-428*
6. CJ Pretorius, GB Firth (2009) Road traffic accidents and orthopaedic injuries in children. *SA Orthopaedic Journal 12/2009;9(3);65-68*
7. R Norman, R Matzopoulos, P Groenewald, D Bradshaw. The high burden of injuries in South Africa, WHO.
8. F Parkinson, S Kent, C Aldous, G Oosthuizen, D Clarke. Road traffic crashes in South Africa: the burden of injury to a regional trauma Centre. *South African Medical Journal.2013 Sep 30;103(11):850-2*
9. **R Simon, J M Gilyoma, R M Dass, M D Mchembe**and **PL Chalya.**Paediatric injuries at Bugando Medical Centre in Northwestern Tanzania: a prospective review of 150 cases.*Journal of Trauma Management & Outcomes* 2013, **7**:10
10. R S Moore, CL Summers, M Jackson, B Tesfayohannes. (1994) Paediatric road accidents in two health districts. *J AccidEmerg Med 1994 11:109-111*
11. HK Herbert, AB van As, AM Bachani, P Mtambeka, KA Stevens, AJ Millar, AA Hyder (2012). Patterns of paediatric injury in South Africa: An analysis of hospital data between 1997 and 2006. *J Trauma Acute Care Surg. 2012 Jul;73(1):168-174*

APPENDIX 2: Datasheet

Pediatric Road Traffic Accident Datasheet	Date: _____ Time: _____h_____ Patient Name: _____ Patient Number: _____ Patient Age: _____ Gender: _____ Study Number: _____

Mechanism of Injury:

MVA ☐ PVA ☐ Other ☐

_____

Accompanied at time of accident by an adult (Person over 16 years of age):

YES ☐ NO ☐

Vehicle Class:

Private Vehicle ☐ Taxi ☐ Bus ☐ LDV (Bakkie) ☐ Motorbike ☐

Bicycle ☐

Other ☐ _____

Restrained:

YES ☐ NO ☐ N/A ☐

Injuries:

GCS at presentation /15 Resus bay ☐ Intubated ☐

Injury: ☒ or☑ **Details:**

Soft Tissue injury ☐ _____

Head Injury ☐ _____

Chest Injury ☐ _____

Abdominal Injury ☐ _____

Limb Injury ☐ _____

Investigations:

X - Rays ☐ _____

CT Scan ☐ _____

Care:

Discharged from Casualty ☐ _____

Out-patient Care ☐ _____

☒ or☑

Details:

Admission - Ward ☐ _____

Admission - ICU ☐ _____

Surgery ☐ _____

Other speciality consulted ☐ _____

Additional Notes:

_____

_____

_____

_____

_____

_____

_____

Completing Doctor's Details: _____

APPENDIX 3: Ethics Clearance Certificate

R14/49 Dr Jo-Anne Carreira

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160451

NAME: (Principal Investigator)	Dr Jo-Anne Carreira
DEPARTMENT:	Surgery Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	Evaluation of the Injury Pattern and Outcome of Paediatric Patients involved in Road Traffic Accidents in Soweto
DATE CONSIDERED:	06/05/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Jerome Loveland
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	16/08/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004,10th floor, Senate House/3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review April and will therefore be due in the month of April each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES