



Preventable Trauma Deaths in Ibadan: A Comparison of Revised Trauma Score and Panel Review

*Les Cas De Deces Par Traumatisme Evitables A Ibadan:
Une Comparaison Des Scores Traumatisme Revise Et D'un Comite D'etude*

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ABSTRACT

BACKGROUND: The proportion of preventable trauma-related deaths may be a reflection of the quality of trauma care in a health institution.

OBJECTIVE: To classify mortality in trauma patients in the emergency room and to determine the proportion of preventable trauma related mortality in a teaching hospital.

METHODS: The records of patients who died in the emergency room following trauma from January 1996 to December 2005 were reviewed. Data extracted from the patients' records included the demographics, the mechanism of injury; and the duration of injury prior to presentation. The Probability of Survival (Ps) was calculated for each patient using the Revised Trauma Score (RTS). The RTS includes three physiologic parameters namely the Glasgow Coma Score [GCS], systolic blood pressure and respiratory rate which were recorded soon after the patient's presentation at the emergency department.

RESULTS: There were 286 patients who died following trauma from January 1996 to December 2006. There was a male:female ratio of 3.4:1. Eighty-one percent were preventable deaths based on the revised trauma score while the panel review considered approximately 22% as preventable. Fifty-nine percent or 168 of the patients arrived in the hospital within six hours of sustaining injury.

CONCLUSION: Despite access to emergency care within the first six hours (golden hours) the overall survival of our trauma patients is poor. The severity of the injuries, inadequate resuscitation, and missed injuries by medical personal are some of the factors associated with poor outcome of trauma care. *WAJM 2011; 30(1): 9–13.*

Keywords: Trauma, Outcome, Mortality, Trauma Score, Panel Review, Ibadan, Nigeria.

RÉSUMÉ

CONTEXTE: La proportion de décès évitables liés à un traumatisme peut être un reflet de la qualité des soins en traumatologie dans un établissement de santé.

OBJECTIF: Définir la mortalité chez les patients reçus pour traumatisme dans la salle d'urgence et déterminer la proportion de décès par traumatisme évitables dans un hôpital d'enseignement.

METHODES: Les dossiers des patients qui sont décédés dans la salle d'urgence suite à un traumatisme de Janvier 1996 à Décembre 2005 ont été examinés. Les données extraites des dossiers des patients incluaient la démographie, le mécanisme de la blessure et la durée de blessure avant la prise en charge. La probabilité de survie (Ps) a été calculée pour chaque patient en utilisant le Score Traumatisme Révisé (RTS). Le RTS comprend trois paramètres physiologiques à savoir le score de Glasgow [SGC], la pression artérielle systolique et la fréquence respiratoire qui ont été enregistrés peu de temps après l'admission du patient à l'urgence.

RÉSULTATS: Il y avait 286 patients qui sont morts suite à un traumatisme de Janvier 1996 à Décembre 2006. Il y avait un ratio hommes / femmes de 3,4:1. Quatre-vingt-un pour cent étaient des décès évitables en fonction du Score Traumatisme Révisé alors que le comité d'étude en a estimé environ 22% comme évitables. Cinquante-neuf pour cent ou 168 des patients étaient admis à l'hôpital dans les six heures suivant leur traumatisme.

CONCLUSION: En dépit de l'accès aux soins d'urgence dans les six premières heures (heure d'or), la survie globale de nos patients traumatisés est mauvaise. La gravité des blessures, la réanimation insuffisante, et les blessures non décelées par le personnel médical, sont certains des facteurs associés aux mauvais résultats des soins en traumatologie. *WAJM 2011; 30 (1): 19–23*

Mots-Cles: Traumatisme, Evolution, Mortalite, Score Traumatisme Revise, Groupe D'etude, Ibadan, Nigeria.

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Abbreviations: APACHE, Acute Physiological and Chronic Health Evaluation; GCS, Glasgow Coma Score; PP, Probably Preventable Death; Ps, Probability of Survival; PTD, Preventable Trauma Death; PV, Preventable Death; RTA, Road Traffic Accident; RTS, Revised Trauma Score; UCH, University College Hospital.

INTRODUCTION

The increasing expectancy of quality of healthcare has necessitated various strategies in assessing the quality of service in all the facets of healthcare; trauma care being inclusive. Trauma is the commonest cause of death in the third and fourth decades of life and the second commonest cause of death in the general population.¹ Early studies of trauma-associated death led to the development of effective trauma systems in developing nations. In the University College Hospital (UCH) Ibadan Nigeria, trauma is only slightly exceeded as a cause of death in the general population by some chronic medical conditions such as hypertension and diabetes.² One of the indices of the quality of trauma care is the proportion of trauma associated deaths which is considered preventable.³ Preventable trauma death (PTD) is defined generally as death which could have been avoidable if the patient had access to optimal care. In some other studies PTD has also been defined as death occurring despite a high calculated probability of survival (Ps).³

The classic description of the pattern of trauma related deaths is trimodal. This comprises of "Immediate, Early and Late death". 'Immediate death'⁵ occurs immediately after trauma and is often due to non-salvageable injuries such as injuries to great vessels. 'Early' death which occurs within the first six hours is often due to progressive haemorrhagic injuries and expanding pneumo-haemothorax. The third peak 'Late death' occurs days to weeks after the injury and is secondary to sepsis and organ failure.⁵ While the first peak is reducible by instituting preventive measures, the concept of preventable trauma death is related to early trauma associated death. These mortalities may be avoidable if life threatening injuries were promptly identified and treated.

Consequent upon the development of the concept of PTD many studies have evaluated patterns of preventable trauma death, using different methods. These include panel reviews of post mortem findings by constituted groups of doctors in various specialties, comparing patient outcome with calculated probability of survival based on an injury scoring systems^{6,7,8} and population based studies.^{9,10}

The objective of this study was to describe the pattern of trauma-associated deaths and to compare the proportion of trauma-related deaths using calculated probability of survival and the panel review methods.

SUBJECTS, MATERIALS, AND METHODS

The University College Hospital Ibadan (UCH) is the only tertiary health institution in Oyo State of Nigeria with a 900-bed capacity. It serves as a referral hospital to other hospitals in Oyo state and neighboring states. The surgical specialties available include cardio-thoracic and vascular surgery, general surgery, orthopedic, neurological and urologic surgery. This was a study reviewing the records of all cases of trauma associated deaths in the Accident and Emergency Department of the University College Hospital (UCH), Ibadan, Nigeria over a ten-year period from January 1996 to December 2005.

All patients who died of trauma-related injuries at UCH within this period were included in the study. All patients who were dead on arrival at the accident and emergency department and patients who did not have an autopsy performed on them after death were excluded from the study. Data extracted from the patients' records included the demographics, the mechanism of injury; and the duration of injury prior to presentation. The Probability of Survival (Ps) was calculated for each patient using the Revised Trauma Score (RTS). The RTS includes three physiologic parameters namely the Glasgow Coma Score [GCS], systolic blood pressure and respiratory rate which were recorded soon after the patient's presentation at the emergency department. The RTS is unable to accurately score patients with endotracheal. Other scoring systems such as acute physiological and chronic health evaluation (APACHE) score could not be used due to inadequate recorded physiologic parameters in their records.

The autopsy findings were extracted from the postmortem records and were reviewed by a panel consisting of a surgeon, an anesthetist and a pathologist to decide if the death was preventable,

probably preventable or non-preventable death. The cases were analyzed by the mechanism and the anatomical sites of injury.

Preventable death (PV) for the purpose of this study was defined as death from injuries which are considered curable or reversible with the existing facilities and manpower in this hospital by the panel or death in patients with the calculated probability of survival Ps above 50%. Probably Preventable death (PP) is regarded as mortality following severe injury, which may have been curable or reversible under optimal circumstances or death occurring in patients with a calculated Ps between 25% and 50%. Non-preventable death was defined as mortality in patients with such severe injuries that were currently not survivable or reversible or death in patients with a calculated Ps of 25% and below. The results of the panel review study were compared with that of the RTS based study.

Statistical Analysis

Data was analyzed using Statistical package for social sciences version 15 (SPSS 15.0) Percentages were compared using the Pearson Chi-Square test while the one way analysis of variance (ANOVA) was used to assess for association between calculated probability of survival and the result of the panel review. A P-value of < 0.05 was considered statically significant.

RESULTS

There were 286 who satisfied the eligibility criteria with a mean age of 32.43 ± 16.61 years.

Table 1: Distribution of Deaths by Mechanism of Injury

Cause	N (%)
Assault	4.7
Gunshot	9.4
Motor Accidents	72.1
Falls	6.9
Industrial Accidents	2.5
Miscellaneous	2.5
Fire Accidents	4(1.4)
Sports Injuries	0.4

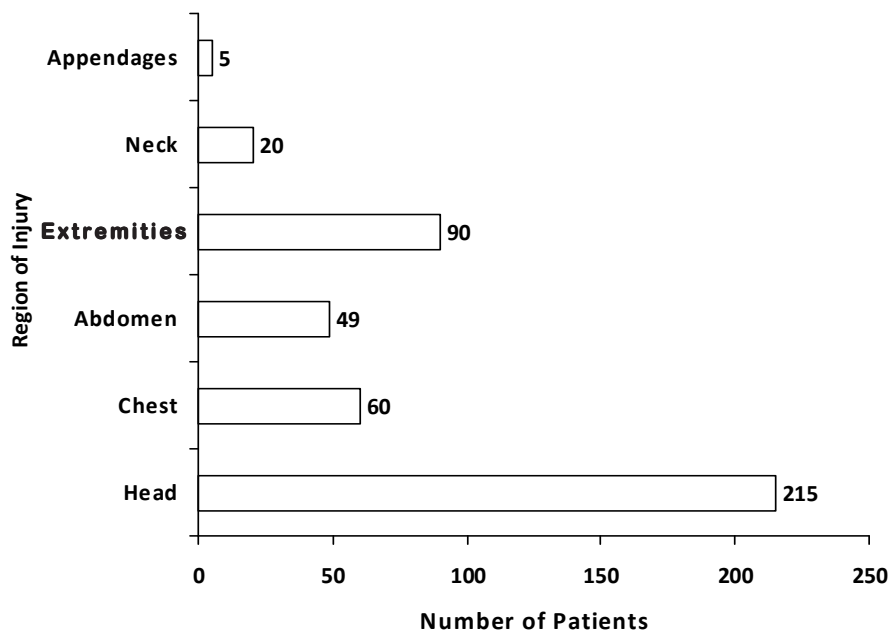


Fig. 1: Distribution of Patients by Site of Injury as Found at Autopsy

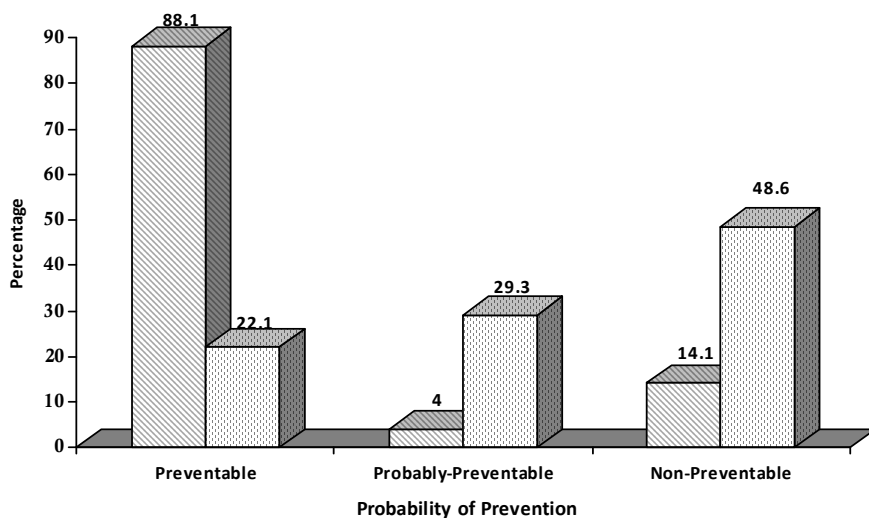


Fig. 2: A comparison of classification based on probability of survival with results of a panel review. Ps Panel Rev.

The male: female ratio was 3.4: 1 with mean ages of 32.2 and 32.7 years respectively. The mechanism of injury is shown in Table 1. The commonest mechanism of injury across both sexes and all age groups was Road Traffic Accident (RTA). There was a significant increase in the proportion of gunshot injuries and assault in males compared to females (11% vs 1.6%; 5% vs. 1.6%) respectively. A review of the female population showed a larger percentage

of RTA related deaths than in the male population.

Anatomical Region

The anatomical regions of injury were divided into the head, neck, chest, abdomen, extremities (limbs) and integuments (skin). The most frequent anatomical site of injury was the head (Fig. 2). Sixty-two percent of the patients sustained injuries in more than one anatomical region. There was a significant

difference in the distribution of anatomical regions of injury between sexes. There were higher proportions of head and extremity injuries among the females than males (87.7% vs. 75.6%) but chest injury was more in males than females (24.4% vs. 13.8%) respectively.

Revised Trauma Score

The complete set of parameters required for RTS calculation was available in only 99 patients for which the probability of survival (Ps) was calculated. Based on the Ps, 14% was Non-preventable death (i.e. Ps below 25%), 4% was Probably-preventable (i.e. Ps between 25 and 50%) while 81% was Preventable (i.e. Ps of 50% and above).

Panel Review

The result of the panel consensus on the other hand revealed that 48.6% of the mortalities were non-preventable deaths while only 22.1% were considered as preventable (Fig. 2).

Age and Injury-Admission Interval

A review of the age specific pattern of preventable death shows a relatively uniform distribution among all age groups with a slight increase in patients less than ten years (Fig. 3). Fifteen percent of the patients arrived in the emergency room within one hour of the injury while a total of fifty nine percent (59%) of the patients arrived in the emergency room within six hours of sustaining injuries.

DISCUSSION

Infectious diseases have been gradually surpassed by trauma as the leading cause of death in developing countries with Nigeria inclusive.¹¹ The high incidence of trauma associated admissions in Nigerian teaching hospitals is well documented.^{1,3} In Ibadan, trauma patients constitute about 30% of the 7,000 annual admissions in the Accident and Emergency Department of the University College Hospital which serves Oyo state and its environs with an average population of about 15 million.¹ Trauma disproportionately affects the young and productive age group of the society (the third and fourth decades of life) as demonstrated in our results.¹² Several preventable trauma related deaths studies

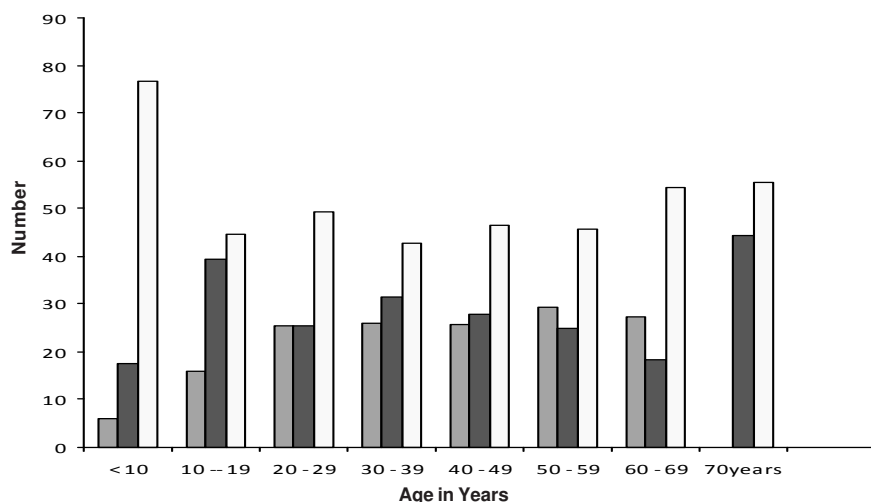


Fig. 3: Distribution of deaths by age and probably by dying ■ Preventable% ■ Probably Preventable% ■ Non-Preventable%

have been conducted and these studies have varied definitions of target population and in the definition of ‘preventable’ In organized trauma care systems which exists in many developed nations, there is adequate triage and resuscitation at the scene of the accidents, rapid transportation to appropriate hospitals, and aggressive surgical management followed by intensive care and subsequent rehabilitation. Secondly the concept of regionalization of trauma care with designated centers for trauma care has reduced trauma related mortalities in the developed countries.¹³ Literature search found an unexpected low incidence of PTD in high volume teaching hospitals and a surprising high incidence of PTD in lower volume community hospitals.¹⁴ In Nigeria however, these two concepts are not yet established and thus level of trauma care is still suboptimal.

The commonest cause of trauma associated death is Road Traffic Accident which is similar to findings in other developing countries^{15, 16}. Accident victims are usually taken to the nearest hospitals which are often inadequately staffed and poorly equipped small private hospitals. This causes a delay in the access to appropriate trauma care with a resultant increase in mortality especially in that category of patients in the second peak whose deaths may have been preventable.

Our results indicate a poor level of performance in the management outcome of patients with preventable and probably

preventable deaths. Eighty-one percent preventable of deaths by RTS and 28% by panel review indicate an unacceptably high trauma-associated death rate in our country. Secondly while RTA is the commonest cause of death in both sexes, assault and gunshot injuries have a higher incidence in men. Head injuries were the most common injuries associated with death. A further analysis showed a higher proportion of extremity injuries in females while chest injuries are more frequent in males. This may be explained by the fact that most of the drivers sustaining chest injuries were male. Occupational injuries or industrial accidents are rare in this environment compared with developing nations.¹⁷

Comparison of Consensus Panel and RTS

To reduce the element of bias in the definition of ‘preventable’ we compared results of the consensus panel opinion on preventable deaths with that based on the RTS. These two methods of classification revealed a significant difference in the distribution of deaths. A significant proportion of patients had high RTS indicating high probability of survival. This did not tally with the outcome of the consensus of the panel. The RTS is a physiologic assessment based on the clinical status of the patient in the field or at the emergency room. This score is subject to inter observer variations¹⁸ and so the panel review in this study may be a more practical and

objective measure of survival chances following trauma in a developing country due to limited ability to measure required physiological parameters in trauma patients. These results demonstrate the inadequacy of RTS as it suggests an underestimation of the severity of injury of the patients.

High Proportion of Preventable Deaths

A review of the injury-admission interval reveals that 41% of the patients were admitted to the casualty more than six hours after their injury suggesting that the effect of secondary injury on the physiological state of the patients would have set in. The proportions of overall preventable deaths in this study based on the Ps and panel review were 86% and 51.4% respectively. This high proportion of preventable death is similar to figures from Pakistan¹⁹ which is also a developing country. It is however unacceptably high when compared with the figures from Poland, Singapore and Michigan^{20, 21} of 11.9%, 22.9%, and 27.7% respectively.

Conclusion

The epidemic of trauma affects the same age group globally. There is a high rate of preventable trauma-associated deaths in Ibadan. Similar to other countries of the world road traffic accidents constitute the commonest cause of trauma related deaths. Gunshot injuries are a distant second cause of death. Reduction in the rate of road traffic accidents will definitely reduce the incidence of trauma -related deaths. It has been demonstrated that there is delayed assess to appropriate trauma care. The relatively high proportion of avoidable deaths is a significant unacceptable outcome in the unorganized trauma system. It suggests deficiencies in our health-care system. Therefore appropriate measures must be instituted to ensure that trauma victims can assess the health care system early and that health care workers functioning in the emergency departments need to possess basic skills in trauma care. Finally policies need to be put in place to reduce the incidence of Road Traffic Accidents which are the commonest cause of trauma related deaths. One of the limitations of this study is the poor documentation of patients’

physiological parameters by the emergency department staff. This is responsible for the small proportion of patients with calculated probability of survival. Even though the emergency department is busy, doctors and nurses should endeavor to make adequate documentation of patients; records.

Competing interests.

The authors declare that there are no competing interests.

REFERENCES

1. Fingerhut LA, Warner M, Cox C. Injury Chartbook. Health, United States, 1996-1997, Hyattsville, MD: *National Center for Health Statistics*; 1997.
2. Afuwape O.O, Alonge T.O, Okoje VN. Pattern of the cases seen in the Accident and Emergency Department in a Nigerian Tertiary Hospital over a Period of Twelve Months. *NPMJ* 2007 14: 302-5.
3. Osvaldo C, Stefania C, Alessio P, Sergio V Preventable trauma deaths: from panel review to population based-studies. *World Journal of Emergency Surgery* 2006,1:12doi:10.1186/1749-7922-1-12. Available on <http://www.wjes.org/content/1/1/12>
4. Solagberu BA, Duze AT, Ofoegbu CP, Adekanye AO, Odelowo EO. Surgical morbidity and mortality pattern in the Accident and Emergency room. A preliminary report. *Afr J Med Sci* 2000; **29**: 315-318.
5. Trunkey DD. Trauma. *Sci Am* 1983; **249**: 28-35.
6. Mackenzie EJ. Review of evidence regarding trauma system effectiveness resulting from panel studies. *J Trauma* 1999; **47**: S34-S41.
7. Champion HR, Copes WS, Sacco WJ, Lavnick MM, Keast SL, Bain LW, *et al*. Major trauma outcome study: establishing national norms for trauma care. *J Trauma* 1990, **30**: 1356-1365.
8. Boyd CR, Tolson MA, Copes WS: Evaluating trauma care: the TRISS method. *J Trauma* 1987; **27**: 370-378.
9. Eastman AB: Blood in our streets. The status and evolution of trauma care systems. *Arch Surg* 1992, **127**: 677-81.
10. Mullins RJ, Mann NC Mullins RJ, Mann NC. Population-based research assessing the effectiveness of trauma systems. *J Trauma* 1999; **47**: S59-S66.
11. Afuwape OO, Ogunlade SO, Alonge T, Ayorinde OR. An audit of deaths in the emergency room in the University College Hospital Ibadan. *NJCN* 2009; **12**: 138-140.
12. Osime O.C, Ighedosa U.S, Oludiran O.O E.T. Patterns of trauma deaths in an accident and emergency unit. *Prehospital and Disaster Medicine*.2007: 75-78.
13. Leong APK, Wong SC, Tay BK, Chao TC. Preventable trauma death in Singapore. *Singapore Journal of Medicine* 1987; **28**: 244-247.
14. Homer T, Peter TYC, Frederick B. Major Trauma. *Current Orthopaedics* 2004; **18**: 304-7.
15. Meel BL. Pre-hospital and hospital traumatic deaths in the former homeland of Transkei. *South Africa. J Clinical Forensic Med* 2004; **11**: 6-11.
16. McDonald AH. Trauma care in Jamaica. A time for decision. *West Indian Med J* 2002; **51**: 167-70.
17. Santana VS, Araujo-Filho JB, Silva M. Mortality, years of life lost, and incidence of occupational accidents in the State of Bahia, Brazil. *Cad Saude Publica*. 2007; **23**: 2643-52.
18. Paul Jennings. A critical appraisal of the Revised Trauma Score. *JEPHC*; 2, 1-2, 2004. Available from http://www.jephc.com/issue_contents.cfm
19. Jat AA, Khan MR, Zafar H, Rajah AJ, Hoda Q. Rehmani R, *et al*. Peer review audit of trauma deaths in a developing country. *Asian J Surg* 2004; **27**: 58-64.
20. Iau PT, Ong CL, Chan ST. Preventable trauma deaths in Singapore. *Aust N Z J Surg*. 1998; **68**: 820-5.
21. Maio RF, Burney RE, Gregor MA, Baranski MJ. A study of preventable trauma mortality in rural Michigan. *J Trauma*. 1996; **41**: 83-90.