

Utilisation of a Level 1 Trauma Centre in KwaZulu-Natal: Appropriateness of Referral Determines Trauma Patient Access

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Abstract

Background Appropriate referral of major trauma patients to an accredited Level 1 Trauma facility is associated with improved outcome. A new Level 1 Trauma Centre was opened at Inkosi Albert Luthuli Central Hospital in March 2007. This study sought to audit the referral pattern of external consults to the trauma unit and ascertain whether the unit was receiving appropriate referrals and has adequate capacity.

Methods An audit was performed of the referral proformas used in the unit to record admission decisions and of the computerised trauma database. The audit examined referral source (scene vs. interhospital), regional distribution, and final decision regarding admission of the injured patients. The study was approved by the UKZN Ethics Committee (BE207/09 and 011/010).

Results Of the 1,212 external consults, 540 were accepted for admission while the rest were not accepted for various reasons. These included 206 cases where no bed was available, 233 did not meet admission criteria (minor injury or futile situation), and 115 were for subspecialty management of a single-system injury. Finally, 115 were initially refused pending stabilisation for transfer at a regional facility. Twenty-six percent of the cases were referrals from the scene, with an acceptance rate of 96 %. Most patients (59 %) were from the local eThekweni region.

Conclusion Major multiorgan system trauma remains a significant public health burden in KwaZulu-Natal.

A Level 1 Trauma Service is used appropriately in most circumstances. However, the additional need for more hospital facilities that provide such services across the whole province to enable effective geographical coverage for those trauma patients requiring such specialised trauma care is essential.

Introduction

Trauma is a significant public health burden in South Africa in general, and in KwaZulu-Natal (KZN) in particular, with interpersonal violence and motor vehicle collisions still prominent as causes of unnatural death, many related to alcohol misuse [1]. For every one death, around four survivors will require hospital treatment and about half of these will need surgery and/or intensive care for severe injury [2]. KZN is a large province on the east coast of South Africa with a largely rural population outside the two main urban centres of eThekweni and Pietermaritzburg. With a population of almost 11 million, this province is home to almost 20 % of the entire South African population within its borders (Fig. 1 shows where KZN lies within the Republic of South Africa).

Previous studies from international and local centres have demonstrated that the admission of severely injured patients to dedicated trauma services improves outcome and that trauma systems that take the most severely injured patient directly to the appropriate centre decrease mortality even further [3–5].

In March 2007 the first Level 1 Trauma Centre in KZN (Trauma Society of South Africa criteria [6]) opened at the Inkosi Albert Luthuli Central Hospital (IALCH) in Durban, a modern tertiary/quaternary hospital built to serve the population of the entire KZN region and surrounding areas.

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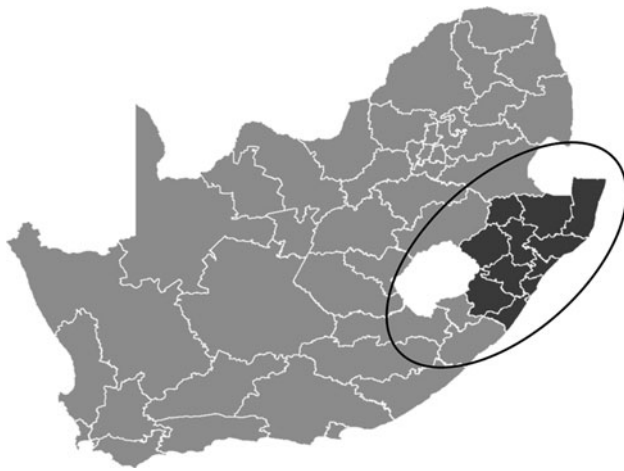


Fig. 1 Map showing location of KZN within South Africa

The unit functions as a “consultant/attending-led service” aimed directly at the management of complex multisystem trauma. A consultant/attending is present for each admission, whilst every referral is discussed and approved or denied by the on-duty consultant. The current informal design of the local trauma system is one exclusive level 1 accredited trauma centre for the entire province with ten level 2-equivalent (regional) centres throughout the province which provide rapid access to definitive care and step-up care for complex cases at the Level 1 Trauma Centre. Thirty-six district (level 3- or 4-equivalent) hospitals manage the majority of minor injuries. The emergency services can admit directly to the Level 1 Trauma Centre after a telephone consultation with the duty consultant from within the eThekweni and Pietermaritzburg regions. None of the other hospitals is currently formally accredited as any formal form of trauma centre.

The Trauma Unit at the Level 1 Trauma Centre consists of a resuscitation area, a surge capacity area, two trauma operating rooms, and an integrated Trauma ICU/High-Care Unit of currently 10 beds, with the capacity to expand to a total of 16 beds. Currently, six high-care beds are not commissioned due to a lack of nursing staff. A written set of admission criteria was designed at the inception of the unit and was widely disseminated to hospital and emergency medical services (EMSs, see Table 1). The neurosurgical and vascular surgical services (located at IALCH) have additional access to other ICU beds for single-system injuries admitted under their care, although when their facilities are full the Trauma ICU accepts the overflow; those patients are considered internal referrals.

Approximately 6 months after inception of the Level 1 Trauma Unit at IALCH, every external referral (i.e., excluding bed requests from within IALCH) has been captured on a standardised data proforma. All inpatient data are recorded in an electronic patient record.

This study aimed to review the utilisation of the referral system and identify whether the unit is appropriately used and has adequate capacity and resources for the current workload and to assess the reasons for denial of access in the case of referrals refused admission.

Methods

An audit was undertaken of the referral data proformas. This was conducted by analysing a computerised database of the referral data from 2007 to end of May 2011. The patients were categorised into five groups: accepted; refused due to no bed being available in the Trauma ICU; refusal as patient did not meet admission criteria to a Level 1 Trauma Centre; refusal as the patient required further urgent intervention(s) prior to transfer; and refusal because the patient had an isolated injury requiring other specialist discipline (e.g., neurosurgery, vascular, plastics, burns) rather than multisystem injuries requiring care at the Level 1 Trauma Centre. The data proformas were then assessed as to the appropriateness of the referral and the ability of the unit to accept deserving cases, while those patients who did not meet the admission criteria were deemed as inappropriate referrals. Referrals were additionally categorised with respect to the source of the referral *vis-à-vis* direct from the scene or from another hospital.

UKZN-BREC Ethics approval was obtained for the databases and related studies (BE207/09 and BE011/010).

Results

During the study period 723 patients were admitted and treated by the Trauma Unit at the Level 1 Trauma Centre, which includes 183 “internal” referrals from within the institution by other treating disciplines (e.g., neurosurgery or vascular surgery). The raw data are outlined in Table 2. A total of 1,212 outside referrals were received, for which the call-report proformas were complete for 1,209 patients. Of these, 540 were accepted as meeting the criteria, with 147 (26 %) being brought directly from the scene of injury by EMSs. Of the 669 patients who were refused acceptance to the unit, 206 were due to the lack of availability of Trauma ICU facilities at the Level 1 Trauma Centre (i.e., no inpatient Trauma ICU bed), while 233 were refused because they did not meet the predefined published admission criteria. An additional 115 trauma patients were not initially accepted for admission to the Level 1 Trauma Centre, but advice and instructions were given to the referring doctors (at regional or district hospitals) to undertake certain procedures or interventions to stabilise the patients to enable safe transfer to the Level 1 Trauma

Table 1 Admission and transfer criteria—IALCH Level 1 Trauma Unit

Anatomic	<ul style="list-style-type: none"> • Multiple regional injuries • Severe blunt chest or abdominal trauma • Penetrating trauma to trunk or neck with unstable physiology • Major pelvic injury • Trauma in pregnancy beyond 24 weeks • Major head injury with another organ system injury or physiological abnormality
Mechanism	<ul style="list-style-type: none"> • Prolonged entrapment • Multiple-casualty incident • Rollover or ejection from vehicle • Fall from height >6 m
Physiology	<ul style="list-style-type: none"> • Hypotension despite fluid therapy • Clinical coagulopathy of trauma • Post-damage control surgery at base • Intubation and ventilation for extensive lung contusion with hypoxia • Renal impairment post-trauma (crush or myonephropathic syndrome, AKIN 2 or 3) • Prehospital Revised Trauma Score <8
Age and comorbidity	<ul style="list-style-type: none"> • Age >55 or <5 years of age • Cardiovascular or respiratory disease • Diabetic on insulin or high-dose oral drugs • Trauma in obese patient

Centre thereafter. In these latter cases, the patients had met admission criteria but were not stable enough for immediate transfer. For another 115 patients (from other hospitals where they had already been fully resuscitated and assessed), the referring doctor was advised to contact the relevant subspecialist discipline directly because the patient had sustained a single-system injury that did not require the facilities of the Level 1 Trauma Centre but instead required that specific discipline's acceptance and expertise. These patients were already in a facility with resources to perform surgery or further resuscitation prior to interhospital transfer.

Table 2 Accepted and refused patients per category

Category	
All admissions	723
Internal admissions accepted	183 (excluded from analysis)
External consult accepted	540
External consult refused (reason)	Refused patients (<i>n</i> = 669)
No bed	206
Not meeting criteria	233
Need intervention	115
Need single discipline	115

The age distribution of referrals was between 1 and 78 years for those accepted and <1 to 92 years old for those who were refused. The Trauma Unit also serves as a paediatric trauma receiving facility that accepts any patient from approximately 18 months of age. One hundred eighty-nine referrals were children (defined as under the age of 13 by national consensus) and the rest were adolescents and adults.

Referrals were direct from emergency services at the scene in 147 cases and from other regional or district hospitals in the remaining 1,062. Subanalysis of the 1,212 referrals, of which 1,209 data proformas were fully completed, included 307 with penetrating trauma (175 gunshots, 123 stab wounds, and 9 other penetrating injuries) and 850 with blunt trauma (714 transport-related injuries consisting of 381 motor vehicle collisions and 333 pedestrian-vehicle collisions, 91 blunt assaults, and 45 falls from heights), and 46 for other reasons, such as the need for dialysis. On nine occasions the unit was consulted to receive patients from multiple-casualty incidents. Since 96 % of the scene calls were accepted, this implies that there was insufficient resource availability of major trauma facilities and possibly under-triage by the emergency services.

The regional referral pattern was as follows: 59 % from the eThekweni region, 20 % from the Northern region (Area 3), 13 % from the South Coast, and 8 % from the inland region (Area 2). The low number of referrals from Area 2 is due to the presence of two large hospitals that receive trauma and which are staffed with trauma specialists. In 2011, a distinct increase in the referrals from Area 3 was noted during a period when the main trauma receiving hospital in that region had a staffing crisis [see map of population distribution within KZN (Fig. 2)].

Discussion

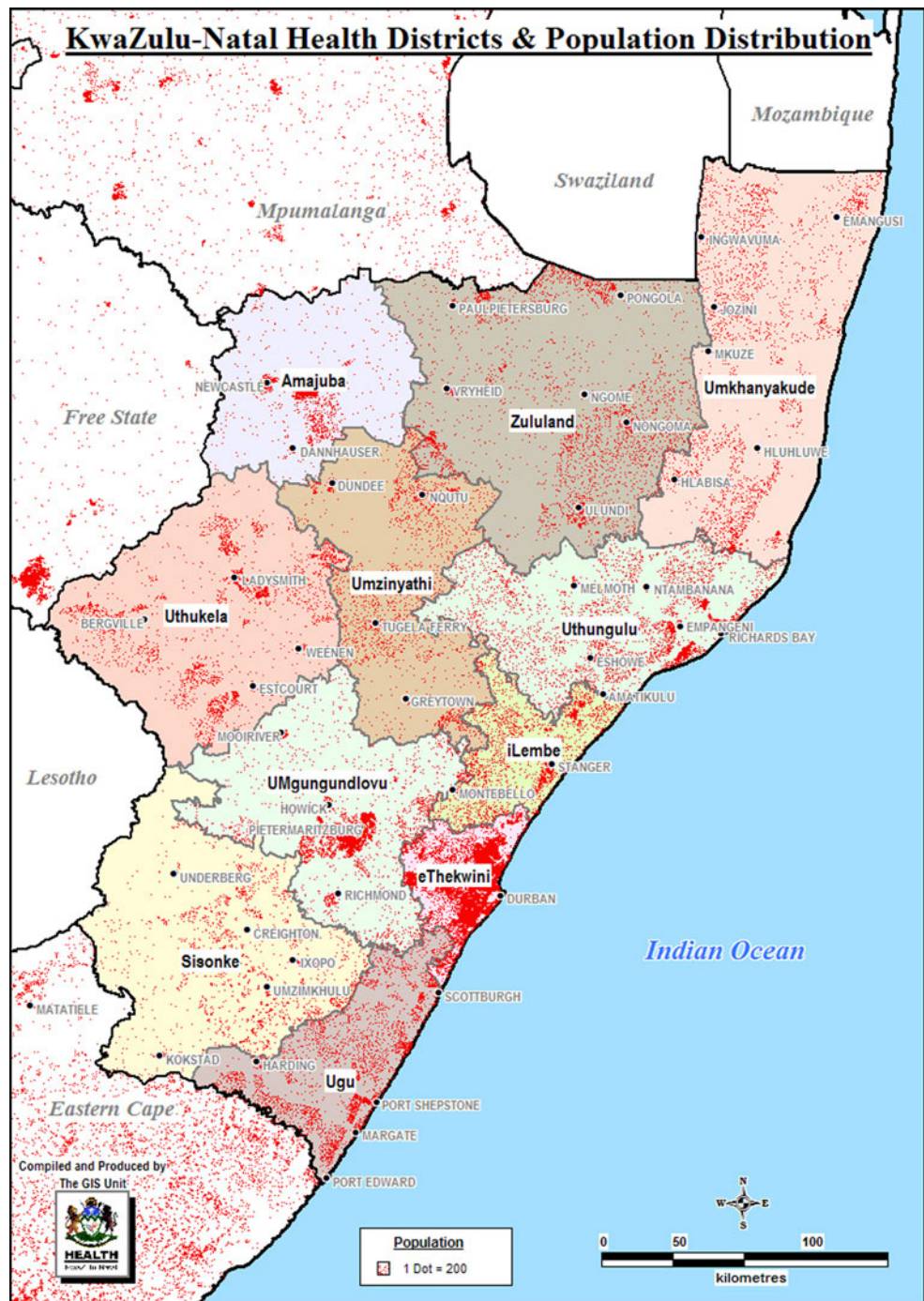
Trauma, despite being eminently preventable, remains a scourge of young people and the leading cause of death in the economically productive and childhood age ranges worldwide, with road-related trauma and interpersonal violence high on the list of underlying causes [7, 8]. In sub-Saharan Africa, notwithstanding the significantly increased trauma burden seen compared with other continents, this increase in both trauma morbidity and mortality is overshadowed by the HIV/AIDS pandemic, infectious diseases, and maternal-health issues, all of which consume resources for disease prevention and primary care.

Appropriate care of the trauma patient requires a functional, well-integrated, and cohesive trauma system. Without a properly designed and functioning trauma system, the overall efficacy and quality of patient care

delivered and therefore subsequent patient outcome and healthcare performance analysis will be adversely affected [9–13]. Failure to operate functioning trauma system is a cause of poor patient outcome, irrespective of the experience and capability of individual clinicians and resources available at local levels. Trauma system design has progressed from the original concept of exclusive systems with all patients cared for in major hospitals with expensive

and highly specialised services to inclusive systems, with multiple levels of care. Studies in the developed world have shown that inclusive systems provide earlier access to appropriate care for minor and moderate injuries at local facilities (Levels 2 and 3 Trauma Centres) [9]. When combined with suitable prehospital emergency care components and competent triage to a Levels 2 or 1 facility within an optimum timeframe, these inclusive systems

Fig. 2 GIS map of population distribution shows the largely rural population of KZN



have demonstrated overall mortality reduction compared with an exclusive trauma system [3, 4, 10–13].

This audit of referrals to the Level 1 Trauma Centre, which operates solely as a Level 1 Trauma Centre within an inclusive informal provincial/state-wide trauma system for a large province in a middle-income developing country, identified a number of interesting findings.

First, there is an under-resourced intensive care component for trauma in the province, since most of the refusals were due to the lack of an inpatient ICU bed. This has been highlighted in other studies of general ICU bed availability in South Africa [14]. In fact, the American College of Surgeons recommends a Level 1 Trauma Centre for every 1,000,000 people (personal communication, Dr. Rajan Gupta, Dartmouth University, Lebanon, NH, USA). This is both impractical and fiscally nonviable for the South African trauma system model [15]. However, two such centres for a province with a population that is 20 % of the entire country is not an unreasonable expectation. Moreover, a Level 1 Trauma Centre is more than just a hospital with multiple specialities; it is a specialist hospital with a specific expertise in the management of major complex trauma patients that has been shown to reduce overall mortality [5, 16].

Second, an inclusive system ensures that the correct patient is referred to the correct level of care [17]. As the KZN system is still a very informal one, many referrals were deemed inappropriate because (1) consultations were received for very minor isolated injuries that could be successfully managed at smaller institutions, or (2) or the referred patient had a futile prognosis as a result of either late presentation to hospital or the severity of the injury. In the case of 115 consultations, the treating facility had not evaluated or managed the patient appropriately so it was requested to (a) undertake adequate initial assessment and/or instigate appropriate initial/further resuscitation of the patient, (b) perform necessary initial procedures such as airway management, chest drainage, and damage control surgery (when appropriate and where suitable facilities existed and were already available), or (c) stabilise the patient to enable a safe transfer to the Level 1 Trauma Centre, which frequently requires the patient to survive long-distance travel and lengthy interhospital transfers. The “devil of distance” is one of the major challenges in this under-resourced and largely rural province.

Since most cases of penetrating trauma can be managed successfully at Level 2 facilities, the lower number of penetrating trauma referrals (25 %) is reflected by the lower need for ICU admission in this group. Most of the referrals were for complex blunt trauma (70 %) or dialysis (not always available at other regional hospitals), thus ensuring that the Level 1 Trauma Centre ICU is admitting patients who will derive maximum benefit from a transfer to the Level 1 facility [5]. This predominance of blunt trauma in our ICU

cohort is higher than the overall trauma mix reflected in other studies [15]. The age spectrum demonstrates that the need for specialised trauma care at the extremes of age has been recognised by all levels of care providers across the trauma system within the KZN province.

Far too many cases are still admitted as interhospital transfers (88 % of referrals), indicating that the prehospital triage, especially outside the eThekweni Metropolitan Region, could be improved by educating the EMS providers, both private and public, to correctly identify complex major trauma patients, even if they do not need immediate intubation, ventilation, or urgent surgery and to refer these patients directly to the Level 1 Trauma Centre facility. This has been achieved in other developing world trauma systems [18], and outreach programs are being instituted to address this weakness. Successful implementation of this elsewhere has been possible through efficient trauma system design and involvement of the EMS providers, from preliminary planning of the trauma system design through its development to eventual subsequent completion and implementation [19]. We also provide a typed discharge summary to all referring hospitals with the intention of trying to educate them as to when the referrals are appropriate or not, and to detail treatment given at the Trauma Unit.

The practical implications of this study for South African trauma care are the following: there is the need for at least one additional Level 1 Trauma Centre in this province and, through extrapolation, around 10–12 such centres are required within the South African national public health system. At present there are only four similar centres throughout the rest of South Africa. Second, to be able to establish more formal trauma systems, the EMS services must be included more in the planning and effective implementation of patient distribution to the appropriate clinical facility and the EMS control centres need to be more involved in directing these transfers to the appropriate clinical facility.

Finally, to enable a formal hospital trauma system to be properly implemented and function effectively and successfully, all hospitals involved in the trauma system must be adequately upgraded as necessary and suitably equipped in addition to being formally accredited in accordance with the Trauma Society of South Africa criteria to the appropriate level. Ongoing audit and quality assurance is essential as this will determine if reduction in mortality is being achieved across the whole trauma system, as has been demonstrated for the Level 1 Trauma Centre under review in this instance [5, 20].

Conclusion

Major multiorgan system trauma remains a significant public health burden in KZN. A Level 1 Trauma Service is used

appropriately in most circumstances. However, additional hospital facilities that provide such services across the whole province to enable effective geographical coverage for those trauma patients requiring such specialised trauma care will likely reduce trauma mortality even further. Formalisation and proper implementation of an inclusive trauma system will enable the more appropriate transfer and earlier admission of trauma patients with multisystem injuries to a suitably equipped and appropriately staffed facility direct from the scene of the incident/injury.

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