Patient transport from rural to tertiary healthcare centres in the Western Cape: Is there room for improvement?

Le transport patient de rural aux soins de sante urbains centre dans le cap occidental: L’Afrique du Sud

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Abstract
Introduction: This study was conducted to evaluate the effectiveness of the current referral system, from rural areas to tertiary care, in the Western Cape of South Africa, and to gain insight into transfer patterns and patient outcomes.
Methods: A one year retrospective observational study of all priority one transfers from two rural regions to a tertiary hospital in Cape Town. Modes of transport used were compared. Data collected included patient demographics, temporal patterns of transfers, transfer distance, level of care during transfer, diagnosis, disposition and outcome, and length of hospital stay.
Results: Out of a total of 334 patient transfers, 64% were males, with 20% of transfers occurring on a Sunday, and 55% between 12:00 and 20:00. Trauma accounted for 46% of referrals; head injury was the diagnosis in 58% of these patients. After admission, 39% of patients required surgery

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and/or intensive or high care unit management. Eighty percent of patients were discharged; 20% died. Males had a longer hospital stay, and rotor wing transported patients stayed longer.

Discussion: The Western Cape EMS system is transferring significant numbers of seriously injured and ill patients, the largest group being young males following trauma. Focused training, outreach and telemedicine services may help to improve the outcome for these patients. Appropriate protocols for the use of rotor and fixed wing resources are required, to help ensure patient outcome and make the best use of limited resources.

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What’s new:

- This is the first documentation of the incidence of head injuries in the rural Western Cape of South Africa.
- The temporal referral patterns highlight the need for staff allocations to be adjusted against the background of a resource poor setting.
- The study highlights the need for aeromedical referral protocols.

African relevance:

- Rural populations are at a high risk of sustaining trauma, but have poor access to trauma care services.
- The Western Cape EMS model for transfer of acutely ill and injured patients can be rolled out to other countries as they develop EMS systems.

Introduction

South Africa has a population of approximately 48 million people, located in nine Provinces with few major cities, and 40% of the population living in rural areas. The Western Cape is home to over 11% of the total population, and covers 129,376 km² (about the size of England)³ ⁴ (Fig. 1). According to 2007 mid-year statistics, the rural Western Cape population is close to one million people, 75% of whom live in poverty, are without medical insurance, and are dependent on public health services.

This healthcare is based on a three-tiered system: Primary Care is delivered at clinics and rural District level hospitals (staffed by general practitioners and junior doctors doing community service); Secondary hospitals serve as the main referral sites and are based in bigger rural towns (and the Cape Town metropole) – they offer general specialist services; tertiary care is provided in two academic complexes in Cape Town, and provides all specialist and sub-specialty services. The majority of rural emergency patients are seen and dealt with completely within the District Hospital system; a small proportion are referred to the local secondary hospital, in line with local policy; however, at the discretion of the referring physician (general
practitioners, community service doctors), or EMS for primary transfers, a patient may be referred directly from primary to tertiary care. These referrals to secondary and tertiary hospitals are made when the patients require specialist care, surgery, high or intensive care management, as well as special investigations (for example Computerized Tomography) that are not available at the referring facility. The doctors at the receiving facility who accept the transfers are registrars, consultants or medical officers. While this system reduces any delay in the pathway for those patients needing emergent tertiary care, it also creates opportunities for inappropriate and delayed referrals.

Transport of these critically ill patients to tertiary hospitals is an important part of patient care, but proves to be challenging against a background of a resource poor healthcare system, staff shortages, referring doctors with varying levels of experience, and few formalised referral protocols.8

The public Emergency Medical Service (EMS) in the Western Cape is a robust system, provided by Advanced Life Support (ALS), Intermediate Life Support (ILS) and Basic Life Support (BLS) practitioners. These practitioners are registered with the Health Professions Council of South Africa (HPCSA), and have been trained at HPCSA accredited EMS Training Colleges. Well-equipped road ambulances, fixed wing and rotor wing aircraft are used by EMS for these rural transfers, with the rotor wing service only being available during daylight hours and favourable weather conditions. The road and fixed wing aircraft are usually staffed by two ALS practitioners, or one medical doctor and an ALS practitioner. This service is based in Cape Town. The road ambulances are manned by an ALS practitioner, and one either ILS or BLS practitioner. Rural EMS stations usually have one to two road ambulances available, with one ALS practitioner available for two to three neighbouring towns. Paediatric referrals include neonatal transfers, which are performed by appropriately trained practitioners using appropriately equipped ambulances and aircraft. The decision which resource to send is made by EMS Command, based at Tygerberg Hospital.

In light of the frequency of these transfers from rural areas to tertiary care, and anecdotal evidence, we questioned whether the current system is functioning efficiently, and whether critically ill patients are transferred appropriately. The aim of this study was to describe the current referral system, transfer patterns and patient outcomes.

Methods

This was a retrospective observational study.

Study location

The Western Cape is divided into five health regions, from where patients are referred to one of two tertiary centres in Cape Town. We identified two health regions (West Coast and Boland), which use Tygerberg Hospital as their tertiary referral centre.

Data collection

All priority one (P1, acutely ill or injured according to the South African Triage Scale9 used by EMS) patients referred to Tygerberg Hospital (TBH) between 1st December 2006 and 30th November 2007 were included in the study.

Modes of transfer used were road ambulance, fixed wing aircraft (FW) and rotor wing aircraft (RW). FW and RW data were obtained from the Red Cross Air Mercy Service database in Cape Town. No electronic database exists for road transfers from rural areas, therefore data were collected from copies of EMS transfer reports, double checked against Tygerberg Hospital Emergency Centre registers.

Data collected included: date, day of the week, time of the day, gender, age, mode of transfer, level of care during transfer, original referral diagnosis, origin of patient, destination in TBH, disposition, final diagnosis, outcome, length of stay (LOS) and whether original and final diagnosis matched.

Data regarding hospital management were obtained using the TBH Clinicom® electronic database, as well as patient folders in the TBH Medical Records Department.

Data analysis

Data analysis was done using Statistica Version 7 (StatSoft Inc., 2004). Statistical analysis included basic descriptive statistics for demographic data, the Mann–Whitney test to assess the effect of gender on the length of stay, the Bootstrap test to assess length of stay based on different modes of transport, and the Chi-Square test to compare patient outcomes with mode of transport used. A p-value less than 0.05 was considered to be statistically significant.

Ethics approval

The study was approved by the Stellenbosch University Committee for Human Research. Reference No. N07/11/260.

Results

A total of 334 P1 patient transfers were identified.
Patient demographics

Males made up 64% of transfers. The patient age group 20–40 years comprised 38% of transfers, and the under-20 year group 28% (Fig. 2).

Day of transfer

Sundays were the busiest days (20%), and 50% of all transfers occurred on weekends; Wednesdays were the quietest (11%) (Fig. 3).

Time of day

The commonest transfer time was 12:00–15:59 (30%), with a further 25% between 16:00 and 19:59. The quietest time was 04:00 and 07:59 (4%) (Fig. 4).

Patient transport

Road ambulance was used in 64% of transfers, and fixed wing aircraft in 11%. Care during transfer was provided by ALS personnel in 54% of cases and ILS in 10%, (35% had no clear record of level of care). Transfer distance was less than 100 km in 63%, and transfer time less than 100 min in 67%.

Diagnosis

Trauma accounted for 46% of referrals, 28% was medical and 14% paediatric. Of the trauma referrals, head injuries accounted for 58% and multisystem trauma 12% (Fig. 5). Other types of trauma patients who were moved sustained chest, neck abdominal and extremity injuries. The referral diagnosis matched the final hospital diagnosis in 84% of cases.

Disposition and outcome

After admission via the emergency centre, 39% of patients required surgery and/or high or intensive care; 42% were transferred directly to a ward from the EC. Of the remaining patients, 26 (7.7%) died in the EC, and 38 (11.3%) were discharged. Final outcome data showed 20% of patients died (4% were transported with FW, and 44% with RW).

Length of stay

Most patients (62%) stayed between 0 and 10 days (15% of patients stayed between 0 and 2 days). Males stayed longer (LOS 11.7 days (95% CI 9.4–14.0), females 9.8 days (95% CI 7.6–12.0, *p* < 0.001). LOS for air transfers averaged 14.9 days (95% CI 10.4–19.3) for rotor wing; 8.2 days (95% CI 4.7–11.7) for fixed wing, and 10 days (95% CI 8.2–11.8) for

![Fig. 2](image1.png)  
**Fig. 2** Comparison of age and sex distribution.

![Fig. 3](image2.png)  
**Fig. 3** Daily referral patterns.

![Fig. 4](image3.png)  
**Fig. 4** Time of day.

![Fig. 5](image4.png)  
**Fig. 5** Comparison of trauma presentations.
Discussion

The need to improve emergency care in rural areas – and the challenges associated with it – are not unique to South Africa, having been tackled repeatedly, including in advanced healthcare settings like the United States and Canada.\textsuperscript{10–12} Possible solutions include clinical support and training for rural physicians, referral protocols, focussed emergency medicine training for rural clinicians and EMS referral protocols. It is hoped that the introduction of emergency medicine as a specialty in South Africa will result in a positive impact on patient transfers,\textsuperscript{13} and area in need of future study.

Our findings will help to inform appropriate service provision in the Western Cape, as we develop a deeper understanding of the types of patients we move across the province. It can also be used as a model to be adjusted according to the need in other provinces and rural areas of South Africa.

Patient profile

The majority of patients were young male trauma victims, which may in part reflect the tendency of this demographic to be exposed to trauma. The findings were consistent with other African\textsuperscript{14} and international data.\textsuperscript{15}

Temporal referral patterns

Most transfers occurred on Sundays, with 50\% of transfers occurring from Friday to Sunday and the majority being moved between 12:00 and 20:00. Allowing for delays in transfer to a Primary care level, assessment and referral, this picture is consistent with known patterns of trauma, occurring predominantly over weekends. Crime statistics from the South African Police Service detailing temporal trauma occurrences are not available, although anecdotal police statistics are in line with this finding. The fact that Sundays were the busiest days, can therefore be explained by trauma occurring between Friday evenings and Sunday, with delayed presentation, delayed referral and a huge demand on especially the EMS ground ambulance service, resulting in delayed transfers. This, combined with substantial transfer distances, demonstrates why the 12:00–20:00 time categories were most common. The busiest time category EMS shift patterns, however, are not yet in line with this workload pattern and review of this practise is required.

Patient transport

Road ambulance was used for the majority of transfers; the majority of these were performed by the very scarce ALS providers, leaving the rural community with no ALS coverage for extended periods. It is generally accepted local practise that air transport be used for distances greater than 100 km, but no formal protocols exist to guide this practise. Inter-physician variation therefore contributes to inefficient usage of limited resources. A significant proportion of our >100 km transfers was done by road, which deprives the referral area of the ALS practitioner for too long.

Diagnosis

Previous data suggest that rural populations are at a greater risk of trauma compared with their urban peers.\textsuperscript{14,16,17} We demonstrated a high trauma workload for transferring personnel (nearly half of all critically ill transfers), with head trauma accounting for nearly 60\% of these. Clearly, focus on the management of trauma by rural physicians and EMS providers are a high priority area for health planners. Adherence to Head Injury Guidelines\textsuperscript{18} can help to optimise the safe transport of this subgroup of patients. Further improvements may be made through the use of telemedicine,\textsuperscript{19} a system recently introduced in the Western Cape (and a ripe area for future research).

Our previous experience with EMS audits has been that the referral and final diagnosis rarely match; encouragingly, in this study, the referral diagnosis matched the final hospital diagnosis in 84\% of cases, a finding which compares well with international data.\textsuperscript{20}

Disposition and outcome

Wong and Lau reported a 34.1\% discharge rate from the Emergency Department following helicopter transfer\textsuperscript{21} – only 19\% of patients in our study were not admitted to a ward (some died but most were discharged), providing some supportive evidence that transfers were appropriate. The distance travelled during transfer was not associated with increased LOS, which is predictable.\textsuperscript{22}

Our mortality data compare well with that reported internationally.\textsuperscript{22,23} The fact that 20\% of transported patients died, warrants further research, investigating predictability of a poor outcome and a way to further optimise scarce resources. Telemedicine can also be used for this purpose. We reported a 44\% mortality rate for RW transported patients, and a longer length of stay, supporting the locally held view that this service is used for the more unstable patients whose clinicians face a tough choice: keep the patient in the small rural hospital lacking the equipment and skills to manage them or risk a fast transfer to a higher level of care. Outreach and support for rural hospitals has become a high priority for the Western Cape in recent years, a move supported by our findings. Appropriate training to help reduce turn-around times for patients will hopefully further impact on outcomes.\textsuperscript{24}

Conclusion

The Western Cape EMS system is transferring significant numbers of seriously injured and ill patients, the largest group being young males following trauma. This has added significantly to the body of evidence in South Africa, especially against the background of previously minimal local research in this field. Focussed training, outreach and telemedicine services may help to improve the outcomes for these patients. Appropriate protocols for the use of rotor and fixed wing resources are required, to help ensure patient outcome and make the best use of limited resources.
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Competing interests

None.

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