



## National audit of critical care resources in South Africa – transfer of critically ill patients

Juan Scribante, Sats Bhagwanjee

**Objectives.** To establish the efficacy of the current system of referral of critical care patients: (i) from public hospitals with no ICU or HCU facilities to hospitals with appropriate facilities; and (ii) from public and private sector hospitals with ICU or HCU facilities to hospitals with appropriate facilities.

**Design and setting.** A descriptive, non-interventive, observational study design was used. An audit of all public and private sector ICUs and HCUs in South Africa was undertaken.

**Results.** A 100% sample was obtained; 77% of public and 16% of private hospitals have no IC/HC units. Spread of hospitals was disproportionate across provinces.

There was considerable variation (less than 1 hour - 6 hours) in time to collect between provinces and between public hospitals that have or do not have ICU/HCU facilities. In the private hospitals, the mean time to collect was less than an hour.

In public hospitals without an ICU, the distance to an ICU was 100 km or less for approximately 50% of hospitals, and less than 10% of these hospitals were more than 300 km away. For hospitals with units (public and private), the distance to an appropriate hospital was 100 km or less for approximately 60% of units while for 10% of hospitals the distance was greater than 300 km.

For public hospitals without units the majority of patients were transferred by non-ICU transport. In some instances both public and private hospitals transferred ICU patients from one ICU to another ICU in non-ICU transport.

**Conclusion.** A combination of current resource constraints, the vast distances in some regions of the country and the historical disparities of health resource distribution represent a unique challenge which demands a novel approach to equitable health care appropriation.

Early effective resuscitation of the critically ill patient is associated with a reduction in morbidity and mortality.<sup>1-4</sup> Of equal importance is the observation that ineffective transportation increases morbidity, mortality and cost of care.<sup>5,6</sup> The majority of hospitals in South Africa do not have intensive care facilities. As a result, critically ill patients are commonly transferred to hospitals that do have facilities. Patients who are in an intensive care unit (ICU) may also be transferred to other hospitals if the appropriate support services needed to address the clinical problem are not available at the primary facility. In either instance, optimal outcome depends on effective initial resuscitation and transportation that is appropriate to the severity of illness. The latter ensures effective ongoing resuscitation and requires appropriate equipment and suitably trained staff. Limited data are available to address the efficacy of transportation of the critically ill in South Africa.<sup>5</sup> A review of the referral practices of public and private hospitals was undertaken as part of the national audit of critical care in South Africa.

Department of Anaesthesiology, University of the Witwatersrand and Johannesburg Hospital, Johannesburg

Juan Scribante, MCur

Sats Bhagwanjee, MB ChB, DA (SA), FCA (SA) (Crit Care)

Corresponding author: J Scribante (juan.scribante@wits.ac.za)

### Methodology

Approval to conduct the study was obtained from eight universities, the appropriate health authorities including the Department of National Health, the Surgeon-General of the South African Defence Force, respective provincial health departments and private hospital groups. Approval was thereafter obtained from the respective hospital managements before proceeding with the study.

A descriptive, non-interventive, observational study method was used. A structured telephone interview for hospitals without an ICU or a high care unit (HCU) was used. For hospitals that did have an ICU and/or HCU the same information was obtained as part of an 11-page questionnaire (Table I). Two researchers conducted the structured interview

**Table I. Transfer data surveyed**

Distance to referral ICU
Mode of transport:
• ICU ambulance
• Ambulance
• Other (specify)
Is transport:
• Private
• Public
• Both
Average time it takes an ambulance to reach your hospital
Comment



and the information was obtained from the CEO of the hospital or the nursing service manager. The medical director, nursing unit manager or nursing service manager completed the questionnaire. Completed questionnaires were reviewed by one of two researchers.

The objective of this phase of the audit was to: (i) establish the efficacy of the current system of referral of critical care patients from public hospitals with no ICU or HCU facilities to hospitals with appropriate facilities; and (ii) establish the efficacy of the current system of referral of critical care patients from public and private sector hospitals with ICU or HCU facilities to hospitals with appropriate ICU facilities.

Strict anonymity was ensured at all times and International Conference on Harmonisation (ICH) guidelines for good clinical research practice were adhered to. A detailed description of the methodology is discussed in a separate paper.<sup>7</sup>

**Results**

The mode of transport is reported as follows: (i) ICU transport is a suitably equipped vehicle (including fixed and rotary wing aircraft) with critical care trained para-medical staff; (ii) non-ICU transport is an ordinary ambulance, or hospital or family vehicle.

A 100% sample was obtained. Of the public sector hospitals 77% (304/396) do not have ICU/HCU facilities compared with 16% (40/256) in private hospitals. The spread of hospitals was disproportionate across the provinces (Table II).

In Gauteng and the Northern Cape the average time to collect was an hour or less for both categories of hospital (Table III). In Limpopo and the SANDE, time to collect was less than

an hour for hospitals that have ICU/HCU facilities. In all other provinces the time to collect exceeded an hour and was the longest in the Eastern Cape (6 hours). There was considerable variation between provinces and between hospitals that have or do not have ICU/HCU facilities (Table IV). In the private sector hospitals, the mean time to collect was less than an hour for all groups and in all provinces with a range of 0.6 - 0.9 hours.

In the group of public hospitals without ICU, the distance to a hospital with facilities was 100 km or less for approximately 50% of hospitals (Fig. 1). The distance to facilities was more than 300 km for less than 10% of hospitals. For hospitals with units (public and private), the distance to an appropriate hospital was 100 km or less for approximately 60% of units while for 10% of hospitals the distance was greater than 300 km (Fig. 2).

For public hospitals without units in all the provinces (except Gauteng), the majority of patients were transferred by non-ICU transport (Fig. 3). Hospitals with ICU facilities transferred patients primarily with ICU transport (Fig. 4). Both public and private hospitals transferred ICU patients from one ICU to another ICU in non-ICU transport in some instances. Public sector hospital ICUs in the Northern Cape only transferred by means of non-ICU transport.

Comments that were made by participants on two or more occasions are listed in Table IV. The comments emphasise the lack of resources and inefficient use thereof.

**Discussion**

Intensive care should start before the patient is admitted to ICU. Critically ill patients should be transferred to the most

**Table II. Hospital facilities by province**

	EC	FS	GP	KZN	LIM	MP	NC	NW	WC
Public with ICU/HCU	16	4	15	22	7	7	2	6	17
Public without ICU/HCU	63	26	14	49	38	23	24	25	42
Private with ICU/HCU	8	7	67	25	1	5	3	6	23
Private without ICU/HCU	6	3	17	5	1	3	1	3	6

**Table III. Average time to collect by province**

	EC	FS	GP	KZN	LIM	MP	NC	NW	WC
Public hospitals without ICU/HCU									
Average time to collect (h)	6.5	1.2	0.3	1.0	0.9	2.0	0.4	2.0	2.1
Range (h)	47.0	1.8	0.3	1.8	1.8	0.0	0.3	4.8	5.8
Public hospitals with ICU/HCU									
Average time to collect (h)	1.4	2.0	1.0	2.9	0.7	1.5	0.4	0.8	1.5
Range (h)	3.8	0.0	6.0	6.0	0.8	2.3	0.3	4.0	3.8
Private hospitals with ICU/HCU									
Average time to collect (h)	0.8	0.8	0.7	0.9	0.2	0.4	0.4	0.8	0.7
Range (h)	3.0	2.5	3.0	5.0	0.0	1.0	0.3	2.3	2.0



**Table IV. Frequently listed comments**

Not enough ambulances, especially ICU ambulances  
 Ambulances in poor working condition and are used to service large rural areas with poor roads  
 Insufficient number of staff to drive and accompany patients, available staff not adequately trained  
 Authorisation process was perceived as a major obstacle  
 Not authorised to transfer to the closest ICU in another province, must transfer to ICU much further away in same province  
 Inappropriate use of ambulances

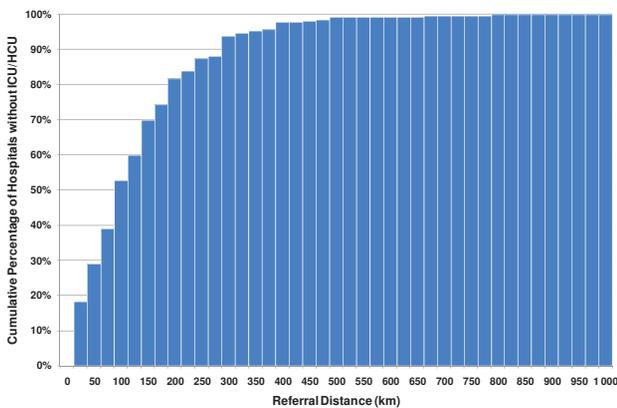


Fig. 1. Cumulative referral distance for public hospitals without ICU/HCU.

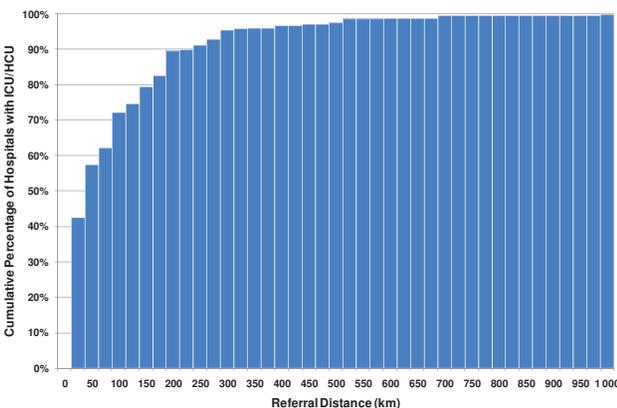


Fig. 2. Cumulative referral distance for public and private hospitals with ICU/HCU.

appropriate ICU in the most effective manner in the shortest period of time.

It was not within the scope of this study to describe transfer-related adverse events and outcome of transferred patients. Hatherill *et al.*<sup>5</sup> demonstrated a high incidence of technical, clinical and critical clinical adverse events among paediatric patients transferred to a university children’s hospital in Cape Town.

This study has, however, identified several deficiencies in the transfer of critically ill patients in South Africa. The transfer procedures are neither centralised nor standardised. Each

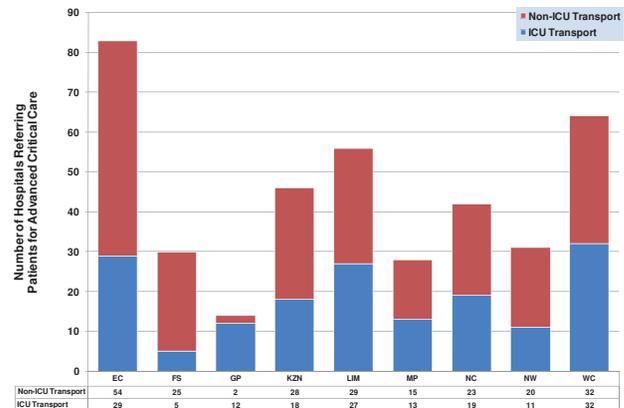


Fig. 3. ICU versus non-ICU transport for public sector hospitals without ICU/HCU.

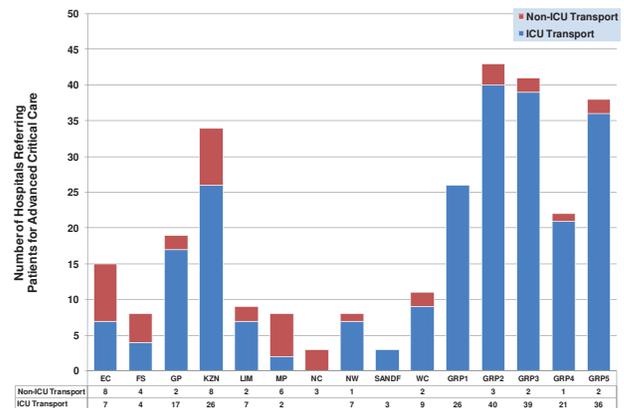


Fig. 4. ICU versus non-ICU transport for public and private hospitals with ICU/HCU.

province functions independently and there are vast differences between the public and private sectors. A centralised system of patient transfer has been shown to be safe and effective.<sup>8,9</sup>

The time from request to collection from the transferring hospital varies throughout South Africa and does not reflect the total time of the critically ill patient’s transfer. Delayed transfer to ICU negatively influences morbidity, mortality, length of ICU stay and scarce resource utilisation.<sup>10,11</sup> The current practice of inter-unit transfer is inappropriate, particularly where resource constraints exist.

The distance that patients are transferred is regarded as an independent risk factor for mortality in transferred patients.<sup>12</sup> A significant percentage of patients are transferred more than 100 km and even in excess of 300 km to an appropriate ICU. Comments from respondents indicate that patients are not always transferred to the closest appropriate ICU (e.g. in another province), but to an ICU that is geographically predetermined (e.g. within the same province).

Uusaro *et al.*<sup>13</sup> have shown that critically ill patients with severe unstable respiratory and circulatory failure can safely be transported over long distances when a specially equipped





vehicle and qualified transport team are used. A significant number of critically ill patients are transferred using non-ICU transport or transport that is not well maintained, ill equipped and inadequately staffed. There is ample evidence confirming that transfer of critically ill patients in an appropriately equipped and staffed vehicle or aircraft, also referred to as a mobile ICU, improves patient outcome and reduces adverse events.<sup>13-17</sup> The patient should receive the same level of monitoring and care during transfer that would be offered in an ICU.<sup>18</sup>

Appropriate stabilisation of the critically ill patient before transfer is another important aspect that influences patient outcome and effective ICU resource utilisations.<sup>11,14</sup> The professional societies, authorities and units that are involved in the transfer of critically ill patients should adopt guidelines for transferring such patients.<sup>17</sup>

There are limitations to this study. The data on time to collect rely on the subjective perceptions of unit/hospital managers. Conversely, the data on distance to the respective unit and mode of transport are guided by current policy and practice. Lastly, the impact of potential delays and inappropriate transportation on patient outcome was not measured.

These limitations suggest the need for appropriate prospective data collection. We admit, however, that there is sufficient evidence to argue for integration and regionalisation of emergency and critical care services. Integration implies *de novo* transfer of patients to an appropriate facility that is capable of managing the identified clinical problem. Health care services have been tiered but integration of each tier remains an unresolved challenge. Timeous and appropriate referral has to be accomplished on a regional basis. Regions cannot be prescribed by provincial boundaries. The combination of current resource constraints, the vast distances in some regions of the country and the historical disparities of health resource distribution represent a unique challenge which demands a novel approach to equitable health care appropriation.

This project was funded by an unrestricted research grant from the Critical Care Society of Southern Africa. The Society received a research grant from Eli Lilly (South Africa).

The authors wish to express their gratitude to the CCSSA Council, National Department of Health, (Dr K Chetty, Dr M Seritsane), all provincial MECs for health CEOs of all hospitals, the directors of private hospital groups, each individual who filled in the questionnaire, Mr T Scribante, Dr M Kohler and Ms H Perrie.

## References

1. Rivers E, Nguyen B, Havstad S, *et al.* Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med* 2001; 345: 1368-1377.
2. Engoren M. The effect of prompt physician visits on intensive care unit mortality and cost. *Crit Care Med* 2005; 33: 727-732.
3. Hochman JS, Sleeper LA, Webb JG, *et al.* Early revascularization in acute myocardial infarction complicated by cardiogenic shock. Shock investigators. Should we emergently revascularize occluded coronaries for cardiogenic shock. *N Engl J Med* 1999; 341: 625-634.
4. Bernard SA, Gray TW, Buist MD, *et al.* Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med* 2002; 346: 557-563.
5. Hatherill M, Waggie Z, Reynolds L, *et al.* Transport of critically ill children in a resource-limited setting. *Intensive Care Med* 2003; 29: 1414-1416.
6. Beckmann U, Gillies DM, Berenholtz SM, *et al.* Incidents relating to the intra-hospital transfer of critically ill patients. An analysis of the reports submitted to the Australian Incident Monitoring Study in Intensive Care. *Intensive Care Med* 2004; 30: 1579-1585.
7. Scribante J, Bhagwanjee S, for CCSSA Support Group. National audit of critical care resources in South Africa – research methodology. *S Afr Med J* 2007; 97: 1308-1310 (this issue).
8. Rohan D, Dwyer R, Costello J, *et al.* Audit of Mobile Intensive Care Ambulance Service. *Irish Med J* 2006; 99: 76-78.
9. Goh AY, Mok Q. Centralization of paediatric intensive care: are ill children appropriately referred to a regional centre? *Intensive Care Med* 2001; 27: 730-735.
10. Chalfin DB, Treckiak S, Likourezos A, *et al.* Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit Care Med* 2007; 35: 1477-1483.
11. Siddiqui AA, Zafar, Bashir SH. An audit of head trauma care and mortality. *Journal of the College of Physicians and Surgeons – Pakistan* 2004; 14: 173-177.
12. Durairaj L, Will JG, Torner JC, *et al.* Prognostic factors for mortality following interhospital transfers to the medical intensive care unit of a tertiary referral center. *Crit Care Med* 2003; 31: 1981-1986.
13. Uusaro A, Parvianen I, Takala J, *et al.* Safe long-distance interhospital ground transfer of critically ill patients with acute severe unstable respiratory and circulatory failure. *Intensive Care Med* 2002; 28: 1122-1125.
14. Gebremicheal M, Borg U, Habasi NM, *et al.* Interhospital transport of the extremely ill patient: the mobile intensive care unit. *Crit Care Med* 2000; 28: 79-85.
15. Bellingan G, Olivier T, Batson S, *et al.* Comparison of a specialist retrieval team with current United Kingdom practice for the transport of critically ill patients. *Intensive Care Med* 2000; 26: 740-744.
16. Vos GD, Nissen AC, Nieman FH, *et al.* Comparison of interhospital pediatric intensive care transport accompanied by referring specialist or a specialist retrieval team. *Intensive Care Med* 2004; 30: 302-308.
17. Beckman U, Gillies DM, Berenholtz SM, *et al.* Incidents relating to the intra-hospital transfer of critically ill patients. An analysis of the reports submitted to the Australian Incident Monitoring Study. *Intensive Care* 2004; 30:1508-1510.
18. Braxton CC, Reilly PM, Schwab CW. The travelling intensive care unit patient. Road trips. *Surg Clin North Am* 2000; 80: 949-956.