

## Commentary

# Recently published papers: Delivery, volume and outcome – what is best for our patient?

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Published: 14 August 2007

This article is online at <http://ccforum.com/content/11/4/155>

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*Critical Care* 2007, **11**:155 (doi:10.1186/cc6082)

See related research by Peelen *et al.*, <http://ccforum.com/content/11/3/R40>

## Abstract

Many studies have demonstrated that prompt appropriate treatment for the critically ill patient improves outcome. Moving patients to the best place for instituting care, however, is not always associated with improved outcome. Recent studies on delivering patients to the best place for treatment as well as further work on the effects of volume are discussed. Finally, a large retrospective cohort study comparing outcomes of patients treated with continuous venovenous haemofiltration or intermittent haemodialysis is outlined.

Evaluation III scores (60.5 versus 49.7), higher intensive care unit (ICU) mortality (14% versus 8%) and higher hospital mortality (22% versus 14%). The length of stay was also longer in terms of both ICU bed days and hospital bed days. These results are in keeping with several other studies [2,3]. When stratified by disease severity using the Acute Physiology and Chronic Health Evaluation III model, however, the crude mortality differences were less striking, with no statistical differences observed. What did remain significantly different was the cost of treatment. On average, a patient transferred to the ICU from outside the institution cost about \$10,000 more per admission. Somewhat surprisingly, this difference was principally confined to the group with the lowest predicted mortality – the reasons for which remain unclear. Does this mean that transferring patients has no impact other than financial? Probably not, as case mix also plays a significant role – an earlier study on medical ICU patients demonstrated that, even after accounting for disease severity, transferred patients had a significantly higher mortality rate [4]. This has also been backed up by findings in Europe [5].

“Nothing is permanent but change”

*Heraclitus, circa 500 BC*

For those of us practicing in the United Kingdom, the National Health Service is approaching its 60th birthday and, far from being pensioned off, there is much political will to change the way healthcare is being delivered in a radical fashion. This reinvention of the National Health Service is being applied across the board, including the critical care arena, and an often-used phrase is that of ‘reconfiguration’ of services. This will probably lead, in time, to fewer critical care units in England and to more patients being transferred between hospitals.

Two papers published in *Critical Care Medicine* therefore make interesting reading for those of us swept up in this maelstrom. Golestanian and colleagues performed a cohort observational study examining the effects of interhospital transfers on resource utilisation and outcomes at a tertiary care referral centre in the USA [1]. They compared patients transferred from other hospitals with those admitted ‘in-house’ from the A&E department or the wards. The patients transferred had higher Acute Physiology and Chronic Health

Following on from this study is a paper from Chalfin and colleagues, who examined the impact of a delay in transfer of critically ill patients from the A&E department (or the emergency department, if you prefer) to the ICU using cross-sectional analysis of the multicentre US Project Impact Database of ICU patients [6]. Patients were divided into two groups: those remaining in the A&E department for longer than 6 hours (referred to as ‘boarding’ patients), and those patients transferred in under 6 hours. The 6-hour value was selected as it correlates with the 5.8-hour period reported as the mean time to transfer from the A&E department to an ICU bed in American hospitals that report overcrowding in the A&E department. The data from over 50,000 patients were

CRRT = continuous renal replacement therapy; ICU = intensive care unit; IHD = intermittent haemodialysis.

examined, of which just over 1,000 were classed as 'boarders', and there was no significant difference in baseline characteristics between the two groups. Unsurprisingly, the boarders fared less well – their ICU mortality was higher (10.7% versus 8.4%), the inhospital mortality was higher (17.4% versus 12.9%) and the median stay of survivors was 1 day longer. The boarding patients also required more frequent ventilation and more invasive haemodynamic monitoring than transferred patients.

So what do these studies tell us? Certainly they highlight some of the similarities between the United States and the United Kingdom with respect to overburdened emergency services. The United States is seeing consistent increases in the volume of and illness severity of patients presenting to the A&E department, just as we are observing in the United Kingdom. The studies also confirm what many of us believe and what may be viewed as 'critical care arrogance': that is, the critically ill are best looked after in the ICU environment with the skills, time and staff to recognise, and react to, physiological deterioration. The latter study does have several weaknesses, which the authors themselves point out. The study is retrospective and there is no ability within the data trawling to identify causes of delay. There is a lack of institutional data and, as such, a few underperforming centres may therefore have contributed to the majority of delayed transfers, which may be explained by other factors independent of 'boarding'. The Acute Physiology and Chronic Health Evaluation II data were limited to about 60% of patients and also the 'boarders' only contributed just over 2% of the sample. As the accompanying editorial points out, however, hopefully this will lead to seeking innovative ways to avoid delays in transferring to ICU care – and to avoid doing so is 'inefficient, expensive and deadly' [7].

For those involved in redesigning services in the United Kingdom, one hopes that these studies will be borne in mind, although advocates of specialist centralisation will point to the evidence supporting this approach. This leads on to a study by Peelen and colleagues published in this journal examining the influence of volume and ICU organisation on hospital mortality in patients admitted with severe sepsis [8]. This was a retrospective cohort study using the Dutch national intensive care database that employed questionnaires sent to the participating units. An impressive response rate of over 90% was achieved. More than 4,500 patients were analysed, and the risk-adjusted mortality rates demonstrated that there was lower inhospital mortality in units that treated a higher volume of sepsis. Unexpectedly, several other factors were also associated with a higher mortality. Those hospitals with a 'step-down' facility were associated with a higher probability of inhospital death, as was the number of intensivists per bed, although no association between the availability of an intensivist outside working hours and mortality was observed. This may in part be explained by the excellent provision of ICU-trained doctors in

The Netherlands. The authors do call for further studies on the volume:outcome relationship in the intensive care arena, but also state that 'the findings of the present study are not sufficient to support regionalization of ICU care for severe sepsis patients' [8]. They also point out that 'transportation to a high-volume, regionalized severe sepsis centre might do more harm than immediate treatment in an ICU with a low sepsis volume', which brings us back to the work by Golestanian and colleagues.

What is clear is that there is a growing body of evidence demonstrating that improved intensive care outcomes are associated with increased volume of the ICU [9-11]. But where do policy-makers go from here? Clearly there is a need for further prospective studies, and if these help elucidate some of the critical factors then these factors may be addressed. The problem may lie in what strategies will be employed to address the inequalities in outcome. Some may advocate a centralised system with the incumbent dangers in transfer, although the knock-on effects may also be felt in an erosion of local expertise and the range of services offered. Others may suggest exportation of training, enforced protocols and 'care bundles'. At present there is no easy answer but change will almost certainly ensue, hopefully to the benefit of our patients.

There are many contentious issues in the treatment of the critically ill patient regarding what is best practice. One of the arguments that continue to rage is that of the delivery of renal support, with advocates of all modalities continuing to promote their favoured technique. However, there is not a great deal of information with regard to long-term follow up. The paper by Bell and colleagues examines data from 32 Swedish ICUs (the SWING group) as a retrospective cohort study between 1995 and 2004 [12]. The quality of data collection is impressive and over 2,000 patients were studied with no discernable differences in baseline characteristics, although patients with sepsis were more likely to receive continuous renal replacement therapy (CRRT). Approximately 50% of the patients died within 90 days, with no differences noted between those treated with CRRT or intermittent haemodialysis (IHD). Of the cohort surviving longer than 90 days the patients treated with CRRT had a better recovery of renal function than those treated with IHD, as judged by the need for chronic renal replacement therapy. The study does have limitations – no data regarding severity of illness are available (although it is implied that those treated with CRRT were sicker) and there is a lack of information regarding the dose and the length of dialysis. Interestingly the study does demonstrate a marked change in practice – the use of continuous techniques increases with time, with 76% of the IHD-treated cohort being treated before 2000, which may also affect the observed results. How does this affect the choice of renal replacement therapy? Bell and colleagues' study cannot answer this question, but one criticism of CRRT is the expense; however, if IHD is associated with a greater

need for chronic dialysis, then this also has significant financial implications as well as the burden of comorbidity associated with chronic renal disease.

## Competing interests

LF works in the NHS and wishes to preserve its integrity.

## References

1. Golestanian E, Scrugs JE, Gangon RE, Mak RP, Wood KE: **Effect of interhospital transfer on resource utilization and outcomes at a tertiary referral center.** *Crit Care Med* 2007, **35**:1470-1476.
2. Borlase BC, Baxter JK, Kenney PR, Forse RA, Benotti PN, Blackburn GL: **Elective intrahospital admissions versus acute inter-hospital transfers to a surgical intensive care unit: cost and outcome prediction.** *J Trauma* 1991, **31**:915-918.
3. Escarce JJ, Kelley MA: **Admission source to the medical intensive care unit predicts hospital death independent of APACHE II score.** *JAMA* 1990, **264**:2389-2394.
4. Rosenberg AL, Hofer TP, Strachan C, Watts CM, Hayward RA: **Accepting critically ill transfer patients: adverse effect on a referral center's outcome and benchmark measures.** *Ann Intern Med* 2003, **138**:882-890.
5. Combes A, Luyt CE, Trouillet JL, Chastre J, Gibert C: **Adverse effect on a referral intensive care unit's performance of accepting patients transferred from another intensive care unit.** *Crit Care Med* 2005, **33**:705-710.
6. Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP: **Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit.** *Crit Care Med* 2007, **35**:1477-1483.
7. Gregory CJ, Marcin JP: **Golden hours wasted: the human cost of intensive care unit and emergency department inefficiency.** *Crit Care Med* 2007, **35**:1614-1615.
8. Peelen L, de Keizer NF, Peek N, Scheffer GJ, van der Voort PHJ, de Jonge E: **The influence of volume and intensive care unit organization on hospital mortality in patients admitted with severe sepsis: a retrospective multicentre cohort study.** *Crit Care* 2007, **11**:R40.
9. Durairaj L, Torner JC, Chrischilles EA, Vaughan Sarrazin MS, Yankey J, Rosenthal GE: **Hospital volume-outcome relationships among medical admissions to ICUs.** *Chest* 2005, **128**:1682-1689.
10. Glance LG, Li Y, Osler TM, Dick A, Mukamel DB: **Impact of patient volume on the mortality rate of adult intensive care unit patients.** *Crit Care Med* 2006, **34**:1925-1934.
11. Kahn JM, Goss CH, Heagerty PJ, Kramer AA, O'Brien CR, Rubenfeld GD: **Hospital volume and the outcomes of mechanical ventilation.** *N Engl J Med* 2006, **355**:41-50.
12. Bell M, Granath F, Schön S, Ekbohm A, Martling R-L: **Continuous renal replacement therapy is associated with less chronic renal failure than intermittent haemodialysis after acute renal failure.** *Intensive Care Med* 2007, **33**:773-780.