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Regionalized Critical Care May Be Feasible, But Will it Improve Outcomes?

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Regionalized critical care is a system in which the sickest patients are triaged while en route to the hospital to specialized ICUs located in referral hospitals. Such a system is currently utilized for trauma and cardiac arrest patients with demonstrated benefits (1, 2), and it has the potential to both improve outcomes among other populations of critically ill patients, and the efficiency of referral and non-referral hospitals (2–4). As a result, United States critical care professional societies and the Institute of Medicine have advocated the adoption of regionalization for the sickest critically ill patients as well (5, 6).

However, there are significant gaps in the literature regarding the feasibility of regionalization, including the effects of pre-hospital triage on EMS transport times and on ICU occupancy. The concern is that with triage to any hospital other than the closest available, pre-hospital transport times could increase such that the benefits of receiving care at a referral center might be outweighed by delays in care received, or that referral centers could become too strained to provide optimal care to these patients (7–9). This study by Dr. Seymour and colleagues (p___ - ___) in this issue of *Critical Care Medicine* seeks to address these questions. Using an administrative dataset of over 100,000 adult non-trauma, non-cardiac arrest, critically ill patients who received care in 14 hospitals located in King County, WA, he and his colleagues simulated a system of pre-hospital triage to designated referral centers using a validated prehospital risk score employed in the field by EMTs (10, 11). Various scenarios involving up-triage of the sickest patients to referral centers and down-triage of less sick patients to the nearest hospital with an available bed were assessed for effects on pre-hospital transport time and ICU occupancy. EMS incidents were geolocated, and Google Maps and ArcGIS (www.arcgis.com) were used to determine and time routes taken to destination hospitals, accounting for fluctuations in traffic patterns (12).

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Interestingly, the results of the study suggest that pre-hospital triage would only marginally increase prehospital transport times, and that ICU occupancy would increase by small amounts, particularly when both up triage of the sickest and down triage of less sick patients were employed. Travel times increased by 2% or less than 12 minutes for most patients in simulations utilizing both up and down triage; ICU occupancy increased from 61 to 64% at referral hospitals, and decreased from 47 to 45% at non-referral hospitals. Sixty-six percent of the sickest patients would have been up-triaged to a referral hospital and 16% would have been taken to a different referral hospital than where they actually received care; among low risk patients, 55% would have been taken to a new, non-referral hospital. Running this simulation with 25% fewer ICU beds resulted in an increase in average referral ICU occupancy to 74%. Simulations involving up-triage only had somewhat less optimistic results: transit times increased by 13%, and referral ICU occupancy increased to 68%. Results from a scenario involving up-triage only and a reduction in available ICU beds were not presented.

These results suggest that a significant proportion of critically ill patients in King County, WA who could potentially benefit from ICU care at a referral hospital are currently receiving care at non-referral centers. If it is true that care at referral hospitals would produce significantly better outcomes (and it is not clear that it is, as the authors state that global outcome measures including length of stay and mortality did not differ between referral and non-referral hospitals), regionalizing critical care may be of substantial benefit to the sickest patients in this population.

One potential problem with this conclusion however, is that given the evidence that timely care saves lives (13), whether the benefits of receiving care at a referral center ICU outweigh delays in care. A recent analysis of sepsis patients brought to the hospital via EMS found that the time from scene to first antibiotics was 3.5 hours; 12 minutes is just a small proportion of that time (14). The clinical significance of delays in care this small is currently unknown.

Further, it is also possible that other patients could be negatively impacted. Referral ICUs in King County appeared robust to the increases in occupancy projected by these models, even when up-triage alone was the chosen strategy. However in other areas of the country that operate at an average ICU occupancy of greater than 60–70% (15), in order to accommodate increases in patient volume to prevent ICU strain from negatively affecting outcomes in referral ICUs, down triage of less critically ill patients to non-referral centers could be necessary. As a result, down-triaged patients could find themselves the recipients of inferior care at a non-referral center than they might have otherwise received.

A simulation of regionalized care that includes projected outcomes based on severity of illness and change in triage destination is the next logical step to assess whether the benefits of up-triage experienced by the sickest patients outweigh the potential decrements in outcomes for down-triaged patients. If ethically feasible, a randomized trial could also be informative, and would additionally permit assessment of the benefits of referral center ICU care versus the costs of delays in care from increased transport time. If regionalization were to be pursued at the national level, it would also be important to repeat this simulation in

other referral areas, as it is likely that other regions have different geography, patient and hospital populations, making regionalization in those areas more or less attractive.

This is an interesting, well performed study that uses sophisticated, appropriate methods to provide pragmatic data for policy makers. It represents an important first step in illustrating the potential effects of regionalization of critical care on pre-hospital transit time and ICU occupancy, suggesting that the effects on those variables might be minimal. Future research should determine the effects of regionalization on outcomes among specific groups of affected patients, whether small delays in care are clinically significant, and the degree to which other regions of the country could also benefit.

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