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Editorial

Survival until hospital admission after out-of-hospital cardiac arrest – A costly victory?

There is little disagreement about the societal burden of out-of-hospital cardiac arrest (OHCA) in terms of both high mortality and morbidity.¹ Previous studies on OHCA outcomes were hampered by the variability in the definitions and reporting of patient outcome; however, in recent decades, with the publication and adoption of the uniform 'Utstein style' reporting guidelines,² several large observational studies have outlined the OHCA outcomes in Europe and elsewhere.^{3–6} Not a moment too soon, a clear shift has also occurred towards including neurological outcomes and patient quality of life in these reports.⁷ Less attention, however, has been focused on health care costs and especially on the cost-effectiveness of out-of-hospital cardiopulmonary resuscitation (CPR) and various adopted cardiac arrest interventions.^{8–10} A major challenge in cost data collection is the multidisciplinary teams involved in the care of OHCA patients. The exact per patient cost figures may be impossible to collect from emergency medical service (EMS) providers, hospitals and the involved insurance companies. On the contrary, this problem may not be unique to OHCA but may be typical for many other types of critical illness and for pre-hospital care in general.

In this issue of Resuscitation, Geri and colleagues have made an effort to accurately estimate the health costs related to cardiac arrest including pre-hospital and hospital care in Ontario, Canada over an eight-year period.¹¹ Using prospectively collected OHCA data from a well-established database and by combining these data with the data on EMS and hospital and outpatient care costs obtained from state-wide health care databases, the authors aimed to measure health care costs after cardiac arrest from a payer's perspective. In a study involving more than 25,000 cardiac arrest patients, they investigate the factors associated with total costs primarily from both an EMS and a hospital perspective. The authors estimate that during the eight-year study period, 160 million Canadian Dollars (CAD) were spent on OHCA management with a gradual increase in yearly costs over time. The pre-hospital costs including the care cost of patients who died on scene account for only 6% of the total costs whereas 92–93% are related to hospital care. Indeed the main conclusion of the study, based on these findings is that initial survival is the main contributor to the total costs after OHCA. Whilst this conclusion may seem completely expected and self-evident at first, it has important layers. The most important point that needs to be acknowledged is a form of "survivorship bias". Many of the interventions such as summoning more EMS teams to the scene, TTM, angiography and CABG are offered in order to improve the chances of survival and some are applied at a time when other patients will have already succumbed. That time bias immediately makes the total costs of these patients a

little higher and, if these interventions are effective, these patients will survive to need more care and this results in higher costs.

The main and simple question that arises with an analysis such as this is whether all these dollars are really well spent. A simple way of answering this would be to divide the total sum of 160 million CAD with the total 2100 OHCA patients alive at 30 days. This would result in a sum of ~80,000 CAD per survivor. This cost would be seen by most as well below what is considered acceptable in medicine today.¹² However, unfortunately, we know that rehabilitation costs and work compensations are considerable in OHCA patients and that the total costs for the former are likely to be much higher than the reported 80,000 CAD for the first thirty days.⁹ In addition, the study does not report on the neurological outcomes of patients. Patients with poor outcomes and a cerebral performance category scale of 3–4 have very high rehabilitation costs and are unlikely to return to work.^{9,13} Thus, the final possible cost per quality-adjusted life year is difficult to estimate based on the current study. Nevertheless, based on previous studies, we know that from an intensive care unit (ICU) perspective, the cost-effectiveness of ICU care for OHCA patients appears very similar to other types of neurocritical illnesses, including traumatic brain injury, stroke and subarachnoid haemorrhage.^{14,15}

The authors discuss means to decrease costs. Regarding pre-hospital costs, the amount of on scene teams, greatly increases costs. However, if as the authors suggest, this results in improved survival and even better neurological outcome this is very much likely to be cost effective.¹⁶ One main contributor to increased hospital costs that was identified by the authors is the need for secondary transport. This may, though, be a modifiable aspect of OHCA management. In some instances, direct transport to a cardiac arrest centre may be justified, even though high quality data on this topic is lacking.¹⁷ The use of TTM also clearly increases costs, but if it increases the number of patients with good neurological outcome, as an intervention, it is likely very cost-effective.¹⁸ Other future aspects of care such as a more widespread use of extracorporeal CPR make this even more complex.¹⁹ Moreover, the possible opportunity of organ donation in patients with catastrophic brain injury such as brain death, is likely to improve the cost-effectiveness of OHCA from a societal perspective.

How can we make OHCA management more cost-effective? This is of relevance, given the rise in health expenditure overall and taking into account the aging population in the western world. Based on the findings of Geri and colleagues, a focus on the basic steps of the chain of survival is likely the answer, but the need for strategies aiming at identifying futile care at all steps should not be ignored.^{20,21} Geri and

colleagues should be congratulated for attempting to provide important information on the OHCA management costs. Only with larger and more comprehensive studies including data on long-term neurological outcome can the total cost of this very complex problem be fully appreciated from a patient, as well as a societal perspective.

Conflicts of interest

Markus B Skrifvars reports lecture fees and travel grants from BARD Medical (Ireland) and a research grant from GE Healthcare. Robin J Prescott reports no conflicts of interest.


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