



Volume and Outcome — Time to Step Forward

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In 1995, two cardiac surgeons in the United Kingdom stopped operating on children because the mortality rates for some of their operations were considered too high [1]. These events sparked considerable debate on the development of a system for the comparative measurement of the quality of surgical care and on the generation of valid risk-adjusted outcomes. A public inquiry underscored the need for reliable information about the results in pediatric cardiac surgery that could be analyzed, published and made available for the assessment of surgical performance. In Israel, few data have been reported on overall mortality rates for pediatric cardiac surgery.

In this issue of the Journal, Dagan et al. [2] examine one of the more contentious issues in the provision of pediatric cardiac surgery: the association between patient volume and outcome of surgery. This report has several limitations, including an unconvincing hypothesis and inadequate analysis of data. It is not clear but it would be interesting to know whether the systematic differences in mortality rates presented by Dagan et al. are obvious from one year to the next. Another finding that they present was that overall mortality decreased, but their data were not adjusted for differences between case mix and risk factors. Furthermore, there is no breakdown or discussion of the volume of cases of individual surgeons. These drawbacks need to be considered when interpreting the authors' findings.

Notwithstanding the above reservations, this study is a step in the right direction. It is a much needed attempt to study the relation between the volume of cases treated by an institution or a surgeon and clinical outcome. It would appear logical to assume that the more experience a surgeon has with a particular procedure the better the result will be, but the dynamics of cause and effect are not conveniently clear-cut. Higher surgeon or hospital volume has been associated with better outcomes in several areas, including pancreatic and esophageal abdominal aortic aneurysm, myocardial infarction, cardiac surgery and pediatric cardiac problems [3–5]. Nine of 11 studies on cardiac surgery in adults showed a significant association, although a large study that examined 97,137 cardiac operations found no significant relation between volumes and outcomes, *after adjustment for risk factors* [5,6]. Two competing explanations for the observed association between

volume and outcome have been advanced. The first, "practice makes perfect," hypothesizes that hospitals and surgeons have better outcomes because their volume of experience allows them to improve their techniques. The second, "selective referral," hypothesizes that hospitals with better outcomes have larger volumes because of the reputation of their excellence, and thus more patients seek care in them [7].

It should be borne in mind, however, that higher volume is not a *de facto* indicator of quality of care. Rather, it is a parameter that is easy to calculate and may be associated with quality because of a combination of components. An association between increased volume and better outcome may be due to one or more common underlying factors, such as case mix, better associated services (such as anesthesia and intensive care), and the ability to attract and retain skilled staff [5,7]. Furthermore, the authors' conclusion that annual surgeon volume and annual hospital volume are significantly inversely related to mortality is not universally accepted [8,9]. Other studies contend that there are no data to conclusively indicate that outcomes of cardiac operations are related to a specific minimum number of cases performed annually by a cardiac surgeon or medical center. In addition, the case mix of a surgeon or program must be carefully considered when evaluating outcomes: it is clear that some surgeons may perform a specific procedure with relative infrequency and in low volume hospitals, yet have excellent results. Moreover, many common procedures inherently have low surgical mortality rates, and so even if a volume outcome trend does exist it may be difficult to demonstrate convincingly in observational studies and it may be of limited clinical relevance.

The article by Dagan and colleagues should sound the call for all cardiothoracic centers to participate in a national and international database that permits comparisons with other programs on a risk-adjusted basis for improvement of care. Unless there are definite data that link volume to outcome, volume alone should not be used as a sole criterion for accreditation, but rather all centers should be evaluated on the basis of their individual results. [10] There is no better time than the present to exploit the momentum of the initiative taken by Mozes et al. [11] and develop a national system for the

comparative measurement and improvement of the quality of surgical care based on proper prospective collection of pertinent clinical data and on the generation of valid risk-adjusted outcomes. We have the resources, know-how and leadership to carry out this project, which we owe to our patients and no less to ourselves as professionals who strive for excellence in their care.

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