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Volume/Outcome in CABG and PTCA: A Summary of the Literature

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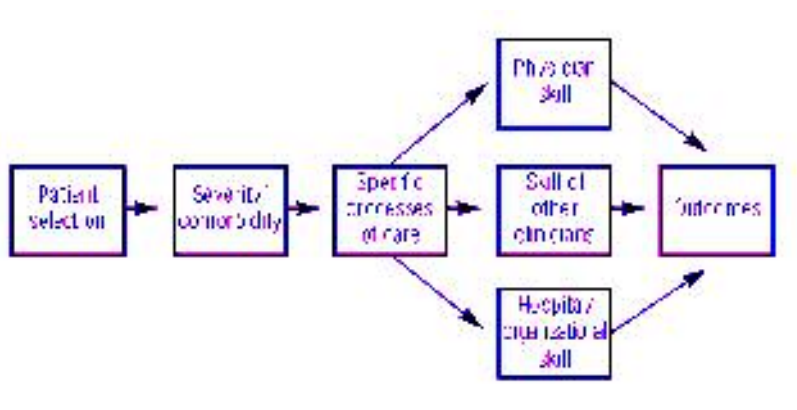
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Volume/Outcome in CABG and PTCA: A Summary of the Literature

A burgeoning body of literature has evolved on the relationship between volume and outcome in healthcare since the early 1980s. A search of this literature yields almost 5,000 articles, many of which have been published in top journals including *Journal of the American Medical Association (JAMA)*, *New England Journal of Medicine (NEJM)*, *Medical Care* and others. Researchers and policy analysts have examined the relationship in specific procedures and populations including cancer, transplant, intensive care, trauma, acute myocardial infarction, carotid endarterectomies, abdominal aortic aneurysms, coronary artery bypass graft (CABG), percutaneous transluminal coronary angioplasty (PTCA), etc. That the relationship exists for many procedures is almost undisputed. However, two points of contention and consternation persist: 1) Even with the breadth of literature, the underpinnings of the relationship remain poorly understood, and 2) while most acknowledge the relationship, the policy implications of this relationship are unclear.

Luft and Flood authored seminal studies on the volume/outcome relationship.¹⁻³ After demonstrating the empirical relationship between volume and outcome by studying 12 surgical procedures including CABG, Luft explored potential causal factors underlying the relationship and hypothesized that this relationship may be due to experience (ie, practice makes perfect) and/or selective referral. Adjusting for case mix, Flood and colleagues confirmed the volume/outcome relationship. They also found that quality improvements can be achieved by increasing the volume of specific services in individual hospitals rather than by concentrating services in those hospitals with the most beds. More than 20 years after Luft and Flood pioneered volume/outcome research, many of the questions posed by Luft and Flood remain unanswered: What is optimal volume? How important is current volume vs. accumulated experience? How do other members of the team (nursing staff, anesthesiologist, OR staff, etc.) influence the relationship? Do high volume hospitals have standards and protocols that account for their better performance?

Ethan Halm, Clara Lee and Mark Chassin performed a systematic review of the extensive body of literature on volume/outcome to support a May 2000 Institute of Medicine workshop.⁴ The conceptual model they developed to guide their review of the literature provides a clear and succinct view of the potential explanatory factors underlying the volume/outcome relationship:



This model is the first new model developed since Luft hypothesized that the relationship between volume and outcome can be explained by practice makes perfect or selective referral.

Halm, Lee and Chassin reviewed 88 studies published from 1980 to 1999 of eight conditions and procedures including CABG and PTCA. They noted that the methodological rigor of many studies considered for inclusion is modest. Additionally, that there is wide variation in the definition of low vs. high volume, inconsistency in the unit of analysis, and variation in the robustness of severity adjustment models makes it difficult to generalize conclusions. Of all studies reviewed, 77% found statistically significant relationships, and no study found a significant relationship in the opposite direction. Of the studies considered to be of the highest quality, all found statistically significant associations between volume and outcome.

In another review of the volume/outcome literature published in JAMA in 2000, Dudley et al. identified 72 articles addressing 40 procedures and diagnoses, again including CABG and PTCA.⁵ For CABG they reviewed 11 studies, nine of which demonstrated a statistically significant difference in mortality between high and low volume centers, and two showing a trend. For PTCA, six studies were reviewed for nonemergent angioplasty, all of which showed a statistically significant difference in mortality between high and low volume centers. For emergent PTCA, one study was reviewed and showed a trend (not statistically significant) toward high volume centers having better outcomes.

The evidence supporting the volume/outcome relationship in many procedures – particularly in CABG and PTCA – is ubiquitous. There is virtually no evidence that better outcomes are achieved in lower volume settings. Challenges to the volume/outcome relationship therefore evolve primarily from objections to the policies centered on the relationship.

While it is often acknowledged that volume is a proxy for other factors that affect care and not a causal factor on its own accord, in the absence of data illuminating the causal factors, volume has been shown to be an acceptable indicator of quality. As Epstein aptly notes in his NEJM April 11, 2002 editorial, "After two decades of research, it is time to move ahead. Few doctors would routinely send their own family members to undergo a high-risk, elective operation at a hospital where such operations were rarely performed (or to a physician who rarely performed them) if good alternatives were nearby."⁶ Multiple strategies can be pursued to improve quality of care including CON, credentialing, report cards and selective referral, but it is clear that volume and mortality needs to be a central component of any of them.

The Office of Health Policy routinely reviews the literature on the volume/outcome hypothesis. For more information on the articles mentioned herein, or for a complete bibliography, please contact Dr. David B. Nash at (215) 955-6969.

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