



THE RELATIONSHIP BETWEEN VOLUME & QUALITY IN HEALTHCARE SERVICE PROVISION

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My direction from Robert Thompson is to review volume & quality, or specifically, the relationship between volume of clinical service provision, and the quality of care and outcomes derived from it.

On the surface of it, it's a no-brainer – the more one does, the better one gets – trauma services, complex cardio-thoracic surgery, and perhaps even the read rate and diagnostic accuracy of mammography. In general, and for defined services, volume begets quality. Contrariwise, there is the view that volume may perpetuate poor practice and entrench inefficiency and mistakes in an unmanaged environment.

There are countless sources and volumes of literature on this subject. It would be easy to lose ourselves in data, a sea of graphics and study reviews. I have chosen a different course and will approach our subject from a policy perspective, with respect for clinical implications. That said, here is my general sense of the methodological side of the literature.

There is an ocean of studies and reviews on volume related to quality in healthcare dating well back to the 70's (Luft NEJM, 1979). Many relate to specific procedures and interventions or clinical populations. Not surprisingly, the quality and methodologic rigor is widely variable, not to mention the context specificity and limited generalizability of many. Every study is to a varying degree challenged by important and confounding features, such as patient risk adjustment; or, the distinction between individual clinician volume/quality performance, and hospital volumes/performance. I'll come back to what I conclude from this literature but please allow me to declare a few biases ...

As a family doctor in Grand Bank 1974-6, the volume/quality phenomenon was important to me, being that I was for most of that time the only GP anesthetist on the Burin Peninsula. My senior colleague by a few years had done a preparatory, post-graduate year in Obstetrics. With the combo, we were often called on to do Caesarian Sections for patients from anywhere on the Peninsula. My colleague was adamant that he could and would not do them, if all that we did was attend to the emergencies. I felt the same, nonetheless realizing we did not have a ventilator at that time and all patients had to be hand-bagged during and after anaesthesia. Hence, we developed a practice of doing carefully chosen, elective caesarian sections, in the days before v-bac – '74, '75, '76. We did 15 - 20/year electively, and I'd guess have an equal number of emergencies. Was it enough? What was the alternate if we did not do that? We were quite mindful that we had to do enough to feel we were doing as best as could be done.

Ten years later, after training in internal medicine and critical care, the volume/quality relationship was very apparent to me, particularly as related to my personal technical skills in the ICU. I know that when I took a year away from clinical practice, while doing graduate training in Boston, I felt that my clinical precision diminished. I was quite aware of this several years later, after a period of absence from clinical practice while serving as the hospital CEO for almost three years, before regionalization in Alberta on April 1, 1995. Despite a three-month re-entry preparation for getting back to practice after being in full-time management, I found it challenging. It serves to remind

me of the volume/quality relationship. For instance, that first blood flash from insertion of those subclavian line did not happen as readily, nor necessarily on the first try; and, I will never forget trouble with one notable and tough endotracheal intubation. The patient survived but the experience kept me thinking about my clinical skills for weeks afterwards.

Returning to the literature, much of the original evidence on volume/quality has come from the US, or is published in US-based journals. A great deal of it has focused on surgical volumes, and quality (Birkmeyer, NEJM, 2002) but I also reviewed the obstetrics literature to assess hospital and provider volume and perinatal outcomes (Snowden, AJOG, 2015). In relation to surgical volume, one widely referenced and original citation (Halm, Annals Intern Med, 2002) suggested that roughly two-thirds of studies of hospital volume, and about the same for physician volume, reported statistically significant associations between higher volume and better outcomes. After reviewing several related papers, I am left to conclude that while high volume is associated with better outcomes for a wide array of interventions, the magnitude of the effect is widely variable. The strongest associations seem to be in highly specialized interventions, such as pancreatic and esophageal cancer resection, pediatric cardiac surgery, and abdominal aortic aneurysmal repair. While the direction in the relationship is the same, the strength of the association is far less for examples that have become more diffused and routinized, such as low-risk coronary bypass graft surgery and orthopedic procedures.

In terms of obstetrical volumes, and after adjustment for confounders, the same inverse relation between volume and outcomes appears to hold, with low volume associated with higher birth asphyxia and post-partum hemorrhage. But, these findings are not consistent across studies and they exemplify the challenge of distinguishing the effects of hospital from individual physician volumes. In studies that have attempted to look at provider volume, there appears to be a consistent relationship between volume and risk-adjusted complications. For instance, physicians with 7 or fewer deliveries/year had higher rates of each complication, and a 50% higher risk of all complications compared to physicians in the highest volume category (90 deliveries/year). These numbers did not change appreciably when adjusted for C-section rates. Low volume providers are more common in rural settings (Janakiraman, O&G, 2011).

Again, I would mention that risk adjustment is a major challenge for studies of the volume/quality relationship. Subtle and unmeasured differences in case mix and selection, and other impactful organizational factors unrelated to volume, can have a large effect on outcomes, while otherwise and spuriously appearing to be relating quality to quantity. My advice is that procedure volume, by itself, should not be used as a proxy measure for quality (Khuri, World J Surg, 2005). Indeed, when carefully examined, much of the outcome differences from procedures and interventions relate to patient-level characteristics, such as co-morbidities, frailty and the like (LaPar, Annals of Surgery, 2012).

This volume-quality relationship is recognized in many other fields and services. But in healthcare, it attracts great public and political attention any time that cost containment and rationalization or centralization of service provision are linked. There is indeed a linkage between concentration and centralization of services, and cost containment – economies of scale and scope are accepted as real, whether or not they are always attained. After all, and for instance, we gave up

on the hospital print shop and laundry a very long time ago; materials management and supply chains have since been consolidated and centralized; and now, we have moved on to laboratory-testing factories, and system-wide and contracted services, such as information and communications technologies, clouds, and what have you. Support services aside, the concentration of clinical services in one place means that they are not in proximity elsewhere. At the very least, this raises equity issues.

In an attempt to make this more graphic, please permit me to contrive a few hypotheticals ... knowing that this is Newfoundland and Labrador and, as with many other places in Canada, there is an inextricable linkage between healthcare service provision in the local community and that community's economic wellbeing, perhaps its sense of identity, and hence its politics.

In other words, using the volume/quality relationship to decide on service consolidation is but one dimension bearing consideration when one decides, let's say, to take all of the in-patient services out of Grand Bank, Burin and St Lawrence and put them in Marystown. Been there, done that, says you. So, let's extend that line of thought, assume there are economies of scale and scope to be realized and savings to accrue, and let's propose options for your consideration. Imagine that all surgical services, including orthopedic and gynecological services, for Gander and its surroundings will henceforth be delivered in Grand Falls; or, that all specialty services in Newfoundland and Labrador will be concentrated in one of St. John's, Corner Brook or Labrador City; or even beyond that, that all subspecialty Medical and Pediatric Services Province-wide will be delivered only in St John's. With each of these proposals comes the understanding that the entirety of Newfoundland & Labrador will be a single integrated health care system and otherwise be serviced by primary health care services, organized in teams, with patients being rostered and attached to a designated medical home and all of this accompanied by much more sophisticated community-based care, communications and transport systems. Affordable? Do-able? Advisable? Palatable? All of these questions are, of course, dependant on a composite judgement of many factors, only one of which is the volume/quality relationship. None of this is to suggest that the volume/quality argument be ignored in regional service planning. Rather, it is to say that it is service planning and distribution of delivery is never easy; don't assume huge savings necessarily coming from it; and, always expect a high political cost.

I mentioned the word equity earlier. It usually enters the argument somewhere, so I saved it until the end. In this case and in Canada, it is unrealistic to think of equity in terms of equality in timely access, such as distance and mileage traveled to secure services, and what have you; rather, I suggest that the bar we seek in concentrating services is that at the very least we maintain, if not improve, equity of outcomes. In other words, one gets a reasonable opportunity to achieve the same outcome, regardless of where one resides. This is not always possible in a vast and sparsely populated country like Canada but it could be far better than it currently is.

In closing, allow me to use an Alberta example attempting to achieve quality and equity in outcomes. We have 3% of Alberta's population living on 50% of our land mass. When we looked at one clinical example, stroke outcomes, there was substantial opportunity for improvement in outcomes, with a difference in 30-day in-hospital mortality of greater than 100 deaths per 1000, comparing the five Zones in Alberta. We have since better understood how to replicate what are

Canada's best outcomes in stroke care, as reported and found in Calgary and Edmonton. With the assistance of many, including the Cardiovascular and Stroke Strategic Clinical Network, we have developed stroke-centre equivalent care programs in rural Alberta; and now we have shown attributable improvements in more rapid imaging, faster provision of fibrinolytics, earlier intensive physiotherapy, and improved functional and neurological outcomes at 30 days. Why tell you this? Here's why.

Whenever we are called to make clinical change, it works if we dwell on improving the quality of outcomes for patients, have the means and clinical leadership to do so, and commit to making it happen. Surprising things can occur, particularly if driven by evidence and with top-down and bottom-up support and decision-making in alignment. Contrariwise, if clinical change is approached with the purpose of saving money and resources as the intended outcome, clinicians are unlikely to engage. Nothing that I have seen in the volume/quality literature refutes this.

All said, in general and as my final statement, if one is considering further concentration or regionalization of service provision, with perhaps specific examples and circumstances as exceptions, I would summarize this way:

The empirical relationship between volume and quality in health care services has been widely and variably studied. It is insufficient, in and of itself, to be the justifying and planning determinant of clinical service distribution, albeit it must be carefully considered.

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References

Luft HS, Bunker JP, Enthoven AC. Should Operations Be Regionalized? *N Engl J Med* 301: 1364-1369, 1979.

Birkmeyer JD, Siewers AE, Finlayson EV, Lucas FL, Batista I, Welch HG, Wennberg DE. Hospital Volume & Surgical Mortality in the United States. *N Engl J Med* 346: 1128-1137, 2002.

Snowden JM, Cheng YW, Emeis CL, Caughey AB. The Impact of Hospital Obstetric Volume on Maternal Outcomes in Term, Non-low-birthweight Pregnancies. *AJOG* 212: 380-397, 2015.

Janakiraman V, Lazar J, Joint KE, Jha AK. Hospital Volume, Provider Volume and Complications After Childbirth in US Hospitals. *O&G* 118: 521-526, 2011.

Khuri SF, Henderson WG. The Case Against Volume as a Measure of Quality of Surgical Care. *World J Surg* 29: 1222-1229, 2005.

LePar DJ, Kron IL, Jones DR, Stukenborg GJ, Kozower, BD. Hospital Procedure Volume Should Not Be Used as a Measure of Surgical Quality. *Annals of Surg* 256: 606-614, 2012.