Review: High-volume hospitals have lower hospital mortality rates than did low-volume hospitals for various procedures

Dudley RA, Johansen KL, Brand R, Rennie DJ, Milstein A. **Selective referral to high-volume hospitals. Estimating potentially avoidable deaths.** JAMA. 2000 Mar 1;283:1159-66.

QUESTION

Do hospital mortality rates differ between high-volume hospitals (HVHs) and low-volume hospitals (LVHs)?

DATA SOURCES

Studies from 1983 to 1998 were identified by searching MEDLINE, Current Contents, and First-Search Abstracts with the terms hospital, outcome, mortality, volume, risk, and quality and by reviewing bibliographies of retrieved studies.

STUDY SELECTION

Studies that reported on the relation between hospital volume and mortality, used data from 1988 or later, and included > 2 HVHs were included. Studies were excluded if they used outcome variables other than hospital mortality or used patient identification variables not available through the California discharge database.

DATA EXTRACTION

For each condition identified, the study most likely to yield an unbiased estimate of the effect of hospital volume on mortality was selected for inclusion on the basis of sample size, range of hospital volume, case-mix adjustment, location, and timeliness. Using a California state database of hospital discharges, the actual number of discharges from and deaths at LVHs in 1997 was determined for each condition. Using data from the best study, the number of deaths at LVHs that could be attributed to low volume was calculated. The odds ratio for death (calculated from best study) was used to calculate the number of expected deaths had patients been admitted to HVHs.

MAIN RESULTS

For 14 conditions, ≥ 1 study met all inclusion criteria. Of these 14 conditions, the best study showed no relation between hospital volume and mortality for emergent repair of abdominal aortic aneurysm, knee replacement, and acute myocardial infarction. For the remaining 11 conditions, the best studies showed a relation between volume and hospital mortality (Table).

CONCLUSION

Patients admitted to high-volume hospitals had lower hospital mortality than did those admitted to low-volume hospitals for various conditions.

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Risk estimates for potentially avoidable deaths among patients treated in low-volume hospitals (LVHs)†

Procedure or condition	Definition of LVH*	Odds ratio (95% CI)†	Percentage of excess deaths in LVHs (CI)
Coronary artery bypass surgery	< 500/y	1.39 (1.16 to 1.67)	27 (13 to 39)
Lower-extremity arterial bypass surgery	20 to 49/y	1.21 (1.12 to 1.30)	19 (13 to 25)
Heart transplantation	≤ 8/y	2.06 (1.69 to 2.50)	0
Pediatric cardiac surgery	< 100/y	1.42 (1.18 to 1.71)	27 (15 to 38)
Coronary angioplasty	< 400/y	1.33 (1.10 to 1.61)	24 (3 to 37)
Elective abnormal aortic aneurysm repair	≤ 31/y	1.64 (1.18 to 2.27)	37 (15 to 54)
Carotid endarterectomy	< 101/y	1.28 (1.13 to 1.45)	22 (11 to 32)
Cerebral aneurysm repair	< 30/y	—	43 (31 to 54)
Ruptured	—	1.90 (1.56 to 2.31)	—
Unruptured	—	1.83 (1.20 to 2.79)	—
Esophageal cancer surgery	5 to 6/y	3.08 (1.66 to 5.70)	78 (44 to 78)
Pancreatic cancer surgery	5 to 6/y	2.29 (1.02 to 5.15)	74 (30 to 85)
HIV/AIDS	10 to 99/y	1.30 (1.22 to 1.38)	21 (17 to 26)

*Number of procedures done/y at LVHs.
†Odds ratio for mortality from admission to LVH.

COMMENTARY

Intuition suggests that persons who do more of something do it better. Dudley and colleagues test this belief in their review of volume–outcome differentials among procedures done in HVHs and LVHs. The authors deal with the potential difficulties of cross comparisons of studies by identifying for each condition the study most likely to yield an unbiased estimate of the effect of hospital volume on mortality.

The implications of these findings when applied to the California discharge database are problematic. The authors cite a number of difficulties. First, although a correlation exists between HVH admission and reduced mortality for 11 of 14 procedures, the reasons for such a correlation are unclear. Second, the projection of outcome benefits for other populations would likely overstate the potential effect of regionalized high-volume treatment centers. The authors' assumptions about the emergency status of admissions, the capacity for HVH selection of patients receiving procedural care 3 days after admission, and the service distance based on patient zip code analysis could also be problematic.

The review did not examine elements of service choice that may affect the consumption of the medical product. A previous personal relationship with a provider or a friend or relative can be a strong motivator for service selection. This assumption is supported by the finding that 71% of the procedural services were not emergencies, which implies a previous relationship. Furthermore, the review did not examine the politics and economics of service distribution. In the analysis of coronary artery bypass grafting procedures, the authors reported that LVHs accounted for 66% of all procedures in this category. LVH and HVH planners know that having a cardiac program can yield important economic benefits.

Until a clear national policy on all forms of medical distribution (i.e., how many physicians, what type, where they are located, and what they can do) has been articulated, the clinical implications of the findings of Dudley and colleagues are uncertain.

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