

# Factors Explaining Inequalities in Colon Cancer Survival—Letter

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Set in Victoria, Australia, I thank Afshar and colleagues (1) for their superb research, with strong study design, comprehensive analysis, highlighted by Monte Carlo methods and directed acyclic graphs. I believe one important aspect could have been strengthened by reducing misclassification bias due to the highly uncertain assertion that provider volume is a proxy for quality hospital performance. Meta-analysis and systematic reviews involving 1 million patients have questioned the validity of this assertion for cancer mortality and other colon cancer surgery (CCS) outcomes, suggesting it unsound (2, 3).

In Victoria between 2005 and 2015, CCS annual volumes ranged between 1 to 608 (3). This study chose 32 as the quality threshold implying a hospital with this volume has equal quality to a hospital with 19 times its volume (608) and hospitals with volume 31 have no quality. Market forces may have directed high volume (HV) referrals to hospitals with known quality outcomes rather than HV causing high-quality outcomes as such, exemplifying reverse causality (3). That is, volume *per se* is no guarantee of quality and requires careful consideration as a proxy (4). HV centers can exhibit wide variation in

outcome quality, but it is possible for a relatively small community hospital to achieve comparably low morbidity and mortality rates by establishing and managing an evidence-based surgical oncology program (5). Conversely, hospitals with volumes 32 or greater, do not necessarily have such programs (3).

Hospital volume is subject to many confounding factors not systematically distributed by volume (3). For example, although HV hospitals may be more likely to have multidisciplinary teams, specialist technology-based services and specialized or HV surgeons, it is not necessarily so and is not predicated on a threshold of 32 (3). Confounding hospital characteristics can be suitably modeled in a multilevel framework, strongly recommended by the Committee of Presidents of Statistical Societies regarding hospital performance (4), and compatible with Monte Carlo methods. A recently demonstrated technique directly modeled hospital contextual effects (3) and provided an individual hospital performance metric relative to all other hospitals. Although demonstrated regarding hospital stay following CCS only, it is adaptable to other CCS outcomes such as mortality, readmissions, or complications, but requires further validation (3).

As cancer treatment is centred in hospitals, quality of hospital services is of vital importance. Therefore, it is crucial that hospital performance be assessed accurately, with appropriate characterization and statistical methods, for the benefit of medical systems and patients alike.

## Authors' Disclosures

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