- 3 Backman SB, Stein RD, Fox GS, Polosa C. Heart rate changes in cardiac transplant patients and in the denervated cat heart after edrophonium. *Can J Anaesth* 1997; 44: 247-54.
- 4 Backman SB, Stein RD, Blank DW, Collier B, Polosa C. Different properties of the bradycardia produced by neostigmine and edrophonium in the cat. *Can J Anaesth* 1996; 43: 731-40.
- 5 Backman SB, Ralley FE, Fox GS. Anaesthesia for cardiac transplant patients (Letter). *Can J Anaesth* 1994; 41: 655-6.

REPLY

I would like to thank Drs. Backman, Fox and Ralley for their interest and comments on my review article "Anaesthesia for patients after lung transplantation."¹ As they correctly point out the majority of texts and the majority opinion has been that no change in heart rate occurs with the administration of anticholinesterases to patients with a denervated heart. Their recent research contradicts this view and may indeed change the previous previously held notions.^{2,3} Their publications also may lead to new insight into the physiology of the transplanted heart and into the possibility of whether re-innervation occurs. I agree with them that anticholinesterases should not be administered without a muscarinic antagonist to block the muscarinic side effects (indeed this may be why the bradycardic effect has been previously missed).

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REFERENCES

- 1 Haddow GR. Anaesthesia for patients after lung transplantation. *Can J Anaesth* 1997; 44: 182-97.
- 2 Backman SB, Fox GS, Stein RD, Ralley FE. Neostigmine decreases heart rate in heart transplant patients. *Can J Anaesth* 1996; 43: 373-8.
- 3 Backman SB, Fox GS, Stein RD, Polosa C. Heart rate changes in cardiac transplant patients and in the denervated cat heart after edrophonium. *Can J Anaesth* 1997; 44: 247-54.

Sample size estimation for nominal data

To the Editor:

In the review *Study Design in Clinical Research*,¹ sample size estimation for nominal data involved transforming the data.^{1,2} However, clinicians may either be hesitant to or not have the means to transform their data. To estimate the sample size for nominal data

without a transformation, readers should be aware of two equations that use the observed proportions:

Equation 1:³

$$n = \frac{(p_1 q_1) + (p_2 q_2)}{(p_2 - p_1)^2} \times f(\alpha, \text{power})$$

where p_1 and p_2 are the observed proportions, q_1 and q_2 are $(1-p_1)$ and $(1-p_2)$ respectively, and f is a constant that is determined by the alpha (α) and power $(1-\beta)$. For $\alpha_2 = 0.05$ and a power of 80% or 90%, the values for f are 7.9 and 10.5 respectively.

Equation 2 takes another approach to estimation of the sample size for nominal data:⁴

$$n = k \times \frac{[\bar{p}(1-\bar{p})]}{(p_2 - p_1)^2}$$

where, $k = 15.7$ for $\alpha_2 = 0.05$ and a power of 80%; and 21.02 for $\alpha_2 = 0.05$ and a power of 90%; and

$$\bar{p} = \frac{(p_1 + p_2)}{2}$$

Both equations yield similar estimates of the sample size for nominal data and similar estimates to those that use the transformed data, for the entire range of proportions.^{1,2,5} However, the reader should take note that at the extremes of proportions (i.e., values <0.05 or >0.95), sample size estimates using the above equations may exceed those determined using equations based on transformed data by approximately 10%.⁵

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REFERENCES

- 1 Lerman J. Study design in clinical research: sample size estimation and power analysis. *Can J Anaesth* 1995; 43: 1-8.
- 2 Lerman J. Erratum. *Can J Anaesth* 1996; 43: 880.
- 3 Wassertheil-Smoller S. Biostatistics and Epidemiology. A Primer for Health Professionals. New York: Springer-Verlag, 1990: 99-101.
- 4 Kramer MS. Clinical Epidemiology and Biostatistics. A Primer for Clinical Investigators and Decision-Makers. Berlin: Springer-Verlag, 1988: 179-81.
- 5 Cohen J. Statistical Power Analysis for the Behavioral Sciences, 2nd ed. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1988: 179-206.