patient study may not be well established as is the case for a phantom, but, nevertheless, the variability between algorithms can be determined. The major difficulty of using such a software phantom or library is the incompatibility between the patient file structures of different computer systems, which, at this time, tends to restrict any survey to systems of similar design. It would be desirable if programs that allow interchange of patient studies between different systems could be made more generally available in order to facilitate these types of comparisons.

The conclusion that could be drawn from the results of Makler et al. is that EFs do not vary significantly from one system to another—at least in the hospitals included in their survey. We would caution against extrapolation of such a conclusion on a wider basis. We have shown how the EF for the Vanderbilt phantom might vary by virtue of the algorithm used for background subtraction (*5*). Other factors may also play an important role. Consequently, it is very necessary that the range for normals be determined in each individual institution and, if different algorithms are used on different systems within the same institution, it will be necessary to establish the normal range for each.

Trevor D. Cradduck
Victoria Hospital
University of Western Ontario, Canada

Ellinor Busemann-Sokole
Academic Medical Center
University of Amsterdam
The Netherlands

References

1. Makler PT, McCarthy DM, Bergey P, et al: Multiple-hospital survey of ejection fraction variability using a cardiac phantom. *J Nucl Med* 26:81–84, 1985
2. Busemann-Sokole E, Cradduck TD: Use of a cardiac phantom for QC checks of camera/computer systems. *J Nucl Med* 24:P59, 1983 (abstr)
3. Cradduck TD, Busemann-Sokole E: Comments regarding the use of a cardiac phantom for QC checks of camera/computer systems. *Med Phys* 10:P548, 1983 (abstr)
4. Busemann-Sokole E, Cradduck TD: The use of phantoms for quality control in gated cardiac studies. *J Nucl Med Technol* 13:5–10, 1985
5. Cradduck TD, Busemann-Sokole E, D'Angelo L: Algorithms for ejection fraction and their influence on ejection fraction measurements with a cardiac phantom. *Eur J Nucl Med* 10:7, 1985 (abstr)

REPLY: We thank Drs. Cradduck and Busemann-Sokole for their thoughtful comments regarding our manuscript. They have shown (and we agree) that the Vanderbilt cardiac phantom does not exactly simulate cardiac physiology. However, we do not feel that their observations invalidate the conclusions of our study.

Our study used the phantom to provide identical input data to the 11 institutions surveyed in order to assess the variability in ejection fraction (EF) calculations. If we had found excessive variability, the issues raised by Drs. Cradduck and Busemann-Sokole could have been the cause; however, we observed low variability between institutions, suggesting that the calculated values were precise. Whether the problems with background assessment would affect the *accuracy* of the determined values was not addressed in our study since it concerned itself only with reproducibility.

Doctors Cradduck and Busemann-Sokole raise an important point regarding the fact that the three attenuators are labeled, and thus the results could have been biased. Our three attenuators are labeled 25%, 35%, and 75%, but the calculated EFs averaged 37%, 52%, and 82%, respectively. Thus the operators probably thought they were reporting incorrect values. The agreement between institutions under these conditions confirms the precision of the calculated results. The differences between the labeled EF and the observed EF may well be related to the errors in background determination, but are irrelevant to an assessment of reproducibility. Of interest, the difference between the MDS and DEC computers noted in the low EF range could possibly be caused by differences in the background algorithms, but we do not have information regarding this point.

In summary, while we agree that the Vanderbilt cardiac phantom may not be the most suitable "gold standard" for cardiac function, we do feel that it was appropriate for a reproducibility survey of this nature.

P. Todd Makler, Jr.
David M. McCarthy
Philip Bergey
Kenneth Marshall
Mark Bourne
Michael Velchik
Abass Alavi
Hospital of the University of Pennsylvania
Philadelphia, Pennsylvania

Schilling Evaluation of Pernicious Anemia

TO THE EDITOR: We read with interest the paper "Schilling Evaluation of Pernicious Anemia: Current Status" (*1*) and agree that the exchange of B_{12} moieties can occur on the intrinsic factor molecule leading to difficulty resolving clinical diagnoses with the dual isotope Shilling test (DIST). However, statistical uncertainty could account for much of the scatter in their Fig. 1, which shows the distribution of DIST results by Bound/Free (B/F) ratio and free Cobalt-58 (^{58}Co) B_{12} excretion.

In situations involving measurement of count rates, the smaller the difference between sample and background rates, the greater the total count required to reduce the error to a given level. Evaluation of the background corrected free ^{58}Co B_{12} excretion and B/F ratio from the DIST involves two and six subtractions, respectively. To demonstrate the effect of total count variation on the uncertainty in the free ^{58}Co excretion, consider the expression (*2*):

$$\text{Free } ^{58}\text{Co excretion} = (X)(Y),$$