$S=10$ $R=100$ $I=300$

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Statistical Analysis:

We tested the null hypothesis that readers' average accuracy with modality 1 is equivalent to readers' average accuracy with modality 2. The alternative hypothesis was that the average accuracies are not equivalent. We applied the multi-reader ROC analysis method of Obuchowski and Rockette [ref] which treats the study readers as randomly-selected readers from the population of readers, and the study patients as randomly-selected patients from the population of patients (i.e. random-reader effects model). A significance level of 0.05 was used. The details of the analysis follow.

Let R denote the total number of readers and let I denote the total number of patients in the study. Let R_s denote the number of readers in subgroup s, and I_s denote the total number of patients in subgroup s, such that $\sum_s R_s = R$ and $\sum_s I_s = I$. Let r_{sj} denote the j-th reader in subgroup s.

For each reader we constructed a ROC curve for each modality and estimated the area under the ROC curve and its variance using standard parametric methods [ref to Metz software]. We let $A^m{}_{s(j)}$ denote the estimated area under the ROC curve for reader j in subgroup s with modality m, where m=1,2. Let $V^m{}_{s(j)}$ denote the estimated variance of the area under the ROC curve for reader j in subgroup s. The covariance between the two estimated ROC areas of reader j in subgroup s is denoted by $V^{1,2}{}_{s(j)}$. Similarly, the covariance between the estimated ROC areas for modality m of readers j and k in subgroup s is denoted by $V^{m,m}{}_{s(i,k)}$. The covariance between the estimated ROC areas for reader j in modality 1 and reader k in modality 2, where both readers j and k are in subgroup s, is denoted by $V^{1,2}{}_{s(j,k)}$. Consider reader j in subgroup s and reader k in subgroup t, where s≠t. Note that $V^{m,m}{}_{s(i),t(k)}=0$ and $V^{1,2}{}_{s(j),t(k)}=0$.

Define the symmetric RxR variance-covariance matrix B^m. The diagonal consists of the variances of the R readers in modality m, i.e. $V^m{}_{s(j)}$. The off-diagonal elements are the covariances between the R readers in modality m, i.e. $V^{m,m}{}_{s(i,k)}$ and $V^{m,m}{}_{s(i),t(k)}$.

Define the symmetric RxR covariance matrix C. The diagonal consists of the covariances of the R readers in modalities 1 and 2, i.e. $V^{1,2}{}_{s(j)}$. The off-diagonal elements are the covariances between the R readers in modality 1 and 2, i.e. $V^{1,2}{}_{s(i,k)}$ and $V^{1,2}{}_{s(i),t(k)}$.

The covariances in matrices B^1, B^2, and C were estimated using ROCKIT [ref to Metx software] by performing the appropriate pairwise comparisons of ROC areas. For example, to estimate $V^{1,2}{}_{s(j,k)}$ we ran ROCKIT to compare the ROC areas of reader j in modality 1 to reader k in modality 2. The covariance between these two ROC areas is estimated by ROCKIT and used here to construct matrix C.

OBUMRM2 [ref to website] is a FORTRAN program that performs the multi-reader ROC analysis method of Obuchowski and Rockette [ref]. Using the second input option in OBUMRM2, we input the Rx2 estimated ROC areas, along with matrices B^1, B^2, and C. OBUMRM2 performed the analysis, and we present the results.