The Medical Journal of Australia

Appendix

This appendix was part of the submitted manuscript and has been peer reviewed. It is posted as supplied by the authors.

Appendix to: Nair BR, Moonen-van Loon JMW, Parvathy MS, van der Vleuten CPM. Composite reliability of workplace-based assessment for international medical graduates. *Med J Aust* 2016; 205: 212-216. doi: 10.5694/mja16.00069.

Maximizing reliability coefficient

In this appendix, the indices for CBD, mini-CEX, and MSF are 1, 2, and 3, respectively. Let w_1, w_2, w_3 be the weights of the different WBAs used for calculating the composite universe and error scores. Let *m* be the index for the WBA, $\sigma_m^2(p)$ be the variance for method *m* and $\sigma_{mm'}(p)$ the covariance for WBAs *m* and *m'*. Then the composite universe score variance is given by

Equation 1: composite universe score

$$\sigma_C^2(p) = \sum_m w_m^2 \sigma_m^2(p) + \sum_m \sum_{m' \neq m} w_m w_{m'} \sigma_{mm'}(p)$$

The composite error score is

Equation 2: composite error score

$$\sigma_C^2(\Delta) = \sum_m w_m^2 \sigma_m^2(\Delta)$$

where $\sigma_m^2(\Delta)$ is equal to the absolute error. Using the above equations, the reliability coefficient is defined as

Equation 3: reliability coefficient

$$E\varrho^2 = \frac{\sigma_C^2(p)}{\sigma_C^2(p) + \sigma_C^2(\Delta)}$$

As the sum of the weights is 1 and each weight is positive, these three equations can be rewritten using $w_2 = 1 - w_1$ for the case with CBD and mini-CEX, resulting in a quadratic equation with one variables, w_1. Setting the derivative to 0, the value for w_1 can easily be calculated, directly leading to the value for w_2.

For the case including the MSF, these three equations can be rewritten using $w_3 = 1 - w_1 - w_2$, resulting in an equation with two variables, w_1 and w_2. By determining the partial derivative of this equation to w_1 and setting this to zero, the optimal value for w_1 can be found which is expressed in an equation with only w_2 as variable. This function for w_1 is included in the rewritten equation for the reliability coefficient, which can be optimised for w_2. Once the optimal value for w_2 is found, w_1 and w_3 can easily be determined. Entering these weights in Equation 3 leads to the optimal reliability coefficient, given the variances, co-variances, and harmonic mean.