

TECHNICAL APPENDIX

Paper Title: The H-PEPSS: An instrument to measure health professionals' perceptions of patient safety competence at entry into practice

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Additional Sampling Details

- 100% of eligible participants in medicine and pharmacy provided email addresses and 87% of the nursing group.
- At the start of survey data collection it became apparent that the Postgraduate medicine group was smaller than initially anticipated. In order to increase the size of this respondent group data collection was extended to those who completed their primary postgraduate training in 2009 or 2010, nearly doubling the size of this group from 495 to 965
- While this sample was designed to be comprehensive, we realize that a small number of individuals would be missed. These include those in the new MD group who were not matched to a postgraduate training program at the time of the data query in October 2010 and a small number of people in the postgraduate medicine group who were unsuccessful on their certification exam and remained in practice with a restricted educational license.

Chi-square values in CFA

- The chi-square test, normed chi-square value, comparative fit index (CFI), and the root mean square error of approximation (RMSEA) were used to evaluate model fit in CFA-1, CFA-2 and CFA-4.
- While a non-significant chi-square ($P > 0.05$) is desirable and suggests the model adequately represents the data, it can be difficult to achieve with large samples. The relative / normed chi-square value, which is the chi-square to df ratio, has been suggested as an alternate index that is less dependent on sample size. Good fit is indicated for values less than two[1] or three.[2]
- CFI takes sample size into account and RMSEA is a residual-based index that takes model complexity (e.g. number of parameters) into account[3] and is scaled such that a lower value indicates better fit. Models with CFI values greater than 0.95 and RMSEA values less than .06 are indicative of good model fit.[4] These criteria have been used in previous medical education research.[5]

CFA Results

- CFA-1 tested the six-factor model of PS competency and included all 23 items initially designed to measure the six factors ($\chi^2 = 886.33$, $df = 215$, $p < .000$, $CFI = 0.948$, $RMSEA = 0.055$, relative $\chi^2 = 4.12$).
- The CFI and RMSEA values were reasonable, however, the chi-square value was quite large and the modification indices and examination of the standardized residuals highlighted seven items not well accounted for by the model.
- From a theoretical standpoint these seven items were either redundant or seemed more distal to the remaining items in the latent construct (see Table 1).
- The retrofitted six-factor, 16-item model produced a good fit of the model to the initial sample in CFA-2 ($\chi^2 = 238.58$, $df = 89$, $p < .001$, $CFI = 0.983$, $RMSEA = 0.041$, relative $\chi^2 = 2.68$) with all path coefficients >0.70 .

- CFA-2 was considered optimal in representing the observed data for all four health professional groups. In order to avoid fitting the model to trivial artefacts of the data further improvements in model fit were not carried out.[3] The final path diagram is shown in Figure 1.
- CFA-3 The results of the *invariance testing* show that the measurement model (e.g. the factor loading parameters) is invariant across the four health professional groups in our study (model 1 $\Delta\chi^2_{(30)} = 34.85$ $p=.248$, $\Delta CFI = .001$). Given the significant chi-square difference in model 2, structural invariance (e.g. factor covariances) of the model remains equivocal despite the acceptable ΔCFI (model 2 $\Delta\chi^2_{(93)} = 155.00$, $p = .000$, $\Delta CFI = .007$). These results, which provide full support for measurement invariance and partial support for structural invariance, indicate that the number of factors and their items (e.g the meaning of the six PS competence factors) is consistent across these different groups of health professionals. The partial support for structural invariance in CFA-3 may reflect real world differences in how the six factors in the model *relate to one another* in the eyes of these different health professional (HP) groups.[6, 7]

REFERENCES

1. Ullman JB. Structural equation modeling. In: Tabachnick BG, Fidell LS, editors. Using Multivariate Statistics. 4th ed. Needham Heights, MA: Allyn & Bacon; 2001.
2. Kline RB. *Principles and practice of structural equation modeling*. 3rd ed. New York: Guilford Press; 2010.
3. Byrne BM. *Structural Equation Modeling with AMOS*. 2nd ed. Routledge Academic; 2009.
4. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling* 1999;6:1-55.
5. Schmidt K, Rees C, Greenfield S, et al. Multischool, international survey of medical students' attitudes toward "holism". *Acad Med* 2005;80:955-63.
6. Intermediate Topics in Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). Available at: http://ied.academia.edu/GavinBrown/Talks/38645/Intermediate_Topics_in_Confirmatory_Factor_Analysis_CFA_and_Structural_Equation_Modeling_SEM. Accessed 7/18/2011, 2011.
7. Ginsburg L, Tregunno D, Norton P, Casebeer AL. Who's Culture is it Anyway: Perceptions of patient safety culture by different stakeholder groups. In: Casebeer AL, Harrison L, Mark AL, editors. *Innovations in Health Care: A Reality Check* Hampshire: Palgrave Macmillan; 2006.