O46 Impact of exposure control on the efficiency and score precision of PROMIS computer adaptive testing

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Objective: The study aimed to assess the impact of item bank utilization control, often referred to as exposure control in literature, on the efficiency and score precision of PROMIS computer adaptive testing (CAT).

Methods: We conducted simulations to investigate various exposure control methods in CAT, utilizing true theta estimates from a large-scale health system that administered PROMIS CATs for pain interference (v1.1, N = 5,587) and physical function (v2.0, N = 5,504). The simulation was performed using the catR package, modeling responses under the graded response model (GRM). The CAT algorithm administered between 4 and 8 items per patient, applying a stopping rule based on either a standard error (SE) below 0.3 or a minimal change in SE less than 0.01. Three item-selection strategies were compared: (1) maximum posterior weighted information (MPWI) method (no exposure control), (2) randomesque selection of the top 5 informative items (R5), and (3) randomesque top-10 (R10). CAT performance was assessed by examining the mean number of items administered, bias and root mean square error (RMSE) of theta estimates, standard error of estimation (SE), and item exposure rates.

Results: Performance varied across the three item-selection strategies, particularly regarding efficiency, estimation precision, and item exposure rates. For pain interference, the R10 method demonstrated the lowest RMSE (0.48) and maximum item exposure rate (37.1%), significantly improving estimation precision and reducing item overexposure compared to MPWI (RMSE=0.26, maximum exposure=100%). The MPWI method showed comparable efficiency (mean items=4.34) but had the highest maximum item exposure rate. For physical function, all three methods had similar efficiency (mean items administered~4.4), but R10 again achieved the lowest maximum exposure rate (34.1%). The SE values indicated comparable precision across methods, with slightly better distribution profiles for randomesque methods.

Conclusions: Overall, the randomesque methods (R5 and R10) improved item bank utilization and reduced item overexposure while maintaining estimation precision comparable to the MPWI method. Future research should investigate the content of frequently administered versus rarely selected items to identify potential gaps or biases in content coverage. Implementing content-balancing algorithms may further improve the clinical relevance of PROMIS CAT for both domains.