

# Does the impact of migraine on physical function mean the same thing for headache and non-headache days?

## Assessing differential item functioning in the MPFID

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### Background & Objectives

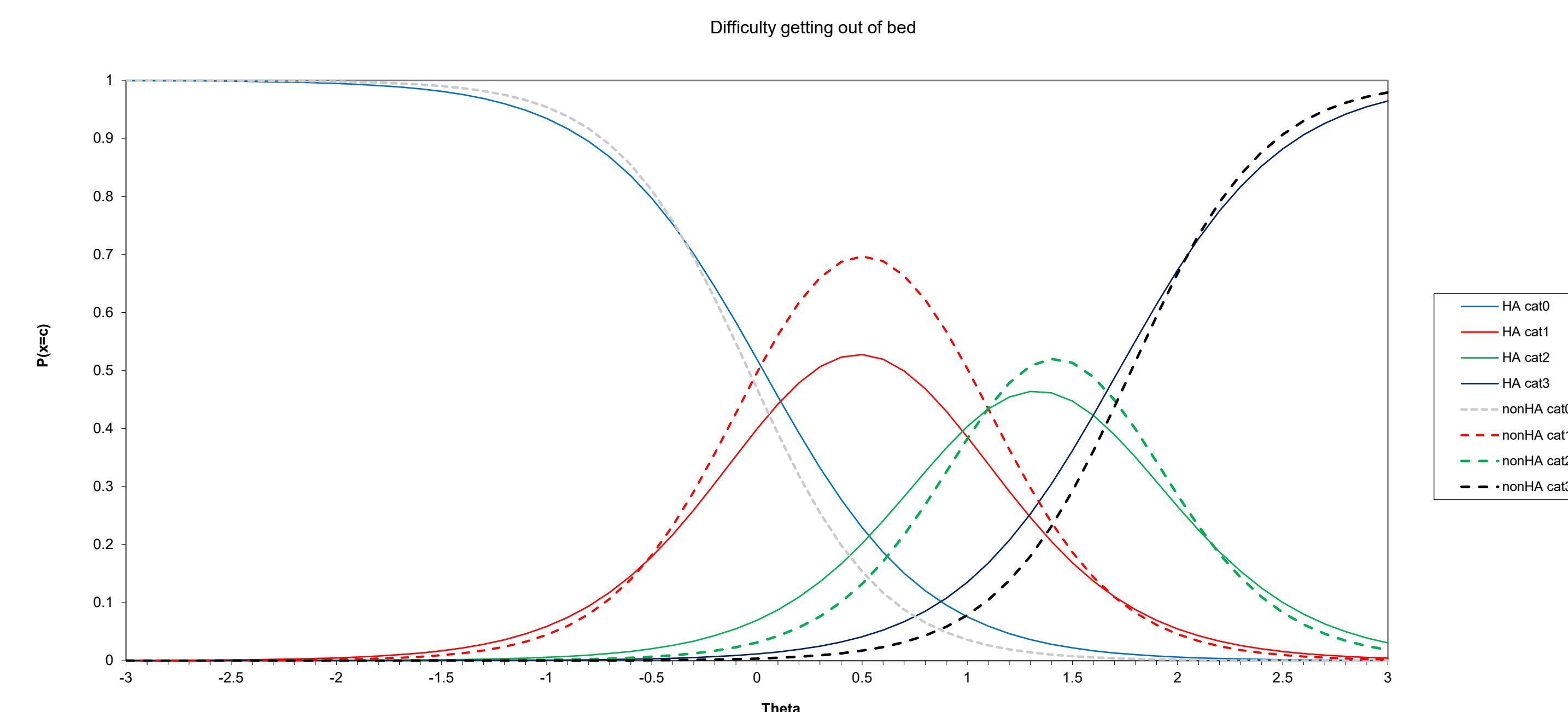
- The Migraine Physical Function Impact Diary (MPFID; Kawata et al., 2017) is a 13-item daily diary patient-reported outcome (PRO) measure intended to assess the impact of migraine on physical function.
- Physical function within the MPFID has been operationalized as two domains: 1) Impact of everyday activities (7 items) and 2) Physical impairment (5 items). In the initial validation article, analyses focused on a “typical day” (which included both migraine and non-migraine days, N = 569) and, separately, on only a migraine day (N = 472).
- However, the developers did not directly investigate possible differences in the psychometric properties of the MPFID for headache days versus non-headache days, which can impact the validity of inferences drawn from MPFID scale scores.
- **OBJECTIVE:** Using differential item functioning (DIF) analyses within the item response theory (IRT) framework, we investigated whether the MPFID items measure migraine’s impact on physical function in the same way for both headache and non-headache days.

### Methods

- The original data for the MPFID were provided by Amgen for these post-hoc analyses. From the approximately 570 participants who provided non-missing observations during the first week of daily diary completion, random selection within each participant was used to obtain a sample, that for all subjects, contained either a headache day or a non-headache day.
- These data were submitted to confirmatory factor analysis (to reproduce Kawata’s specified structure in the current data subset) and then to IRT analyses to investigate DIF in the MPFID items between headache days and non-headache days.

### Results

- Through the random selection of one headache or non-headache day per subject from the first 7 days of diary completion, a total of 567 (n = 271 headache days, 296 non-headache days) observations were available for analysis. The two single dimensions reported in Kawata et al. (2017) were replicated in our subsample by confirmatory item factor analysis models. Following this confirmation of structure, IRT-based DIF analyses were completed.
- Within the Physical impact domain, no items were found to exhibit statistically significant or substantively meaningful DIF across headache days and non-headache days ( $p > .05$  for all). However, as expected by theory, headache days had significantly higher average physical impact than non-headache days (standardized mean difference [SMD] = 1.8). The trace line plots for both HA day and non-HA day for one item contributing to the Physical impact domain are presented below.



- Within the Everyday activities domain, headache days also had significantly higher mean levels of impact compared to non-headache days (SMD = 1.7) but one item (Activities outside the home) was flagged as exhibiting statistically significant DIF (overall  $p < 0.001$ ).

- Upon review, it was found that in the non-headache day sample MPFID item 1 (Household chores) and MPFID item 2 (Activities outside the home) were highly correlated (observed polychoric  $r = 0.96$  in our random sample), while a lower correlation (observed polychoric  $r = 0.93$ ) between these items was observed in the headache day subsample. This difference, when item parameters were estimated by group, led to the “hijacking of theta” (e.g., Edwards, Houts, & Cai, 2014) in the non-headache day subsample, in which slopes of two or more highly correlated/locally dependent items are unreasonably large (e.g., slopes of 10.0 or more) because the factor is accounting for the local dependence between the highly similar items, rather than the common variance among all items.
- Removal of the MPFID item 2 (Activities outside the home) resolved the modeling issue and in the remaining 6 Everyday activities items, no meaningful DIF was found. That is, when the Activities outside the home item was removed from the Everyday activities domain, all items performed the same on headache and non-headache days. As results indicated item removal, sensitivity analyses conducted with or without MPFID item 2 demonstrated the Everyday activity scores were functionally the same ( $r = 0.99$ ) regardless of item 2’s presence, indicating that the Everyday activities domain can be scored either with or without item 2 without a substantial loss of information.

### Conclusions

- These post-hoc psychometric analysis results suggest that, in general, the MPFID items do not exhibit meaningful DIF across headache days and non-headaches. This finding is an important result because while headache and non-headache days are typically scored using the same rubric, there was previously no empirical evidence to support this assumption. The current work, to our knowledge, provides the first information that such an assumption, at least for the MPFID items, can be supported by empirically derived results.

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