

Applying a Novel Diagnostic Code Set to Identify Post-Concussive Symptom Subgroups Among Service Members with Mild TBI

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Introduction

OBJECTIVE

- Develop a novel post-concussive symptom (PCS) diagnostic code set using routine Military Health System (MHS) ICD-9/10 data, then apply it to identify distinct PCS subgroups among service members with mild traumatic brain injury (mTBI).

SETTING

- MHS medical record data spanning FY2002–FY2021.

PARTICIPANTS

- Population-based cohort of service members with MHS-documented mTBI and proximal MHS care (n = 148,293).
- Cohort derivation and exclusions are shown in Figure 1.

Methods

DESIGN & MAIN MEASURES

- Retrospective cohort study. A multidisciplinary clinical team iteratively refined a PCS code set comprising ICD-9/10 codes for vestibular, sensory, cognitive, mood/behavioral, and non-specific symptoms.
- Latent class analysis used 20 PCS indicators. Class enumeration used 70/30 split-sample cross-validation, information criteria, clinical interpretability, and class separation to identify statistically distinct and clinically meaningful PCS subgroups.

Results

- The final code set captured 20 PCS. The most common were headache (31%), non-specific global symptoms (23%), sleep problems (21%), and non-specific mood/behavioral symptoms (18%).
- A 5-class solution was selected: Minimal (58.5%), Headache (16.3%), Mood-behavioral (14.7%), Headache-Sleep (5.6%), and Headache-Mood-Sleep (4.9%).

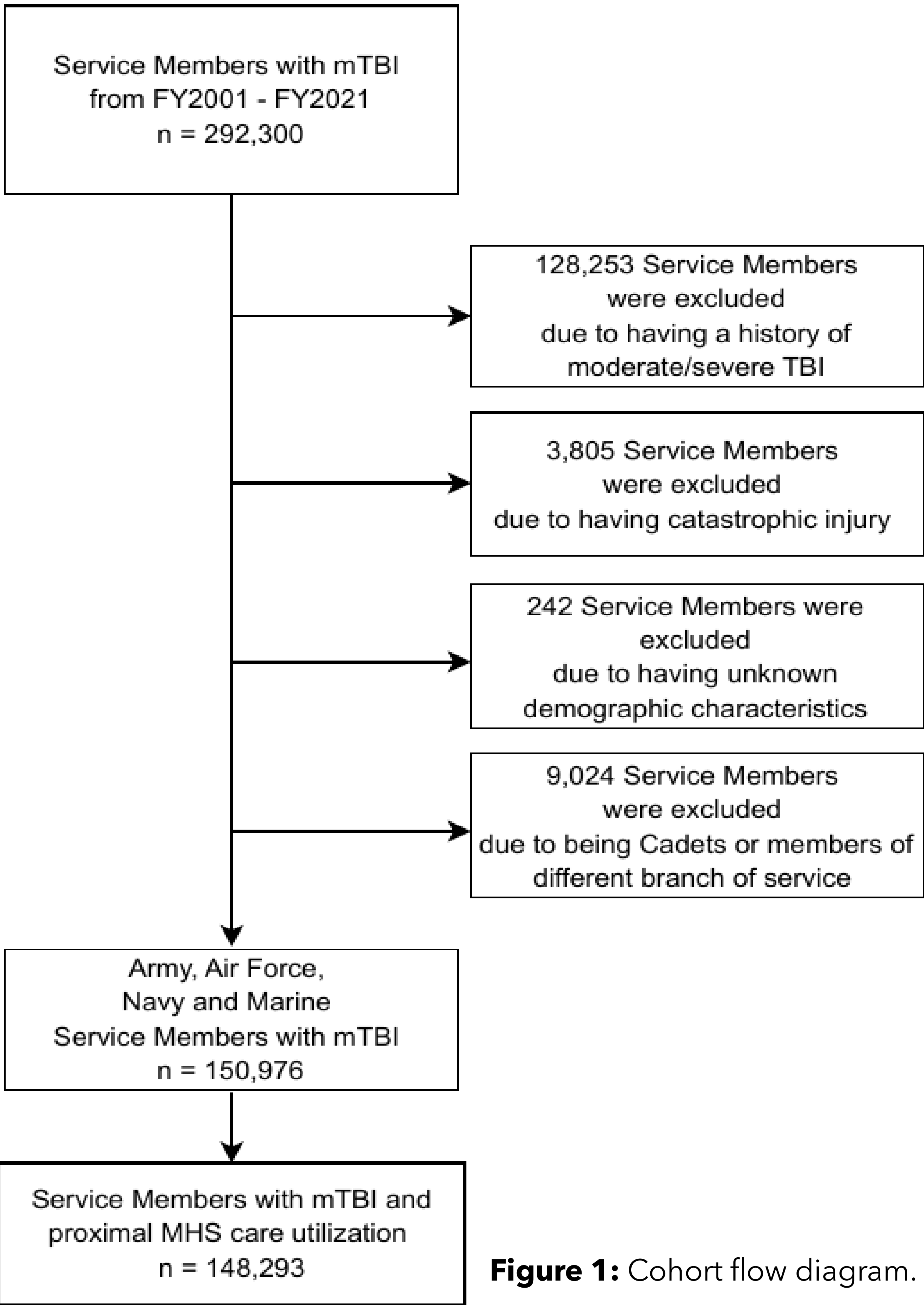


Figure 1: Cohort flow diagram.

Conclusions

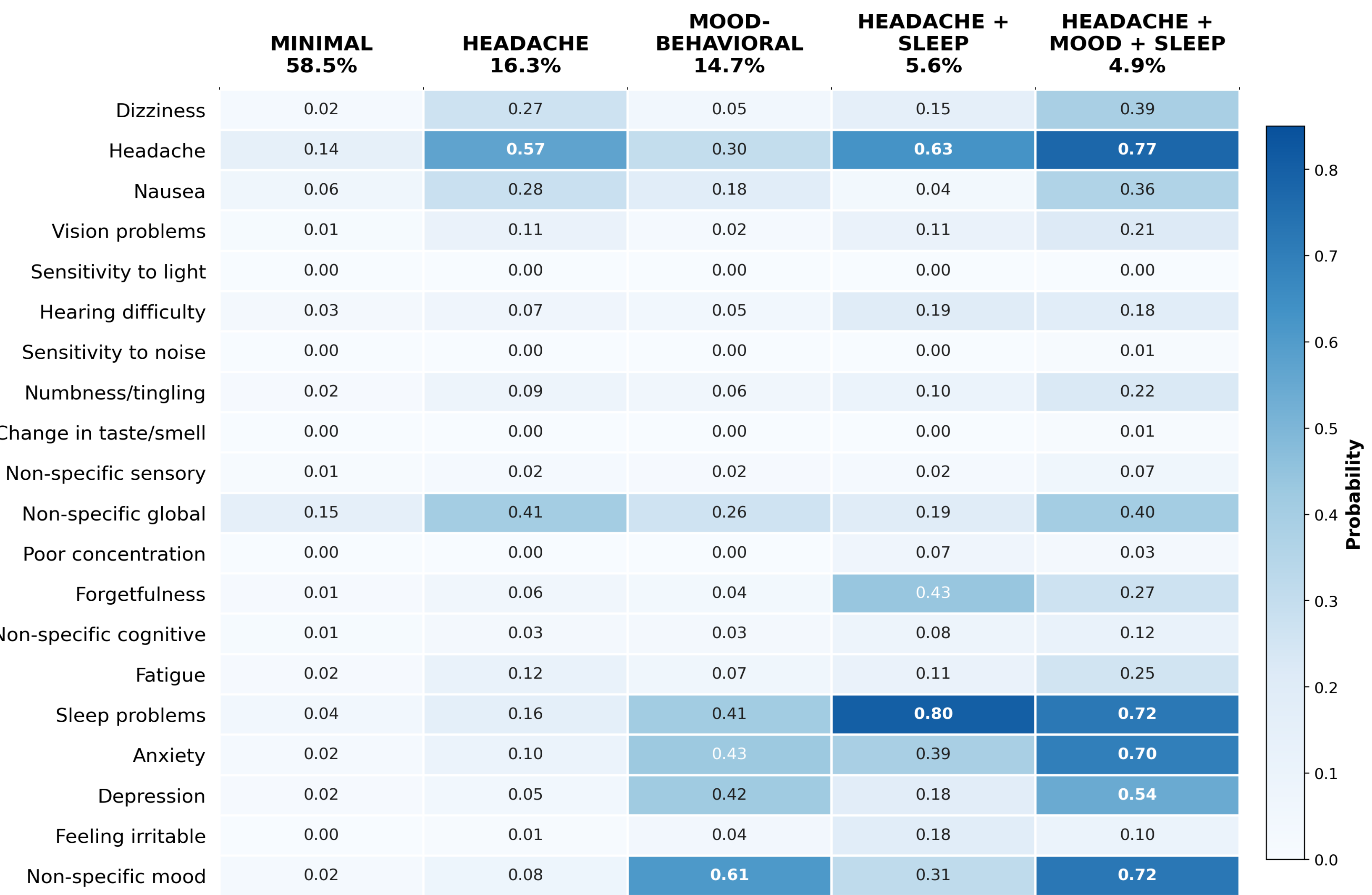
- Using a novel PCS diagnostic code set, we identified five clinically meaningful and statistically distinct symptom subgroups in a population-based MHS cohort of service members with mTBI.
- These subgroups offer pragmatic, person-centered phenotypes for tailoring symptom-based care, testing targeted multi-domain interventions, and examining risk factors and outcomes across trajectories of recovery.

Clinical Implications

- Minimal subgroup was the most common, but 41.5% belonged to subgroups marked by headache, mood/behavioral symptoms, sleep problems, or their co-occurrence.
- Headache, sleep, and mood-related symptoms were the clearest differentiators across classes, offering priority targets of multi-domain interventions.
- Cognitive symptoms did not help distinguish between classes, raising questions about under-reporting, under-coding, or access to cognitive rehabilitation.

LIMITATIONS

- PCS subgroups are subject to inaccuracies in medical record coding.
- mTBI was identified in the medical record, limiting understanding of time since injury.
- Absence of non-TBI comparison group, limiting our ability to attribute symptom patterns to the injury.
- Limited generalizability beyond service members with mTBI.



Darker cells indicate higher probability of receiving each post-concussive symptom diagnosis; bolded values are $\geq .50$.

Figure 2: Conditional item probabilities for five latent post-concussive symptom classes.