Development of a Brief Mental Health Screening Check-List

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Introduction: Aviation personnel must be physically and mentally fit to safely transport thousands of passengers daily. Aeromedical Centers (AeMCs) and Aeromedical examiners (AMEs) are responsible for assessing these workers' cognitive and emotional fitness. Mental health checklists can be considered a viable strategy to speed up decision-making. To this aim, we developed a 21-item screening checklist (MHSC) covering the most common psychological conditions and life stressors. Additionally, we created an unsupervised machine learning pipeline to detect individuals with outlier profiles (i.e., with responses falling outside the typical range) who may need to undergo in-depth evaluations by mental health specialists.

Methods: Within a cross-sectional design, we collected MHSC data from 203 aviation professionals, including pilots, pilot applicants, and flight attendants. We trained an unsupervised machine learning pipeline built upon five strategies to detect MHSC profiles with anomalous responses: (1) a rule-based system to verify missing items, (2) a rule-based system to spot positively answered *sentinel items* such as *aggressiveness towards others or self*, (3) a rule-based system to identify profiles with unique response patterns, and (4) two isolation forests to assess the degree of outlierness of the MHSC responses and aggregated scores. Furthermore, the dataset was projected onto a two-dimensional surface via a dimensionality reduction technique to visualize how extensively the pipeline tracked down anomalous MHSC profiles.

Results: The machine learning pipeline identified about 20% of profiles that required additional scrutiny for mental health risk potential. About 60% of such profiles showed a strong-to-extreme level of outlierness, while the rest had moderate values. The 2D projections of the dataset confirmed that the pipeline correctly marked as extreme outliers those MHSC profiles that resided in the peripheral regions of the representational space.

Conclusions: The MHSC proved to be a fast, easy, unobtrusive way to screen aviation workers for mental health issues; the users perceived MHSC quite well, the reason being that it is a "cultural device" proximal to the aviation industry mental toolset. The machine learning pipeline was a valuable tool for automatically flagging individuals who should be considered candidates for an in-depth clinical interview. The checklist and the pipeline are made available in the public domain.