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 are 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., having responses falling outside of the typical range) who need an in-depth evaluation by mental health specialists.

Methods: Within a cross-sectional design, we collected MHSC data from 240 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 18% of profiles that required additional scrutiny for mental health risk potential. About 70% 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 the MHSC profiles in the peripheral regions of the representative space.

Conclusions: The MHSC is a fast, easy, and unobtrusive way to screen aviation workers for mental health issues; the users perceived MHSC quite well, as 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 were candidates for an in-depth clinical interview. The checklist and the pipeline are available in the public domain.