Technology-enhanced medication taking and symptom monitoring

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Purpose Taking medications correctly is a challenge worldwide. If your mother is not taking her medications, you worry. If you are the director of a behavioral health center with 4000 active and aging patients, you worry more. Technology can play a critical role in supporting medication taking. There are three challenges: 1) reinforcing medication taking, 2) monitoring adherence, adverse reactions, and side effects, and 3) connecting the care team to intervene when problems arise. Our three-component platform is designed to be a solution for all three challenges. This study focused on adult and older adult individuals taking antipsychotic medications who are at risk of Tardive dyskinesia (TDD). TDD is a late-developing, debilitating side effect of dopamine receptor-blocking medications, particularly antipsychotics, with risk increasing with age. Characterized by involuntary facial, trunk, and extremity movements, TDD is difficult to treat, potentially irreversible, and varies in severity from mild to debilitating. While tetrabenazine-based drugs can reduce symptoms, they are under-prescribed, with only 40,000 of the estimated 2.6 million individuals affected receiving treatment. Early detection of TDD is critical for timely intervention to prevent permanent disability, yet assessments are rarely performed, as it is challenging for even the most qualified diagnosticians to provide the frequent monitoring necessary. This challenge is exacerbated by the shift to telemedicine and the increasing patient load on mental health professionals. An efficient, automated method for TDD detection is crucial for improving patient outcomes and reducing the burden on healthcare providers. **Method** Participants (n=268) across three studies completed video-recorded abnormal involuntary movement scale (AIMS) assessments and semi-structured interviews, yielding 268 usable video clips. A vision transformer machine learning architecture was employed to analyze these recordings. Convolutional recurrent neural networks (CRNNs) were also used to evaluate changes over time in the visual data. The model's performance was assessed using the Receiver Operating Characteristics curve (ROC) and the Area Under the Curve (AUC). **Results and Discussion** The TDtect model, trained on a hold-out set (20% of samples), achieved an AUC of 0.984 (95% CI, 0.93 to 1.0), with a sensitivity of 1.0 and specificity of 0.951 in the validation cohort of Study 1. Across the combined cohorts of Studies 1, 2, and 3, the model reached an AUC of 0.89. These results indicate that the model reliably detects TDD, outperforming human raters. The algorithm's high sensitivity and specificity demonstrate its potential for early detection and intervention in TDD, improving patient care and reducing permanent symptoms. The next step in the research is to utilize the full platform for improving medication adherence, monitoring, and intervention by the care team.

References

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