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Discovering and translating knowledge of patterns of stroke recovery: A role for unsupervised machine learning.

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Background
After stroke, people experience physical, mental and social changes, which are closely associated with their individuality, ability for re-learning, and recovery. Outcomes from clinical tests represent each patient from multiple perspectives and collectively the results capture similar patient conditions and behaviors, but such patterns are difficult to detect purely by human observation. This is especially the case for patterns which occur over time. We propose an unsupervised machine learning based approach to discover patterns of behavioral and condition changes during recovery by constructing latent representations of post-stroke outcomes.

Objectives
To map patterns of recovery that capture multiple perspectives of the individual over time for translation to clinical practice.

Method
Data from the START stroke cohort was used to map recovery across multiple domains over time. Tests measured neurological functions (NIHSS), physical well-being (RAPA), mood disorders (MADRS), cognition (MoCA), and social adjustment (WSAS) at 3-7 days, 3-months and 12-months post-stroke, and were mapped relative to pre-stroke characteristics.

Results
Using this approach, we (1) detect similar recovery patterns among patients leading to the identification of patient sub-groupings within and across stroke severity categories, (2) explore the identified sub-groups to find multi-granular associations between stroke severity (NIHSS) and RAPA, MADRS, MoCA and WSAS outcomes, and (3) identify similar patient recovery journeys across different time scales post-stroke.

Conclusions
Our novel approach captures the individuality of recovery across multiple domains and over time, and may be applied to interactively ask questions about recovery for persons with stroke at different times in the recovery journey.