Impaired Habit Formation Prevents Adaptive Decision-Making in People with Methamphetamine Use Disorder

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Introduction and Aims: People seeking treatment for Methamphetamine Use Disorder (MUD) navigate choices between old habits and new goals. The model-based/model-free framework of decision-making provides one way to objectively measure this behaviour by interrogating the degree to which individuals repeat previously rewarded actions (model-free, habitual) versus the degree to which they attempt to predict the outcome of their choices (model-based, goal-oriented).

Design and Methods: We compared model-based/model-free decision-making on a Two-Stage Decision-Making Task between 30 treatment-seeking participants with MUD and 31 controls with similar sociodemographic characteristics. Participants chose between three different environments associated with varying probabilities of reward. Travel between states was controlled via "common" and "rare" transition rules, which fixed how likely each action led to reward outcomes. Model-free decisions were those in which participants repeated their previous rewarded action, even if it was the result of a "rare" transition. Model-based decisions were those in which participants incorporated both previous rewards and transition knowledge to choose their next action.

Results: Compared to controls, participants with MUD used less model-free (i.e., habitual) decision-making, *OR* = 1.22, *95% CI* [1.10, 1.35]. Behaviourally, this was associated with a reduced likelihood of repeating their previous choice, even after it was rewarded. In contrast, participants with MUD and controls did not significantly differ in their model-based (i.e., goal-directed) decision-making, *OR* = 0.94, *95% CI* [0.85, 1.04].

Discussions and Conclusions: People with MUD who present for treatment do not show a bias towards habitual behaviour. Instead, they appear to exhibit a reduced capacity to identify adaptive behaviours that are worth persisting with.

Implications for Practice: People with MUD may require additional scaffolding to learn associations between recovery-oriented choices and their outcomes. This could involve increasing the level of reinforcement associated with adaptive actions and/or increasing the opportunity to self-monitor choice outcomes during recovery.

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