



TITLE: Modeling Longitudinal Behavioural Data in Preclinical Home Cage Monitoring Studies

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ABSTRACT: Home cage monitoring is an increasingly valuable tool in Drug Discovery and Development, enabling continuous tracking of animal behaviour over time. These systems automatically record behavioural and physiological parameters without requiring investigator intervention during data acquisition, thereby capturing more representative and less biased behavioural patterns. This approach is particularly well suited for studying disease progression, longitudinal treatment effects, and animal welfare indicators.

In this work, we analysed home cage monitoring data from an experiment involving treatment and control groups of mice housed in multiple cages, with the aim of assessing treatment effects over time.

The recorded parameters are heterogeneous in nature, including parameters expressed as % of time spent in different types of activity as well as continuous measures such as velocity, distance, and activity rates, all collected longitudinally.

To address this complexity, we applied a combination of statistical modeling approaches aligned with two primary study objectives. First, to evaluate treatment effects over time on individual parameters, we fitted generalised mixed-effects models with autocorrelated residuals. Second, to achieve a more integrated view of animal behaviour, we applied dimensionality reduction techniques to summarise behavioural patterns and subsequently assessed treatment effects on the resulting principal components. These approaches proved effective in assessing treatment effects over time while accounting for the data structure, and dimensionality reduction emerged as a valuable tool for capturing the main sources of variation among recorded parameters enabling more comprehensive conclusions about animal behaviour.