UpDown -an R Package to characterize unknown disturbances from longitudinal observations

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The response of an animal to a disturbance depends on its resilience and the characteristics of the disturbance experienced (intensity and duration). As the latter are generally not registered on the farm, the R package UpDown was developed in order to detect and characterize unknown disturbances from the analysis of longitudinal individual observations that are now available in many species thanks to the development of electronic devices. Depending on their nature, disturbances are likely to affect one or more animals organised in hierarchical groups. For instance, in pig farming, the animals are grouped in pens which are themselves grouped in batches leading to a 3-levels hierarchical organization (individual, pen, batch). The UpDown method consists in analysing the summarised longitudinal observations at these different group levels in order to gain power to detect disturbances and facilitate their characterisation. The Up step identifies elements undergoing a disturbance at the different hierarchical levels that is validated and characterised in the down step. The UpDown package can consider as many hierarchical levels as desired and different validation options in the down step, which allow it to be adapted to different farming systems and environmental conditions. Applied to simulated data mimicking 100 days of observations in a pig farming system, the UpDown package showed a sensibility to detect elements undergoing a disturbance that increased with the hierarchical level (from 43% at the individual level to 93% at the batch level) and was associated with a good specificity for all levels (>95%). The quality of the characterization of the disturbances increased with their duration. The correlations between the estimated and the true intensities were large (>0.72 for the group scales). The median gap between the estimated and true starting (ending) date was lower than 3 days. Different information on individual trajectories can be obtained from the output of the UpDown package and used to analyse the resilience of animals after correction by the disturbances identified and characterized by the UpDown package.