

Lay Summaries of Statistical Analyses

Note, we thank the reviewers for noting the complexity of the analyses performed in the present study relative to what both researchers and practitioners are used to encountering in the field. We have done our best to provide both detailed explanation and justification of the choices made, describe what the models being used are doing, provided mathematical notation for them, and all code for the analyses conducted is available. We have also included in the online supplementary material a brief "lay" summary which was generated making use of ChatGPT to assist in developing these explanations. We prompted ChatGPT explicitly by providing it with the copied text, including equations, from our quarto manuscript files and asked it to provide a lay description. We then edited these.

Time Under Load Model

What is this model trying to understand?

We have studied how long people spend performing a resistance exercise ("Time Under Load" or TUL), comparing two types of training sessions: **Core** and **Assisted**. We've noticed that some people seem to stop exactly at **120 seconds**—the upper range for their TUL target as prescribed in their training program—while others keep going or stop earlier. So, we suspect **two different processes** might explain the data:

1. **Some people aim for the 120-second target and stop there**, no matter what.
2. **Others stop based on physical fatigue and momentary failure or some other reason**, and this time varies more.

How does the model reflect this idea?

To reflect the two processes, the model does two things **at once**:

- **Step 1 (Hurdle part):** It asks "**Did this person stop exactly at 120 seconds?**"
 - This is a *yes/no* question.
 - The model estimates the **probability** of this happening.
 - **Step 2 (TUL part):** If the person didn't stop at 120 seconds, the model then estimates **how long they continued** (could be shorter or longer).
 - This uses a **Student's t-distribution**, which is flexible and handles "outliers" or extreme values better than a normal distribution.
-

What factors does the model consider?

The model looks at both:

- **Fixed effects** — the *main effect of training type (Core vs. Assisted)*.
- **Random effects** — the influence of:
 - The **clinic location** (some locations may differ),
 - The **individual person** (some people train differently),
 - The **machine used** (some machines might be easier or harder).

These effects are included in *both* the decision to stop at 120 seconds and the actual TUL if they don't.

Why use a Bayesian approach?

- We already had **previous data**, which gave us a sense of what typical outcomes and variations might look like.
 - With Bayesian analysis, we can formally include this existing knowledge (**priors**) and then update it with new evidence (**the current experimental data**) to get **posterior estimates**.
 - Bayesian methods also give a **full probability distributions** for the parameter estimates, which helps in making nuanced decisions (e.g., how confident we are that one condition differs from another).
-

How were the models used?

1. We first ran the model on **previous (prior) data** using general assumptions (weak priors).
2. We then used the *results from that model* to inform more **precise assumptions** (informative priors) in the **new experimental model**.
3. We then modelled the outcome (TUL) in two ways:
 - Whether someone stopped at 120s,
 - And if not, how long they trained.

Finally, we **summarised the results** by comparing average values between conditions and visualizing the full uncertainty in the estimates.

Rating of Perceived Effort and Discomfort Models

What is this model trying to understand?

We have also similarly studied peoples rating of perceived effort (RPE) and discomfort (RPD), comparing the two types of training sessions: **Core** and **Assisted**. But, different scales for RPE were used in the prior and experimental dataset—6–20 Borg (prior sample) and 0–10 (experimental). So, ratings were rescaled to the (0,1) interval to reflect percentage of perceived effort. An **ordered beta regression model** was employed to handle the resulting distribution, which includes probability masses at 0 (no effort), (0,1) (graded effort), and 1 (maximal effort). A similar approach was applied to RPD, which was also bound between no and maximal discomfort.

How does the model reflect this idea?

The ordered beta regression model essentially encompasses three processes which are modelled **at once**. It uses a three-part model using a cutpoint process to model the probability of:

- **0:** No effort/discomfort
 - **(0,1):** Partial effort/discomfort
 - **1:** Maximal effort/discomfort
-

What factors does the model consider?

The model looks at both:

- **Fixed effects** — the *main effect of training type (Core vs. Assisted)*.
- **Random effects** — the influence of:
 - The **clinic location** (some locations may differ),
 - The **individual person** (some people train differently),
 - The **machine used** (some machines might be easier or harder).

These effects are included in *both* the mean and the precision parameters for the beta distribution used in the model.

Why use a Bayesian approach?

- We already had **previous data**, which gave us a sense of what typical outcomes and variations might look like.
 - With Bayesian analysis, we can formally include this existing knowledge (**priors**) and then update it with new evidence (**the current experimental data**) to get **posterior estimates**.
 - Bayesian methods also give a **full probability distributions** for the parameter estimates, which helps in making nuanced decisions (e.g., how confident we are that one condition differs from another).
-

How were the models used?

1. We first ran the model on **previous (prior) data** using general assumptions (weak priors) for RPE.
2. We then used the *results from that model* to inform more **precise assumptions** (informative priors) in the **new experimental model for RPE**, but for **RPD we just used general assumptions** (weak priors).
3. We then modelled the outcomes of RPE and RPD

Finally, we **summarised the results** by comparing average values between conditions and visualizing the full uncertainty in the estimates.
