Effects of Workout Variation on One-Repetition Maximum Lifts
Grant Vanderlinden – Joey George
Iowa State University – College of Business – University Honors Program

Introduction

Purpose and Scope
- To analyze the effects of five main weightlifting moves on one-repetition maximum lifts exclusive from diet
- To develop a baseline one-repetition-maximum-increasing workout plan that can be customized on a per-individual basis

Assumptions
- Heart rate should be recorded at the end of a workout
- The minimum number of related moves performed should be two
- Total workout time should be rounded to five-minute intervals
- Weightlifting should be performed once a day, five days a week

Limitations
- The inability to test the predictive model on other weightlifters
- The inability to test true one-repetition maximum lifts

Definitions
- Business analytics: the analysis of empirical data using software to develop descriptive, predictive, or prescriptive models
- Empirical data: data that has happened; data that exists
- Ensemble: combination of multiple predictive models
- Failure: occurs when fatigue causes a weightlifter to be unable to finish a move; for safety reasons, this should only be attempted when a spotter is present
- Input variable: a variable used to predict another variable
- Lift: used to measure the performance of a predictive model based on how many more responses can be identified in terms of multiplicity
- Move: a specific type of lift (e.g., standing barbell curl, seated barbell military press, barbell back squat, barbell bench press, and barbell dead lift)
- Muscle group: a broad definition of a group of related muscles (e.g., arms, shoulders, legs, chest, back)
- One-repetition maximum: the maximum weight an individual can lift once (one repetition) for a specific move
- Overfitting: a phenomenon that occurs when a predictive model has become too granular with the provided data, so it is only useful for predicting the parent data set, rather than any general data set
- Predictive model: a model generated by an analytics tool based on empirical data that can predict, to some degree of accuracy, the values of unknown data
- Related move: a type of lift that works the same specific muscle group as the main move for the weightlifting session
- Specific muscle group: a sub-grouping of individual muscle within a muscle group (e.g., biceps, deltoids, quadriceps, pecs, and erector spinae)
- Spotter: a person who assists a weightlifter in case of failure by relieving some or all of the weight
- Target variable: a variable that is to be predicted

Methods

- Six data points for each workout
  - Date (MM/DD/YY)
  - Move
  - Max (lbs)
  - Heart Rate at End of Workout (BPM)
  - Total Workout Time (hr min)
  - Related Moves
- Three additional data points generated after comparison of the prior week’s, or month’s, data
  - Max (lbs) Delta from Prior Week
  - Total Max (lbs) Delta for the Month
  - Notes
- Five moves with their corresponding muscle groups performed Monday through Friday each week from August 3, 2015, to March 11, 2016
  - Standing barbell curl – arms
  - Seated barbell military press – shoulders
  - Barbell back squat – legs
  - Barbell bench press – chest
  - Barbell dead lift – back

Results

Microsoft Excel Pivot Table

- The Effect of Heart Rate Variation on One-Repetition Maximum Lifts
- The Effect of Time Variation on One-Repetition Maximum Lifts
- The Effect of Related Moves Count Variation on One-Repetition Maximum Lifts

Conclusions

- Each of the five moves benefit most from different heart rates, workout times, and number of related moves
- Additional research is warranted to develop an ensemble model and a larger data set
- The current results are sufficient to develop a baseline one-repetition-maximum-increasing workout plan

Definitions:

- **Standing Barbell Curl**
- **Seated Barbell Military Press**
- **Barbell Back Squat**
- **Barbell Bench Press**
- **Barbell Dead Lift**