DETERMINING THE RELATIONSHIP BETWEEN WALKING ACTIVITY AND INTER-DAY PATTERNS IN STROKE SURVIVORS

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INTRODUCTION

Populations with chronic stroke inherently tend to take less steps each day than a healthy individual of similar age¹. Proper walking rehabilitation in stroke patients can help to prevent further health risks such as heart disease². Many rehabilitation techniques have been introduced to this area, and researchers try to determine which has the best outcome. One of these techniques is the promotion of a daily step goal³. We will use data that collected step counts for every minute across multiple days² to analyze the distribution of steps through a day and how similar those patterns are across days using non-linear analysis. From this data, we will determine if a correlation is present between the similarity of patterns across days for a subject and and their mean daily steps, which could influence clinical treatments for chronic stroke patients by encouraging step goals or patterned behavior. Because the non-linear analysis that we will use, Jensen-Shannon Divergence (JSD), will provide a lesser value for more similar patterns across days, we hypothesize that there will be a negative correlation between these JDS values and mean daily steps, representing a positive correlation between daily walking activity and inter-day walking patterns.

METHODS

Participants included 172 persons with chronic stroke
- Each wore a Fitbit above the ankle on their less affected side for all waking hours (excluding bathing and swimming) for multiple days
- Each returned to continue the program up to a total of four times
- Steps were recorded at 60-second increments
- One day for a single subject is shown above
- Recorded steps were separated by their distinct day and grouped by consecutive days of collection using a custom-written MATLAB code (MathWorks, Natick, MA)

The above graph shows the distribution of steps for one subject during 6 days.
- 148 of 172 subjects had 6 days in their first session, which were used for comparing walking activity and patterns
- Jensen-Shannon Divergence (JSD) non-linear analysis determined the level of similarity in a person’s walking pattern across multiple days
  - Lesser values correspond to more similarity
- Mean daily steps for each subject were compared to the JSD values for each subject using a linear regression to determine if a significant relationship exists between patterns of daily walking activity and the total amount of daily walking activity in stroke survivors

DISCUSSION

As hypothesized, our results show a negative relationship between JSD and mean daily steps in chronic stroke patients. It should be noted that greater similarity of walking patterns across days is represented by a low JSD value, so the present negative correlation represents a relationship where more daily steps corresponds to more similar activity patterns. This relationship is useful for the clinical setting in support of rehabilitation techniques that motivate for greater amounts of total and habitual activity.

Moving forward, we will investigate any changes in this relationship as subjects return for multiple sessions of intervention. Additional research should also be conducted to determine if there is any causation involved in the correlation between inter-day patterns and daily walking activity in stroke survivors to better determine whether a step goal or encouraging patterns with task-loads would be a more effective treatment.

RESULTS

The above graph compares JSD values to mean daily steps values over a constant period of six days for 148 subjects. Using linear regression analysis, our results showed a significant negative correlation was found between JSD and mean daily steps (p = 5.25x10^-9, R² = 0.7878, and y = 2.3762 - 9.3x10^-x).

REFERENCES


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