Use of Language to Identify Stages of Dementia

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Background and Introduction

Dementia is a general term for loss of memory and other mental abilities severe enough to interfere with everyday life. Dementia describes a wide range of symptoms, such as difficulty with memory and language.

The Cookie Theft Picture (CTP) is a commonly used assessment tool to investigate markers of dementia.

Task: Subjects were asked to describe what they see in the picture

Methods

Kaplan Meier Survival Curve
- Visualizes the distribution of time until word is first said.

Log-Rank Test
- Test to compare the distribution of time across groups

Results

We first wished to analyze how long the three main groups, those in the Control, MCI, and Probable AD groups, took to say certain words when describing the picture. (Figures 1, 2, 3)

Data

Groups
- Control
- Mild Cognitive Impairment (MCI)
- Probable Alzheimer's Disease (Probable AD)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>243</td>
</tr>
<tr>
<td>Probable AD</td>
<td>234</td>
</tr>
<tr>
<td>MCI</td>
<td>41</td>
</tr>
</tbody>
</table>

Data Generation
- Generated by performing Computerized Language Analysis (CLAN) on the audio files of subject descriptions of the Cookie Theft Picture above.

Data Description
- 518 Pittsburgh Individuals
- Key Variables
  - Time
  - Total time it took each individual to describe the picture
  - Time until each core lexicon word was said
- Demographic Information: Age, Gender
- Frequency of Core Lexicon Usage

Kaplan Meier Survival Curve for ‘Girl’ Utterance
- Curve showing the time until the word “girl” was said through the three groups. We note that the Probable AD group starts falling behind the others, then later the MCI group also slows down compared to the control.

Log-Rank Test: \( p \leq 5 \times 10^{-4} \)

Kaplan Meier Survival Curve for ‘Fall’ Utterance
- Here we once again see the same pattern for the word “fall”, where there is an almost immediate difference between the Control and Probable AD groups, followed by MCI which stays with control until eventually falling behind.

Log-Rank Test: \( p \leq 2 \times 10^{-8} \)

- Next we wanted to see if there was a difference in time until a word was said within regions of the image between the Control and Probable AD Groups, (Figure 4)

Log-Rank Test: \( p \leq 6 \times 10^{-7} \)

Conclusions

Main findings
- Statistically significant differences in time-until words between groups
- Difference in time until different quadrants of the image

Implications
- Use of language may help identify and track development of dementia

Further Research
- Replicating results with other datasets

References