Enhancing the Identification and Management of Frailty in Primary Care

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Background
Over one million older adults in Canada are medically frail; this number is expected to double to over two million by 2030. In primary care, the goals of caring for those who are frail are to:

• Prevent or delay increasing frailty
• Improve function and quality of life
• Avoid unnecessary admission to hospital or long-term care

Study Purpose: To develop a frailty definition for use in a primary care electronic medical record database.

Methods
The goal is patient panel identification of frailty through CPCSSN data presentation tools.

Data: Clinicians provided assessments of frailty using the Rockwood Clinical Frailty Scale on a subset of their patients who were over the age of 65.

Analysis: Clinical Frailty Scores provided the reference set for machine learning techniques (classification and regression trees) to build frailty algorithms to identify frailty using the Rockwood Clinical Frailty Scale on a subset of their patients who were over the age of 65.

Visualization of Frailty Clusters with t-SNE Plots

T-distributed Stochastic Neighbor Embedding Plots are a data exploratory tool that allows for the visualization of whether frail and non-frail patients can be separated by machine learning. If darker and lighter dots are separable, machine learning may be able to separate the patients.

Frailty is generally defined as a medical syndrome with multiple causes, usually characterized by a loss of muscle mass and strength, weakness, weight loss, and decreased physical activity, resulting in an increased risk of health deterioration, functional decline, and overall negative health outcomes.

Sensitivity and Specificity Analysis

4-Group Frailty Categorization

<table>
<thead>
<tr>
<th>Frailty Level</th>
<th>NPV</th>
<th>PPV</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Frail</td>
<td>0.439394</td>
<td>0.765376</td>
<td>0.819512</td>
<td>0.360248</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>0.824126</td>
<td>0.285</td>
<td>0.267006</td>
<td>0.836384</td>
</tr>
<tr>
<td>Mild-Moderate Frail</td>
<td>0.864387</td>
<td>0.376712</td>
<td>0.323529</td>
<td>0.889563</td>
</tr>
<tr>
<td>Severely Frail</td>
<td>0.961963</td>
<td>0.285714</td>
<td>0.114286</td>
<td>0.987406</td>
</tr>
</tbody>
</table>

Binary Frailty Categorization

<table>
<thead>
<tr>
<th>Frailty Level</th>
<th>NPV</th>
<th>PPV</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frail</td>
<td>0.905332</td>
<td>0.869036</td>
<td>0.575611</td>
<td>0.806421</td>
<td>0.7023</td>
</tr>
</tbody>
</table>

Conclusions
• Due to its extremely complex nature, frailty is very difficult to identify in primary care using machine learning methods.
• Characteristics related to frailty may not be adequately captured in primary care EMR data, making prediction of frailty difficult.
• Frailty as a dichotomous variable (frail/not frail) can be used as a screening flag to identify patients for whom further assessment is required.

Acknowledgements
This work is funded by The Canadian Frailty Network as a collaboration with the Canadian Primary Care Sentinel Surveillance Network (CPCSSN).

We would also like to acknowledge CPCSSN data managers and research assistants in their assistance with data collection and management.