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Enhancing the Identification and Management of Frailty in Primary Care

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Réseau sur les innovations en soins de santé de première ligne et intégrés
Primary and Integrated Health Care Innovations Network
Canadian Frailty Network | Réseau canadien des soins aux personnes fragilisées

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 severity
- 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.

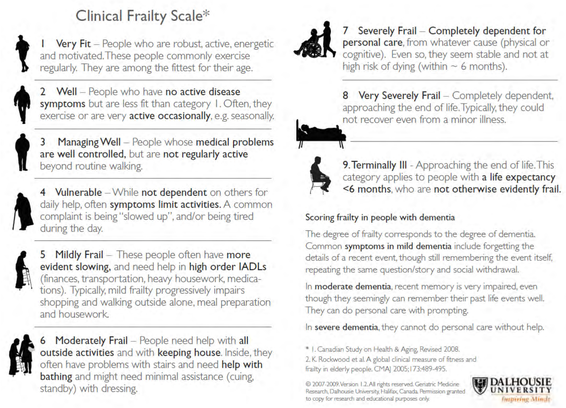
Methods

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

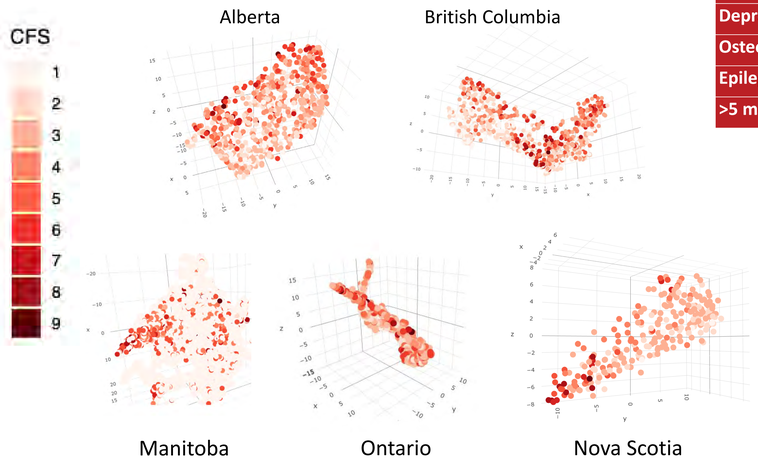
Data: Clinicians provided assessments of frailty using the Rockwood Clinical Frailty Scale on a subset of their patients who were over the age of 65.

Analysis: Clinical Frailty Scores provided the reference set for machine learning techniques (classification and regression trees) to build frailty algorithms to identify patients at increased risk of frailty. Sensitivity and specificity analyses were used to assess model performance.

Data Collection Tool: Rockwood Clinical Frailty Scale



Visualizing 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.

National Demographic Data (n=4133, age≥65)

	Not Frail CFS 1-3	Vulnerable CFS 4	Mild-Moderately Frail CFS 5-6	Severely Frail CFS 7-9
N (%)	2736 (66.20)	711 (17.30)	568 (13.75)	118 (2.86)
Categorization by Province				
AB, n(%); N=875	573 (65.5)	147 (16.8)	126 (14.4)	29 (3.3)
BC, n(%); N=1147	859 (74.9)	138 (12.0)	122 (10.6)	28 (2.4)
MB, n(%); N=885	585 (66.1)	194 (21.9)	97 (11.0)	9 (1.0)
NS, n(%); N=271	203 (74.9)	37 (16.7)	22 (8.1)	9 (3.3)
ON, n(%); N=982	527 (53.7)	208 (21.2)	203 (20.7)	44 (4.5)
Demographics				
Age, Mean (SD)	72.95 (6.32)	75.94 (7.52)	79.98 (8.48)	83.41 (9.34)
Male, N (%)	1351 (49.4)	308 (43.3)	204 (35.9)	47 (39.8)
Frailty Risk Factors				
Hypertension, N (%)	1959 (86.8)	623 (94.0)	509 (93.4)	97 (87.4)
Diabetes, N (%)	1618 (71.7)	530 (79.9)	415 (76.1)	83 (74.8)
Dementia, N (%)	1120 (49.6)	427 (64.4)	362 (66.4)	87 (78.4)
Depression, N (%)	1339 (59.4)	497 (75.0)	398 (73.0)	72 (64.9)
Osteoarthritis, N (%)	1589 (70.4)	521 (78.6)	411 (75.4)	76 (68.5)
Epilepsy, N (%)	1120 (49.6)	412 (62.1)	321 (58.9)	66 (59.5)
>5 meds last yr, N (%)	1263 (46.2)	428 (60.2)	396 (69.7)	80 (67.8)

Sensitivity and Specificity Analysis

4-Group Frailty Categorization

	NPV	PPV	Sensitivity	Specificity
Not frail	0.439394	0.765376	0.819512	0.360248
Vulnerable	0.824126	0.285	0.267606	0.836384
Mild – Moderately Frail	0.864387	0.376712	0.323529	0.889563
Severely Frail	0.961963	0.285714	0.114286	0.987406

Binary Frailty Categorization

	NPV	PPV	Sensitivity	Specificity	AUC
Frail	0.905332	0.369906	0.57561	0.805421	0.7023

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.

Results

Model performance analyses resulted in a greater ability to accurately detect patients who are not frail relative to those who are frail (high specificity, low sensitivity). Using a binary frailty categorization, the ability to accurately detect patients who are frail improved (sensitivity = 0.58).

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.

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CPCSSN RCSSSP Canadian Primary Care Sentinel Surveillance Network
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