Prevalence of Frailty Phenotypes and their association with Functional Disability and Mortality: Findings from the Singapore Longitudinal Ageing Studies

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Background & Aims

Current perceptions of frailty
Current Approaches of Frailty

Multi-Dimensional Conceptualization

Single Dimensional Phenotype
Multi-Dimensional Approach

Physical

Mental

Social

Frailty Index (FI)$^1$

EDMONTON FRAILTY SCALE (EFS)$^{4,5}$

Tilburg Frailty Indicator (TFI)$^{2,3}$
Physical Frailty Phenotype

Fried Physical Frailty Phenotype

FRAIL

SARC

• Focuses predominantly on muscle mass and function loss.
Little Empirical Understanding

Physical

Mental

Social
Physical

Social

Mental

Adverse Health Outcomes
Aims

1. Estimate the Prevalence of individual and combined Physical, Social and Mental Frailty Phenotypes.
2. Estimate the independent associations and abilities to predict
   1. Functional Disability (Instrumental Activities of Daily Living (IADL) Disability)
   2. Mortality
3. Determine if a combined multi-dimensional frailty phenotype substantially increased the ability to predict disability and death.
Methods
Participants

2,387 Chinese Community-dwelling healthy older adults, aged 55 and above

Cross-sectional analysis was conducted on 2,387 participants for baseline IADL Disability.

Longitudinal analyses were conducted on:

1) 1,258 participants who were free of IADL Disability at Baseline
2) 2,387 for mortality analyses
Social Frailty

- Conceptualized based on Bunt & colleagues (2017):
  - **Social frailty** is a multi-dimensional construct, describing a continuum of being at risk of losing, or having lost general or social resources, social behaviors and activities, and self-management abilities which are important for fulfilling basic social need(s).\(^9\)

- A 7-item scale, with 2 or more = **Social frailty phenotype (SFP)**

- The index was shown to predict both prevalent IADL and severe disability (≥3ADL disability).\(^9\)
Living alone

No Education

Absence of a confidant

Infrequent Contact¹

Infrequent social activities²

Financial Difficulty

Socio-economic deprivation

(1) Infrequent contact refers to participants who have either indicated that they have (a) none or once a year visits from family, friends or loved ones; (b) none or once a year calls from family, friends or loved ones or (c) none to a very little extent of help when they require it. If the participants indicate that they have any one of the three, they qualify for this criterion.

(2) Infrequent social activities refers to participants who have indicated that they rarely or do not at all participate in all of the six social activities stated in the social activities questionnaire found in the SLAS-1 Questionnaire. These six activities are: (1) Attendance at any religious service; (2) visits to cinemas, restaurants or sports events; (3) day or excursion trips; (4) if they play cards, games, bingo, mahjong; (5) if they attend senior citizen club activities or (6) if they attend social group activities.
Mental Frailty

Cognitive Impairment

Low Mood

Poor Self-reported health status

• 1 or more = Mental Frailty Phenotype (MFP)
Physical Frailty

- Shrinking
- Low Physical Activity
- Weak
- Slow
- Exhaust

- Based on the Fried’s criteria used in the Cardiovascular Health Study (CHS)

- Summed scores were used to categorize subjects as frail (score=3-5), pre-frail (score=1 or 2) and robust (score=0 point).
Outcome Variables

• Functional Disability
  • The presence of IADL disability was indicated by the requirement for help on 1 or more IADL items.

• Mortality (date and cause of death):
  • up to the end of November 2016 was obtained by record linkage with the National Death Registry of Singapore (NDRO).
Other Variables

- Socio-demographic Data
- Medical Morbidity
- Lifestyle Variables
- Hospitalization and physician visits
- Poly-pharmacy
- Nutritional Risk
- Hearing impairment
- Visual impairment
Results
Prevalence of Frailty Phenotypes

Participants without PFP, MFP & SFP: N = 884 (35.7%)

PFP
N = 627 (25.3%)

N = 252 (10.2%)

N = 169 (6.9%)

MFP
N = 188 (7.6%)

SFP
N = 112 (4.5%)

Robust without SF/MF: 35.7%

Prevalence of any phenotype: 65.3%

PF, M F & SF: 6.9%

Prevalence of single domain < multiple domain frailty

Definition of Phenotypes:
SF = Having 2 or more indicators
MF = Having 1 or more indicators
Fried’s Physical Frailty (PF) = 1 or more indicators
Frailty Phenotype Inter-relationships

Table 1: Prevalence of components for social, mental and physical frailty in the SLAS-1 Chinese older adults (n = 2,387)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (N=2,387)</th>
<th>Physical Frailty (PF) (N=1,154)</th>
<th>Mental Frailty (MF) (N=657)</th>
<th>Social Frailty (SF) (N=438)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=2,387 (%)</td>
<td>No PF (N=1,233)</td>
<td>PF (N=1,154)</td>
<td>No MF (N=1,730)</td>
</tr>
<tr>
<td>Fried Shrinking</td>
<td>209 (8.8)</td>
<td>0 (0.0)</td>
<td>209 (18.1)</td>
<td>127 (7.3)</td>
</tr>
<tr>
<td>Fried Low Physical Activity</td>
<td>635 (26.6)</td>
<td>0 (0.0)</td>
<td>635 (55.0)</td>
<td>439 (25.4)</td>
</tr>
<tr>
<td>Fried Weak</td>
<td>471 (19.7)</td>
<td>0 (0.0)</td>
<td>471 (40.8)</td>
<td>256 (14.8)</td>
</tr>
<tr>
<td>Fried Slow</td>
<td>77 (3.2)</td>
<td>0 (0.0)</td>
<td>77 (6.7)</td>
<td>29 (1.7)</td>
</tr>
<tr>
<td>Fried Exhaust</td>
<td>206 (8.6)</td>
<td>0 (0.0)</td>
<td>206 (17.9)</td>
<td>73 (4.2)</td>
</tr>
<tr>
<td>Cognitive Impairment</td>
<td>282 (11.8)</td>
<td>77 (6.2)</td>
<td>205 (17.8)</td>
<td>282 (42.9)</td>
</tr>
<tr>
<td>Low Mood</td>
<td>480 (18.0)</td>
<td>164 (13.3)</td>
<td>266 (23.1)</td>
<td>450 (65.5)</td>
</tr>
<tr>
<td>Poor Health Status</td>
<td>59 (2.5)</td>
<td>15 (1.2)</td>
<td>44 (3.8)</td>
<td>59 (9.0)</td>
</tr>
<tr>
<td>Live Alone</td>
<td>174 (7.3)</td>
<td>79 (6.4)</td>
<td>95 (8.2)</td>
<td>114 (6.6)</td>
</tr>
<tr>
<td>No Education</td>
<td>453 (19.0)</td>
<td>169 (13.7)</td>
<td>284 (24.6)</td>
<td>211 (12.2)</td>
</tr>
<tr>
<td>Infrequent Contact</td>
<td>487 (20.4)</td>
<td>215 (17.4)</td>
<td>272 (23.6)</td>
<td>296 (17.2)</td>
</tr>
<tr>
<td>Infrequent Social Activities</td>
<td>326 (13.7)</td>
<td>158 (12.8)</td>
<td>168 (14.6)</td>
<td>226 (13.1)</td>
</tr>
<tr>
<td>Financial Difficulty</td>
<td>254 (9.8)</td>
<td>110 (6.9)</td>
<td>124 (10.8)</td>
<td>127 (7.3)</td>
</tr>
<tr>
<td>Absence of Confidant</td>
<td>117 (4.9)</td>
<td>34 (2.8)</td>
<td>83 (7.2)</td>
<td>58 (3.4)</td>
</tr>
<tr>
<td>SES Deprivation</td>
<td>150 (6.3)</td>
<td>35 (2.8)</td>
<td>115 (10.0)</td>
<td>62 (3.6)</td>
</tr>
</tbody>
</table>

Footnotes:
Significance Tests: Chi-Square for Categorical Variables

- There were considerable overlaps of the physical, mental and social functioning components belonging to each of the three phenotypes
Baseline characteristics

• The three frailty phenotypes shared many similar associations in socio-demographic, lifestyle, health and behavioral variables.

• Having a higher tendency to be older, female, single, divorced or widowed, have current smoking habits, higher prevalence of nutritional risk but a lower likelihood of drinking habits.
Baseline characteristics

**Physical frailty**
- Obesity
- Hypertension
- Metabolic Syndrome
- Coronary Heart Disease
- Cardiac Failure

**Mental frailty**
- Arthritis

**Social Frailty**
- Not associated to Increased:
  - Hospitalization
  - Physician Visits
  - Poly-Pharmacy
Comparison of Frailty Phenotypes

- The three phenotypes **independently predict** relevant adverse outcomes of functional disability and mortality.

- **Physical frailty phenotype** appears **consistently** to be **a strong predictor** of adverse outcomes, when adjusted for age, gender and each other frailty phenotypes.

<table>
<thead>
<tr>
<th></th>
<th>Prevalent IADL Disability</th>
<th>Incident IADL Disability</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFP</td>
<td>1.83</td>
<td>1.68</td>
<td>1.56</td>
</tr>
<tr>
<td>MFP</td>
<td>1.88</td>
<td>1.73</td>
<td>1.47</td>
</tr>
<tr>
<td>SFP</td>
<td>1.29</td>
<td>1.29</td>
<td>1.25</td>
</tr>
</tbody>
</table>
Combined Frailty measures

Comparison of Odds/Hazards Ratios

- **R without MF/SF**
- **R with MF and/or SF**
- **PF without MF/SF**
- **PF with MF and/or SF**

<table>
<thead>
<tr>
<th></th>
<th>R without MF/SF</th>
<th>R with MF and/or SF</th>
<th>PF without MF/SF</th>
<th>PF with MF and/or SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalent IADL Disability</td>
<td>1</td>
<td>1.3</td>
<td>1.48</td>
<td>3.4</td>
</tr>
<tr>
<td>Incident IADL Disability</td>
<td>1</td>
<td>1.76</td>
<td>1.94</td>
<td>2.57</td>
</tr>
<tr>
<td>Mortality HR</td>
<td>1</td>
<td>1.4</td>
<td>1.55</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*after adjusting for age and gender.
The addition of mental and social frailty to the physical frailty phenotype provides incrementally increased risk estimates of adverse outcomes.
Receiver Operator Characteristics

- Prevalent IADL Disability
- Incident IADL Disability
- Mortality

SF index: 56, 60, 60
MF index: 58, 57, 59
PF index: 56, 62, 62
PMSF index: 67, 64, 66
Discussion
• Generated through Strong Theoretical Foundations

• Can be Discriminated well from each other

• Considerable overlaps consonant with literature$^{11,12}$
Functional Disability & Death

Physical

Social

Mental

• More Discriminative items Vs. TFI
• Possibility of developing brief, multi-dimensional screening tools

• Providing essential information of differential needs in the frail older population
Physical + Social + Mental → Functional Disability & Death
Clinical Utility

65% had at least 1 frailty phenotype

≥10% absolute likelihood of being/becoming disabled

1.7-1.9 times increased likelihood of being/becoming disabled, when compared to those without any frailty phenotype.
Clinical Utility

7% were Socially, Mentally & Physically Frail

20-53% absolute likelihood of being/becoming disabled

3.3-4.4 times more likely than their healthy counterparts.

3 times faster death rate than those who were socially, mentally and physically robust.
Conclusion

- Frailty should be measured holistically, accounting for physical, social and mental components.

- Each frailty sub-domain provides essential information for individualized care planning.

- Future Research should focus on:
  - Using standard operational definitions for frailty phenotypes
  - Investigate the transition of Mental and Social Frailty states
Acknowledgments

Grant funding support
A*STAR Biomedical Research Council
• BMRC grant 03/1/21/17/214
Ministry of Health National Medical Research Council
• NMRC/0846/2004
• NMRC/1108/2007:
• NMRC/08/1/21/19/567:
Anonymous Donor
R-177-000-028-720.

Voluntary Welfare Organizations Support
• Geylang East Home for the Aged, Presbyterian Community Services,
• Thye Hua Kwan Moral Society
• (Moral Neighbourhood Links),
• Yuhua Neighbourhood Link,
• Henderson Senior Citizens’ Home, NTUC Eldercare Co-op Ltd,
• Thong Kheng Seniors Activity Centre (Queenstown Centre)
• Redhill Moral Seniors Activity Centre.
References


