Impact of frailty on critical illness

Dr Khadija Khatry
Overview

- Describe frailty and ways it can be measured
- Explain how frailty can impact critical illness
- Review potential pitfalls
- Discuss future directions
What is frailty?

- A state of increased vulnerability to stressors
- Reduced physiological reserve and a reduced ability to compensate for disruptions to homeostasis
- Increased risk of
  - Disability
  - Institutionalisation
  - Death

*Figure 1: Vulnerability of frail elderly people to a sudden change in health status after a minor illness*
From: Frailty: mind the gap
Age Ageing. Published online December 29, 2017. doi:10.1093/ageing/afx193
How can frailty be measured?

- The associations of frailty are well described
- Little is known about how frailty can be assessed in hospital inpatients
- 3 main approaches:
  - Clinical syndrome or phenotype
  - Subjective opinion
  - Multidimensional risk state
Clinical syndrome

- Fried’s Frailty Phenotype (Fried et al 2001)
- Criteria: the presence of 3 or more of
  - Unintentional weight loss >10 pounds in the last year
  - Weak grip strength
  - Self-reported exhaustion
  - Slow walking speed
  - Low physical activity level
Fried phenotype

• Strengths
  – Clinical coherency
  – Reproducibility
  – Wasting disorder with sarcopenia as pathophysiological feature

• Weaknesses
  – Omission of mood and cognition
  – Selection of initial cohort
  – Dichotomous/trichotomous outcome
  – Reliance on performance based tests
Fried phenotype in clinical practice

Table 2. Completion of physical performance, lung function, strength, mood, cognition and functional status tests by subjects in each group

<table>
<thead>
<tr>
<th>Test</th>
<th>Independent old (N = 40)</th>
<th>Day hospital (N = 40)</th>
<th>Continuing care (N = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timed get-up-and-go</td>
<td>40</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>6 min walk</td>
<td>39</td>
<td>38</td>
<td>0</td>
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<tr>
<td>Lung function</td>
<td>40</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>Grip strength</td>
<td>40</td>
<td>40</td>
<td>26</td>
</tr>
<tr>
<td>Mini-Mental State Examination</td>
<td>40</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>Hospital Anxiety and Depression score</td>
<td>40</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Barthel Index score</td>
<td>40</td>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>

Hubbard et al., Age and Ageing
Subjective opinion

- “we know it when we see it”
- Visual estimation of biological age
- Global measures
  - Studentski et al, JAGS 2004
  - Rockwood et al, CMAJ 2005
Clinical Frailty Scale

**Clinical Frailty Scale***

1. **Very Fit** — People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

2. **Well** — People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g., seasonally.

3. **Managing Well** — People whose medical problems are well controlled, but are not regularly active beyond routine walking.

4. **Vulnerable** — While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up", and/or being tired during the day.

5. **Mildly Frail** — People often have more evident slowing, and need help in high order IADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

6. **Moderately Frail** — People need help with all outside activities and with keeping house. Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.

7. **Severely Frail** — Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

8. **Very Severely Frail** — Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.

9. **Terminally Ill** — Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise evidently frail.

**Scoring frailty in people with dementia**

The degree of frailty corresponds to the degree of dementia. Common symptoms in mild dementia include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In moderate dementia, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In severe dementia, they cannot do personal care without help.


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Pitfalls

- Frailty \( \neq \) cachexia

- Frailty \( \neq \) comorbidity but \( \approx \) comorbidity

- Frailty \( \neq \) polypharmacy
Multidimensional risk state

- Deficit accumulation
- Measured by quantity rather than by nature of health problems
- Individuals accumulate various disorders throughout their lives
- The more deficits, the more likely to be frail
Deficit accumulation – Frailty Index

- Symptoms, signs, diseases, disabilities coded as deficits
  - Associate with health status
  - Cover a range of systems
  - A deficit’s prevalence should generally increase with age
  - Chosen deficits must not saturate & must not be too rare
- Can be derived from a comprehensive geriatric assessment
- Weaknesses:
  - Complex
  - Time consuming
  - Mathematical
Evans et al. Age and Aging, 2014
Complex system failure

• A frail older person is analogous to a complex system on the threshold of failure (redundancy has been lost)

• When a complex system fails, it fails with higher order functions first
  – Geriatric Giants: Falls, immobility, incontinence, delirium
Frailty and polypharmacy

- Altered pharmacokinetic responses and pharmacodynamic changes
- Additional hazards of polypharmacy
- Prescribing should be individualised and based on goals of care
Poudel et al, JAMDA, 2016
Associations of frailty

- Incident falls
- Susceptibility to acute illness
- Perioperative complications
- Unplanned hospital admissions
- Disability
- Institutionalisation
- Death
In the context of critical illness

- More likely to experience adverse events
- Longer lengths of stay
- Increased in-hospital mortality
- Increased mortality within 12 months of admission
- More likely to have new functional dependence
- Higher rates of readmission
Frailty and critical illness

- Age alone is not associated with poorer prognosis
- Identifying older persons who should be admitted to ICU can be challenging
- ICU severity scoring systems
  - Guide treatment
  - Predict outcomes
  - Do not incorporate a frailty measure
### Table 3 Logistic regression model predicting physical recovery 12 months after ICU admission

<table>
<thead>
<tr>
<th>Variables</th>
<th>Single predictor</th>
<th>Multivariable predictor model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>$c^a$</td>
</tr>
<tr>
<td>Age (per 5 years)</td>
<td>0.77 (0.64, 0.93)</td>
<td>0.53</td>
</tr>
<tr>
<td>Sex (male vs. female)</td>
<td>0.79 (0.60, 1.04)</td>
<td>0.53</td>
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<tr>
<td>APACHE II score (per 10 points)</td>
<td>0.55 (0.38, 0.80)</td>
<td>0.62</td>
</tr>
<tr>
<td>Marital status (married or living as married vs. other)</td>
<td>0.85 (0.60, 1.20)</td>
<td>0.52</td>
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<tr>
<td>Baseline SOFA score (per 5 points)</td>
<td>0.82 (0.64, 1.05)</td>
<td>0.54</td>
</tr>
<tr>
<td>Admission type (medical vs. surgical)</td>
<td></td>
<td>0.64</td>
</tr>
<tr>
<td>Surgical elective vs. medical</td>
<td>4.37 (2.82, 6.76)</td>
<td></td>
</tr>
<tr>
<td>Surgical emergency vs. medical</td>
<td>1.99 (1.18, 3.35)</td>
<td></td>
</tr>
<tr>
<td>Primary ICU diagnosis</td>
<td></td>
<td>0.64</td>
</tr>
<tr>
<td>CABG/valve vs. cardiovascular/vascular</td>
<td>5.60 (3.32, 9.43)</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal vs. cardiovascular/vascular</td>
<td>1.25 (0.59, 2.65)</td>
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<tr>
<td>Neurologic vs. cardiovascular/vascular</td>
<td>2.10 (0.88, 5.00)</td>
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<tr>
<td>Other vs. cardiovascular/vascular</td>
<td>0.73 (0.29, 1.83)</td>
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<tr>
<td>Respiratory vs. cardiovascular/vascular</td>
<td>0.96 (0.51, 1.80)</td>
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<tr>
<td>Sepsis vs. cardiovascular/vascular</td>
<td>0.85 (0.36, 1.98)</td>
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<tr>
<td>Stroke vs. cardiovascular/vascular</td>
<td>0.18 (0.02, 1.53)</td>
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</tr>
<tr>
<td>Trauma vs. cardiovascular/vascular</td>
<td>0.70 (0.29, 1.70)</td>
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</tr>
<tr>
<td>Baseline PF score (per 50 points)</td>
<td>1.00 (0.73, 1.37)</td>
<td>0.51</td>
</tr>
<tr>
<td>Charlson Comorbidity Index (per 2 units)</td>
<td>0.61 (0.49, 0.77)</td>
<td>0.60</td>
</tr>
<tr>
<td>ICD-10-AM at baseline (per 0.5 point)</td>
<td>0.75 (0.57, 0.98)</td>
<td>0.59</td>
</tr>
<tr>
<td>Frailty index (per 0.2 point)</td>
<td>0.48 (0.35, 0.66)</td>
<td>0.63</td>
</tr>
<tr>
<td>Family preferences for life sustaining treatment</td>
<td>0.69 (0.29, 1.65)</td>
<td>0.53</td>
</tr>
<tr>
<td>Comfort measures vs. other</td>
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<tr>
<td>Total model degrees of freedom/events</td>
<td>1–8/123</td>
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</tr>
<tr>
<td>c-Statistic$^a$</td>
<td>0.51–0.64</td>
<td></td>
</tr>
</tbody>
</table>

Heyland et al. Intensive Care Medicine, 2015
Frailty and ED

- Clinical guidelines for frailty is sparse, and those that do exist do not encompass frailty management in emergency departments.
- Methods to identify frailty are “too complicated”.
- Usually completed after the decision about a patient’s care has been made.
- No standard measurement exists.
- Frailty is erroneously judged to be part of the normal aging process.
Pitfalls in ED triage of frail older patients

- Triaged in lower acuity categories
  - Absence of vital signs measurements
  - Atypical presentations
  - Non-specific complaints
  - Functional impairment often unrecognized contributing factor
Frailty: Limitations and Pitfalls
Stigmatisation

• “The condition of being weak and delicate… weakness in character or morals”

• In the minds of many older people, frailty may identify their most feared aspects of the ageing process: wasting, decrepitude, dependency, decline.

• Being labelled by others as ‘old and frail’ might contribute to a frailty identity …. including a loss of interest in participating in social and physical activities, poor physical health and increased stigmatisation.
## Heterogeneity of measures

<table>
<thead>
<tr>
<th>Fried Frailty Assessment.</th>
<th>Original Definition of the Fried Phenotype by Fried et al (5)</th>
<th>Interpretation of Fried Phenotype (n = 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slowness</strong></td>
<td>Gait speed (n = 17, 74%)</td>
<td></td>
</tr>
<tr>
<td><strong>Gait speed</strong></td>
<td>Questionnaire based assessment of physical function (n = 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subjective perception of gait speed (n = 1)</td>
<td></td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>Dyno metre measurement of grip strength (n = 14, 61%)</td>
<td></td>
</tr>
<tr>
<td><strong>Grip Strength</strong></td>
<td>Questionnaire based assessment of physical function (n = 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timed sit-to-stand (n = 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-report (n = 2)</td>
<td></td>
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<tr>
<td><strong>Exhaustion</strong></td>
<td>Patient self-report (n = 11, 48%)</td>
<td></td>
</tr>
<tr>
<td><strong>Centre for epidemiological studies depression scale</strong></td>
<td>Centre for Epidemiological Studies depression scale (n = 5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short form 36 Questionnaire (n = 6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short form 12 Questionnaire (n = 1)</td>
<td></td>
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<tr>
<td><strong>Shrinkage</strong></td>
<td>Weight loss of 10 pounds over 12 months (n = 12, 52%)</td>
<td></td>
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<tr>
<td><strong>&gt;10 pounds of unintentional weight loss in 12 months</strong></td>
<td>Other measures of weight loss (BMI, 5% loss in total weight, lean appendicular mass, cachexia) (n = 9, 39%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not measured (n = 2)</td>
<td></td>
</tr>
<tr>
<td><strong>Low Physical Activity</strong></td>
<td>Estimated kilocalories (n = 9, 39%)</td>
<td></td>
</tr>
<tr>
<td><strong>Estimated kilocalories per week</strong></td>
<td>Patient self-report (n = 8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Questionnaire based physical activities scale (n = 6)</td>
<td></td>
</tr>
</tbody>
</table>

### Frailty-Defining Diagnoses in Johns Hopkins ACG Frailty Indicator

<table>
<thead>
<tr>
<th>Frailty Concept Diagnoses (Examples)</th>
<th></th>
</tr>
</thead>
</table>
| Malnutrition                         | Nutritional Marasmus  
Other severe protein-calorie malnutrition |
| Dementia                             | Senile dementia with delusional or depressive features  
Senile dementia with delirium |
| Impaired Vision                      | Profound impairment, both eyes  
Moderate or severe impairment, better eye/lesser eye; profound |
| Decubitus Ulcer                      | Decubitus Ulcer |
| Incontinence of Urine                | Incontinence without sensory awareness  
Continuous leakage |
| Loss of Weight                       | Abnormal loss of weight and underweight  
Feeding difficulties and mismanagement  
Incontinence of Feces  
Incontinence of feces  
Obesity (morbid)  
Morbid obesity |
| Poverty                              | Lack Of Housing  
Inadequate Housing  
Inadequate material resources |
| Barriers to Access of Care           | No Med Facility For Care  
No Med Facilities Necessary |
| Difficulty in Walking                | Difficulty in walking  
Abnormality of gait |
| Fall                                 | Fall On Stairs Or Stairs  
Fall From Wheelchair |
Semantic dissonance

- “pre-disability syndrome” vs. state of health
Opportunities

- Target and evaluate interdisciplinary programs of care and rehabilitation
- Minimize unnecessary sedation
- Screening for delirium
- Early assessment for weaning mechanical ventilation
- Nutritional support
- Medication reconciliation
- Early mobilization

→ aim to improve recovery, avoid mortality, functional dependence, reduced QOL, health service utilisation
Future directions

• Evidence for its use in clinical practice is lacking
• Will quantification of frailty inform decision making?
• Will this result in better outcomes?
• Potential of electronic medical records