

# Development And Validation Of A Frailty Model For Acute Medical Care

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# Overview

- **Frailty in the unscheduled admission setting**
  - assessment and management of frail patients is a significant challenge, several models
- **A risk prediction model developed**
  - Clinically facing and predicts patient outcomes
  - To be used at point of care for management, for better outcomes
- **What next?**
  - Validation
  - Develop first clinically predictive model and score for acute setting

# Introduction

The **assessment and management** of **frail** patients presenting acutely to hospital is a **significant challenge** to healthcare services in the UK<sup>1,2</sup>, and worldwide

- *Acute presentation: an unscheduled admission to hospital*

**Frailty** is a **complex physiological syndrome** characterized by decreased reserve and diminished resistance to stressors, resulting from cumulative decline across multiple physiological systems, and **causing vulnerability to adverse outcomes**<sup>3</sup>

1 Cornwell J. *The Care of Frail Older People with Complex Needs: Time for a revolution*. The Sir Roger Bannister Health Summit, Leeds Castle: The King's Fund; 2012.

2 Future Hospital Commission. *Future Hospital: caring for medical patients* A report from the Future Hospital Commission to the Royal College of Physicians. London: Royal College of Physicians; 2013.

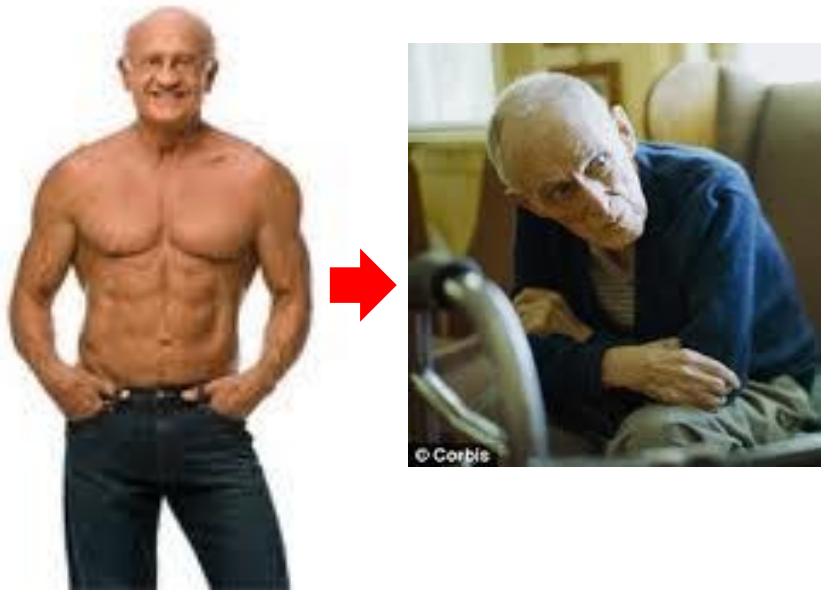
3 Ferrucci L, Guralnik JM, Studenski S et al. Interventions on Frailty Working Group. Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: a consensus report. *J Am Geriatr Soc* 2004; 52: 625–34.

# Variation in assessment

- **UK clinical audits report wide variation in quality of care** and outcomes delivered to frail patients, admitted with hip fractures and delirium.
- **Our recent survey** of frailty assessment within London NHS acute medical units revealed a **large variation in reliability, quality and type** of frailty assessment used.
- **Variation in assessment** leads to variation in care, with delayed onset of treatment, and thus longer patient stays, with **affected outcomes**.

# Two operational models exist

## Phenotype

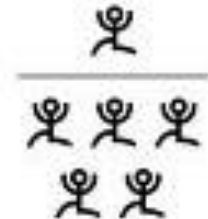


Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. *Journals of Gerontology Series A Biological Sciences & Medical Sciences*. 2001;56(3).

## Index of accumulated deficit



All Deficit



Rockwood K, Howlett SE, MacKnight C, Beattie BL, Bergman H, Hebert R, et al. Prevalence, attributes, and outcomes of fitness and frailty in community-dwelling older adults: report from the Canadian study of health and aging. *J Gerontol A Biol Sci Med Sci*. 59. United States 2004. p. 1310-7.

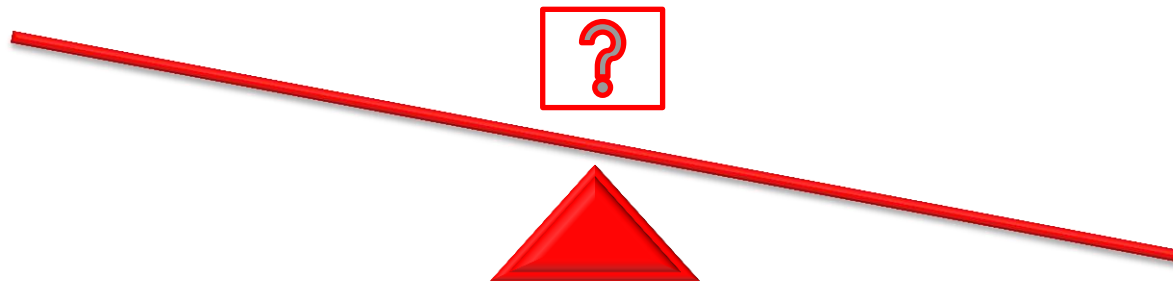
# Existing models

## Pros

- Reproducible
- Predict important health outcomes (e.g. Death and institutionalisation)
- Cross validation with biomarkers and animal models

## Cons

- Early phenotype models exclude important dimensions (e.g. Cognitive impairment)
- Large data requirements (e.g. At least 40 variables for index model)
- Specialised apparatus needed (e.g. Dynamometer)
- Reliant on self reported data



# Frailty Syndromes: An Alternative?

- Recognized as common clinical presentations in the elderly:
  - falls, mobility problems, cognitive impairment, nutrition/pressure ulcer, incontinence, anxiety/depression
- Confer a higher risk of death, institutionalization, disability and poor quality of life

## Acute care toolkit 3

Acute medical care for frail  
older people March 2012

QUALITY CARE FOR  
OLDER PEOPLE WITH  
URGENT &  
EMERGENCY CARE  
NEEDS



- Within UK recommendations as way of recognizing the frail elderly within **acute** care (a busy and pressured setting)
- Letter to BMJ <http://bit.ly/1fBvZBq>
- **How to use in practice?**

Isaacs B. The challenge of geriatric medicine: Oxford University Press, USA; 1992.

Inouye SK, Studenski S, Tinetti ME, Kuchel GA. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. Journal of the American Geriatrics Society. 2007;55(5):780-91.

# Our Aim

- Develop and validate a risk prediction model for mortality, readmissions, and functional dependence based on frailty syndromes
  - Building outputs from the on Frailty in Acute Care Summit, held in conjunction with Royal College of Physicians London
  - Clinically relevant & usable (simple, fast)
  - To be used on access of acute care
  - Predict outcomes relevant to unscheduled admissions
  - Clinician assessed
- Why?
  - Predictive model usable by staff at bedside, without highly specialised knowledge
  - Better management of patient need and better outcomes
    - Contrast: National Early Warning Scores



# Developing a risk prediction model

- **Methodology:**
  - Risk prediction model based on national secondary care dataset
- **Source:**
  - Hospital Episode Statistics (HES) - National administrative database containing patient-level records of all admissions to NHS hospitals in England
- **Data profiling:**
  - ICD-10 diagnostic codes were grouped to code for frailty syndromes.
- **Analysis:**
  - What can predict Mortality, 30 readmission, Functional dependence?

# Developing a risk prediction model

- **Final model :**
  - Spells for patients > 65 years who had emergency/ unscheduled admission to NHS acute providers in England in 2012
- **Statistical analysis:**
  - **Pseudorandom numbers** used to split patients into train (60%, n=1,259,185 spells) and test (40%, n=840,067) groups;
- **Logistic regression** to create risk prediction model
- **Area Under the Receiver Operator Characteristic (AUROC)** curves were plotted from the predicted probabilities to explore predictive power (0.8 desired for clinical usefulness)
- Our model closer to phenotype, blends in index ideas

# Comparison of predictions

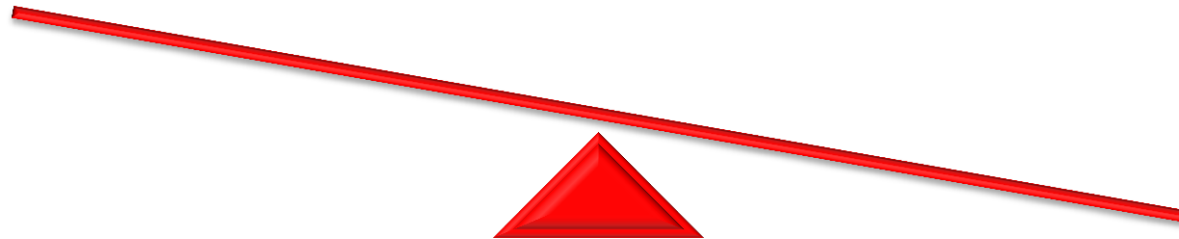
Model/scores AUROCs (Review of literature)	Mortality		Re-admission		Functional dependence	
	Inpatient	90 Day	30 Day	90 Day	Institution- alisation	≤ 2 points Barthel ADL
<b>Frailty syndromes and admission history</b>	<b>0.63</b>		<b>0.63</b>		<b>0.63</b>	
<i>Frailty syndromes and admission history prospective* * provisional</i>	~0.7-0.9*		~0.7-0.9*		~0.7-0.9*	
<i>Charlson score 2012 (Historic)</i>	0.64		0.59		0.62	
<i>CHS model</i>		0.61		0.52	0.57	0.55
<i>SOF model</i>		0.59		0.53	0.44	0.56
<i>Avila-Funes</i>		0.68		0.55	0.50	0.59
<i>Rothman</i>		0.67		0.53	0.45	0.59
<i>Frailty Index</i>		0.69		0.57	0.55	0.57
<i>ISAR</i>		0.62		0.60	0.65	0.60
<i>PARR30</i>			0.70			

# Limitations

- Hospital Episode Statistics are retrospectively coded
- Diagnostic coding accuracy in HES has been challenged
- HES data do not contain some variables previously identified as being predictive of frailty
  - e.g. poly-pharmacy; social isolation; functional assessments

# Strengths

- Simple
- Clinical focus
- Amenable to non-specialists
- Not self-reported
- Cross outcome performance is stable
- Fast



# Conclusions

- Model confirms that **frailty syndromes are valid predictors of risk**, for elderly patients with unscheduled admission to hospital in the UK **using administrative data**
  - Predictive power within HES is insufficient for *clinical* risk prediction at the bedside
- **What next?**
  - Validation in other settings
  - Correlation with a clinical dataset, and indications good: AUROC~0.7-0.9
  - What about Frailty Syndromes PLUS (? Biomarkers; linked data; ??)
  - Change in condition may be most important
- **Operationalise Model into a Score**
  - Trialling a collection strategy for this

# Summary

- **Frailty in the unscheduled admission setting**
  - alternative model proposed: blending other assessment types
- **A risk prediction model developed**
  - we have shown it is possible to use frailty syndromes that are amenable to easy assessment on clinical presentation to predict outcomes
  - a prospective set seeing better performance (AUROC ~0.9)
- **What next?**
  - Validate the model in other settings
  - operationalise model and score for point of care use
    - trials for predictive model data collection beginning
  - action oriented response sort

# Acknowledgements

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# Contact

- Slides available online at:  
[http://www.clahrc-northwestlondon.nihr.ac.uk/CLAHRC\\_news](http://www.clahrc-northwestlondon.nihr.ac.uk/CLAHRC_news)
- Letter to BMJ (our start point)  
<http://www.bmj.com/content/343/bmj.d4681/rr/645724>
- Twitter: @jsoongRCP @clahrc\_nwl
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