Concurrent validity of the Global Burden of Disease study Frailty Index (GBD-FI): external validation using the Survey of Health, Ageing and Retirement in Europe

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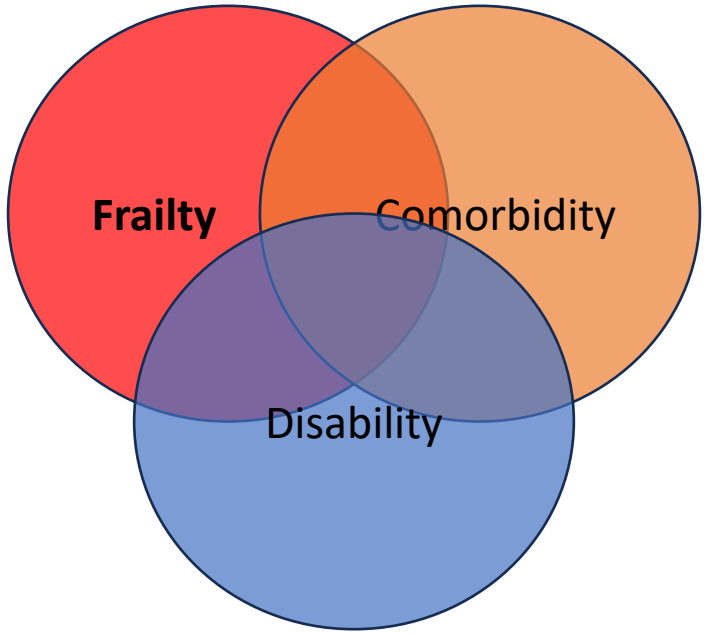
Main topics in geriatric medicine (older persons)

- Frailty: being vulnerable (at high risk) of adverse health outcomes
- Comorbidity: presence of multiple diseases
- Disability: unable to do activities of daily living (living independently)

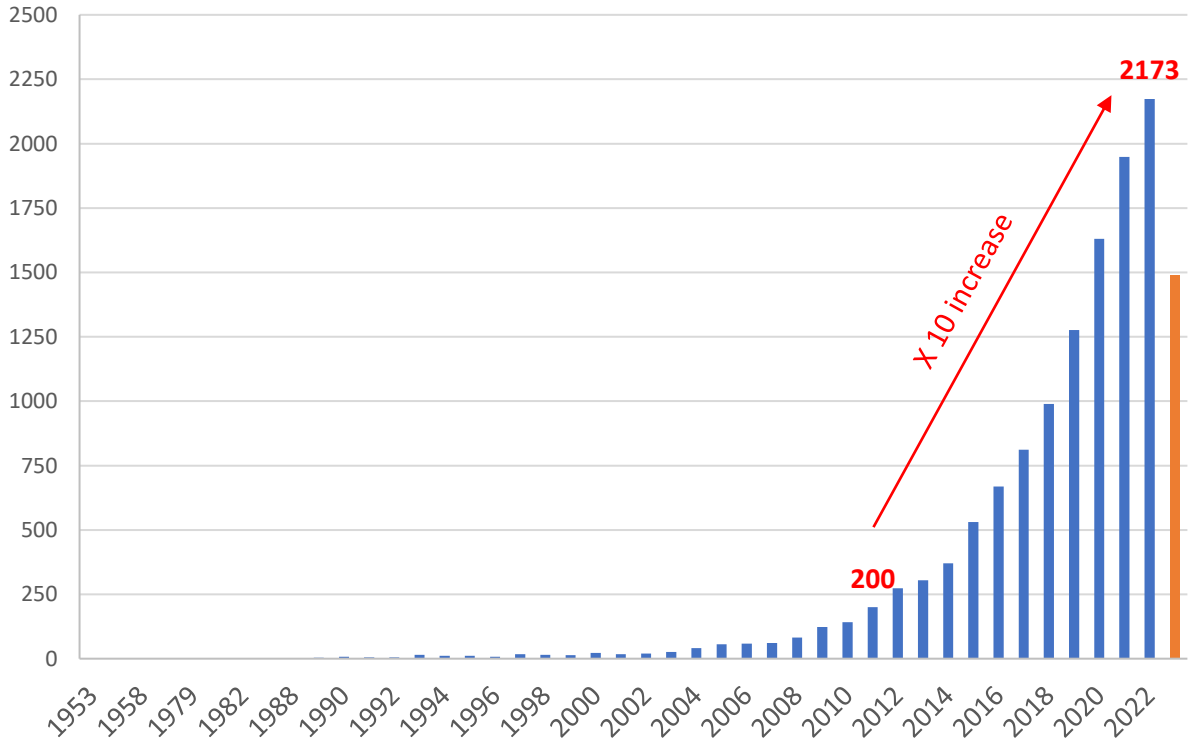


Frailty

- Now an “area of special interest” in geriatric medicine/research!

Two most common approaches are:

- the frailty phenotype
- deficit accumulation (frailty index)



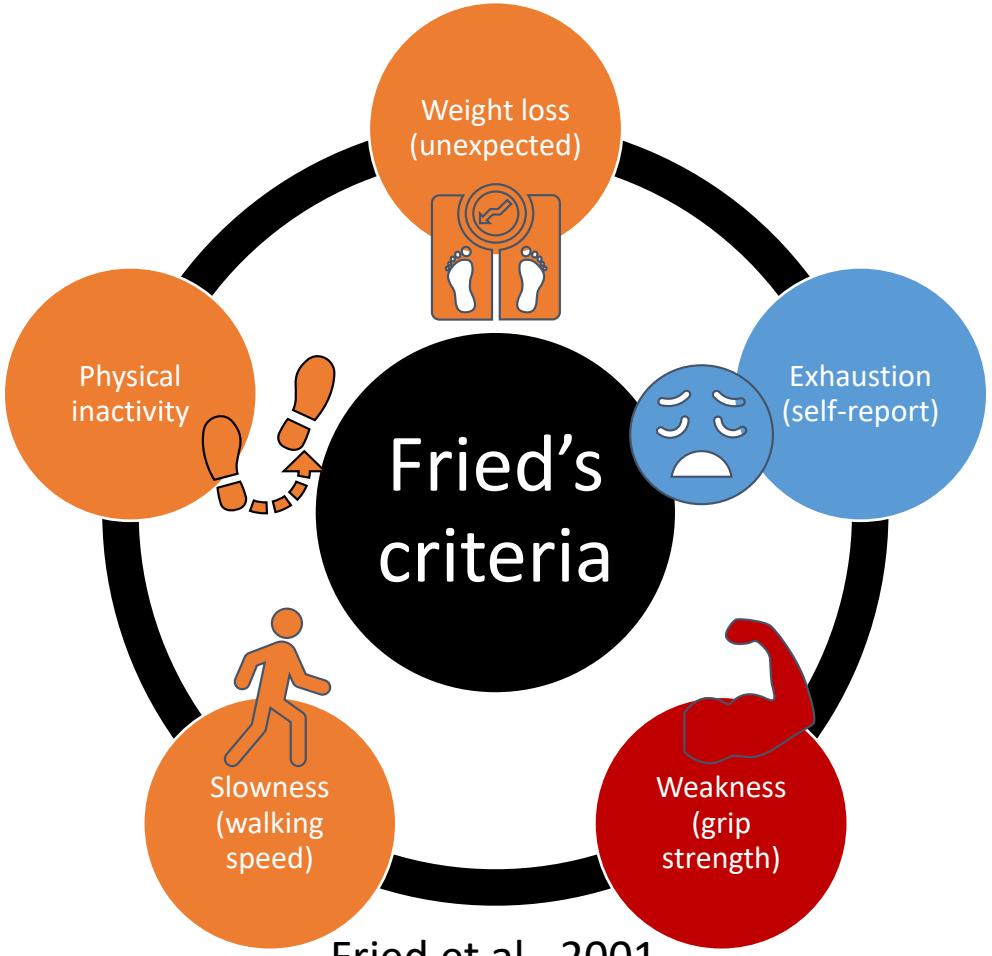
PubMed: “frailty” title search by year

advantAGE
MANAGING FRAILTY

Frailty phenotype

- Most common approach

- A medical syndrome with multiple causes and contributors that is characterized by diminished: strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death." (Morley et al., 2017)



Fried et al., 2001

Frail if ≥3 out of the 5 signs/symptoms present

Accumulation of deficits

- A risk state characterized by a higher number of ageing associated health deficits
- Health deficits include symptoms, signs, diseases, disabilities, etc.
- The GBD-FI is a frailty index developed from GBD items

A FI is scored as:

Total number of deficits present

÷

Total number of deficits considered

(i.e. the proportion of deficits a person has)

(Rockwood et al., 2001; Searle et al., 2008)

International Journal of *Environmental Research and Public Health*

(O'Donovan et al., 2020)

MDPI

Article

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Mark O'Donovan [1,2], Duygu Sezgin [1], Zubair Kabir [3], Aaron Liew [1,4] and Rónán O'Caoimh [1,5,*]

External validation of the GBD-FI

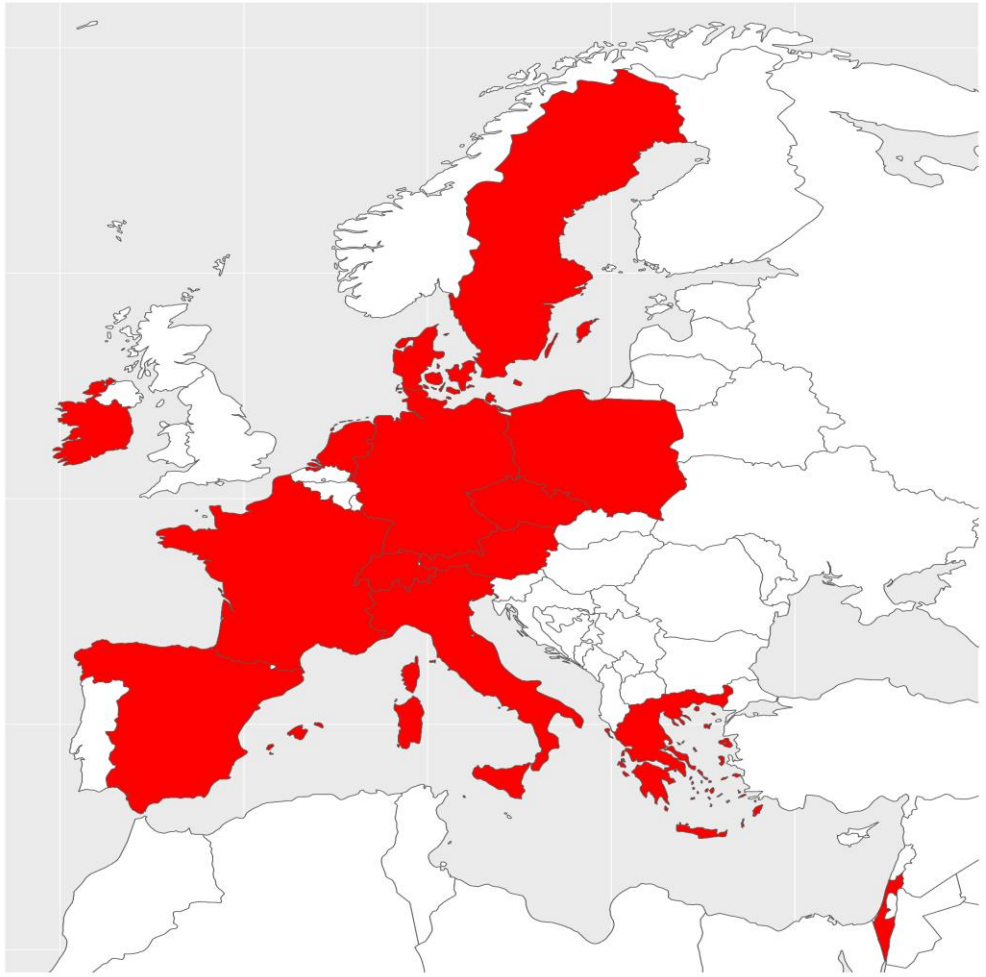
- Concurrent validity of the Global Burden of Disease study Frailty Index (GBD-FI): external validation using the Survey of Health, Ageing and Retirement in Europe

Accepted for publication in Age and Ageing

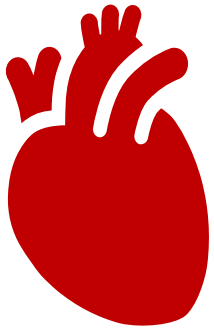
Mark R. O'Donovan, Brecht Devleesschauwer, Duygu Sezgin, Aaron Liew, Zubair Kabir, Rónán O'Caoimh

The Survey of Health, Ageing and Retirement in Europe (SHARE)

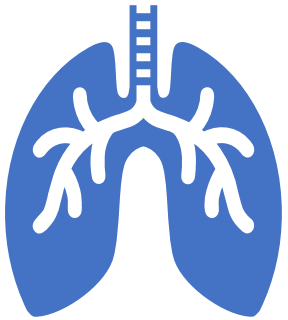
- Individual-level anonymous data - accessed via online registration process
- Wave 2 (2006/2007); 15 countries
- 34,054 individuals aged ≥50 years
- Individual survey-weights were applied for more representative estimates



GBD-FI (SHARE version)



- A heart attack or other heart problem
- Stroke or cerebral vascular disease
- Hypertension



- Chronic lung diseases (CLD / asthma / persistent cough)

- Stomach or duodenal ulcer, peptic ulcer
- Bothered by incontinence

- Arthritis
- Osteoporosis
- Bothered by falls

- Dementia or other serious memory impairments
- Parkinson's disease
- Depression screening (EURO-D score ≥4)

- Eyesight fair/poor
- Hearing fair/poor
- Dizziness/faints/blackouts

- Malignant cancers
- Diabetes or high blood sugar
- Hypercholesterolaemia
- Dentures use
- Physical activity level

GBD-FI scored as:

Total number of deficits present ÷ 20

Scores ≥0.25 = frail

Other frailty measures in the SHARE

- Numerous tools available

- We choose three to compare with the GBD-FI

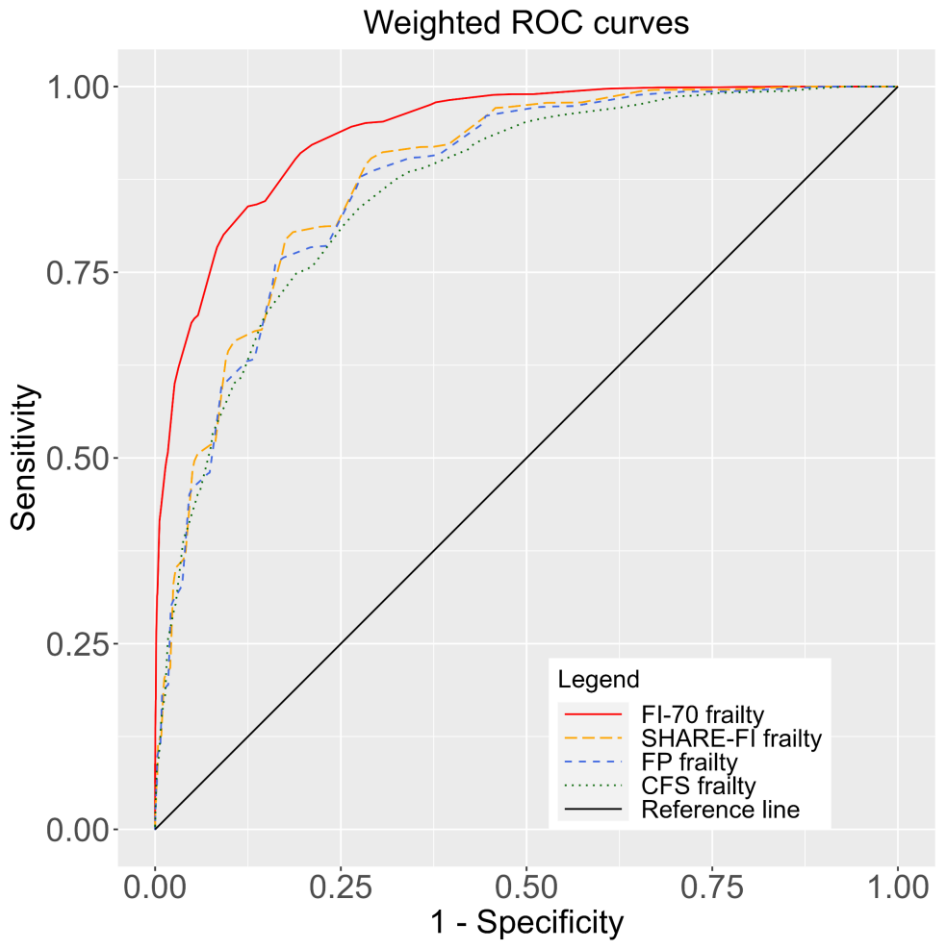
Deficit accumulation	Other multidimensional	Frailty Phenotype
		
• 70-item frailty index (FI-70)	• Clinical Frailty Scale (CFS)	• Frailty phenotype (FP) • SHARE-FI (a weighted FP)

Diagnostic accuracy of the GBD-FI

- Measured using area under the receiver characteristic curves (AUC) - survey-weighted bootstrap method

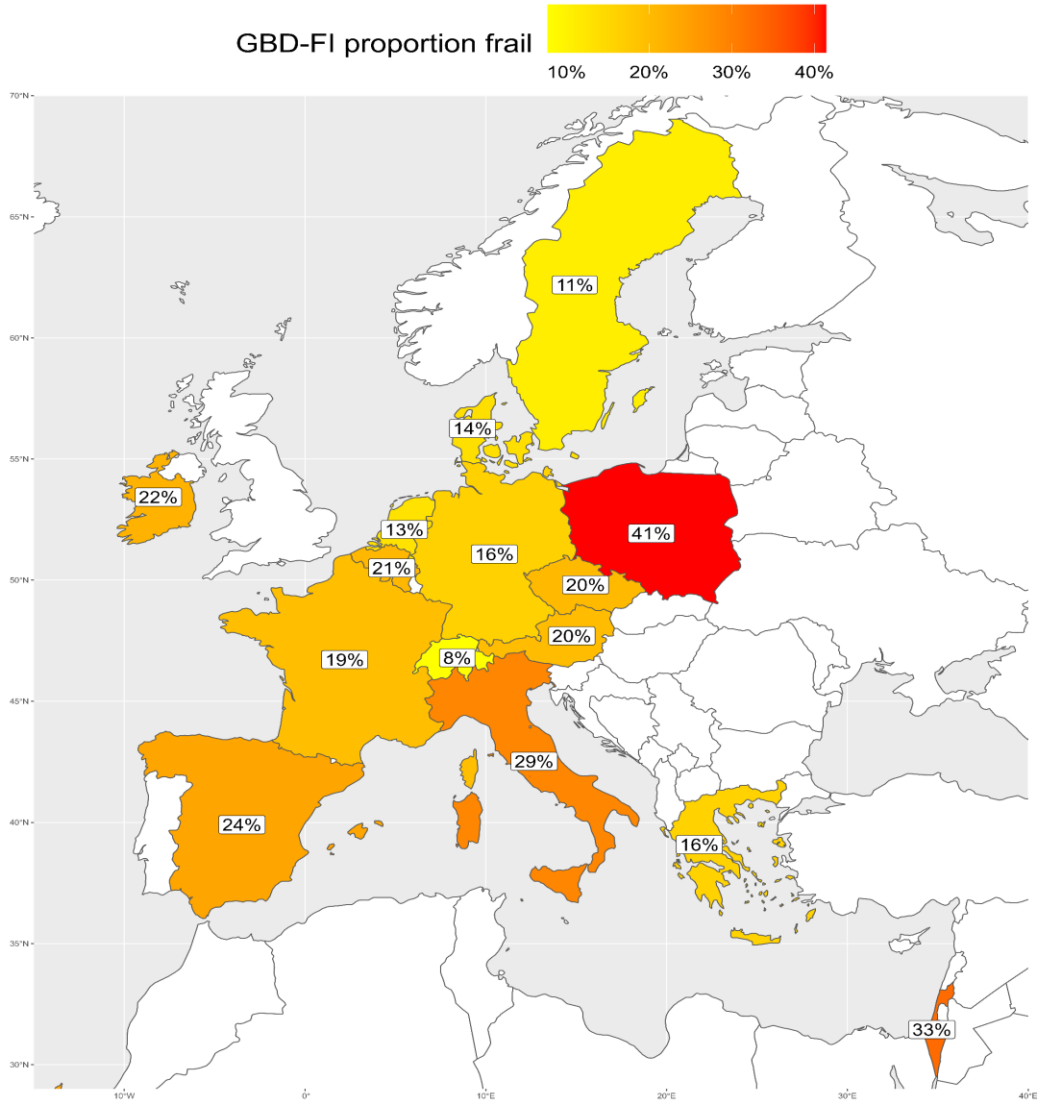
AUC (95% CI) was:

- 0.94 (0.94-0.94) FI-70 frailty
- 0.86 (0.85-0.87) for CFS frailty
- 0.87 (0.86-0.88) for FP frailty
- 0.88 (0.87-0.89) for SHARE-FI frailty



Frailty prevalence

- Overall frailty prevalence according to the GBD-FI was 22%
- Ranged from 8% in Switzerland to 41% in Poland.



Conclusions

- A frailty measure can be defined using items in the GBD
- Despite not having disability items it had very good to excellent diagnostic accuracy for frailty according to other common definitions
- The GBD-FI could be a useful way of comparing frailty estimates using GBD data

Applying GBD-FI to GBD data (preliminary plan)

Published

Deficits: Select age-associated health deficits for the GBD-FI

36 deficits selected for GBD-FI

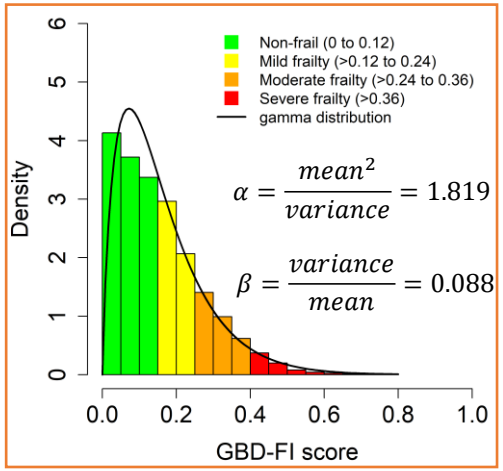
Mean: Estimate the mean GBD-FI score for the population

$$\frac{Sum\ 36\ prevalence\ estimates}{36}$$

Unpublished

Variance: Estimate GBD-FI variance from mean GBD-FI score (linear regression?)

May have a linear relationship with the mean score (Rockwood et al., 2001)



Accepted

Gamma distribution: Apply to estimate proportions (using mean and variance)

International Journal of Environmental Research and Public Health (O'Donovan et al., 2020) MDPI

Article

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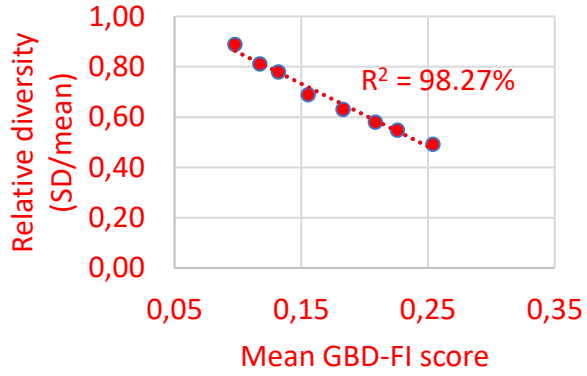

Plot of 5-year age groups (50-54, 55-59 … 85+)

y = -2.4971x + 1.1072

$$Variance = \sqrt{mean \times (-2.4971 \times mean + 1.1072)}$$

	Non-frail (0 to 0.12)	Mild frailty (>0.12 to 0.24)	Moderate frailty (>0.24-0.36)	Severe frailty (>0.36)
Prevalence	44%	34%	16%	7%
Estimated prevalence	45%	34%	14%	7%

Accepted for publication (Age and Ageing)

Applying GBD-FI to GBD data (preliminary results)

Published

Deficits: Select age-associated health deficits for the GBD-FI

Mean: Estimate the mean GBD-FI score for the population

↓

Unpublished

Variance: Estimate GBD-FI variance from mean GBD-FI score (linear regression?)

↓

Accepted

Gamma distribution: Apply to estimate proportions (using mean and variance)

By location (≥70 years)	Frail (≥0.25)	Pre-frail (0.08-0.24)	Non-frail (<0.08)
Asia	**16%**	**54%**	**31%**
Americas	**18%**	**56%**	**26%**
Africa	**18%**	**56%**	**26%**
Europe	**20%**	**56%**	**24%**
China	**14%**	**52%**	**34%**
Hungary	**27%**	**58%**	**15%**
By age (global)	**Frail (≥0.25)**	**Pre-frail (0.08-0.24)**	**Non-frail (<0.08)**
50-54 years	**2%**	**30%**	**68%**
55-59 years	**3%**	**35%**	**62%**
60-64 years	**6%**	**42%**	**52%**
65-69 years	**10%**	**48%**	**42%**
70-74 years	**14%**	**52%**	**34%**
75-79 years	**16%**	**54%**	**30%**
80-84 years	**20%**	**57%**	**23%**
85-89 years	**25%**	**58%**	**17%**
90-94 years	**28%**	**58%**	**14%**
≥95 years	**31%**	**58%**	**11%**

Mean GBD-FI scores from GBD 2017 data (O'Donovan et al., 2020)