

Construction of a frailty index using Understanding Society and analysing the influence on ethnicity using a multilevel growth modelling framework

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Background and motivation

- Little is known about the influence of ethnicity on the level and the development of frailty (growth trajectories).
- Understanding Society (US), a large panel study of 40,000 households in Great Britain includes a 'boost' sample of 11,500 participants from diverse ethnic minorities.
- First, construction of a FI from US and then estimating growth trajectories of frailty dependent from cohort age and wave.

Understanding Society sample

- Understanding Society (US) sample with all parts of the UK.
- Using the first 9 waves.
- Age restriction: 50 years and older
- Ethnicities (using EMB and IEMB samples):
 - 1) White British and other white
 - 2) Indian
 - 3) Pakistani
 - 4) Bangladeshi
 - 5) Caribbean
 - 6) African

How to measure frailty

Fried vs Rockwood approach I

- **Fried** approach: assesses physical frailty through five criteria:
 - 1) unintentional weight loss
 - 2) weakness or poor handgrip strength
 - 3) self-reported exhaustion
 - 4) slow walking speed
 - 5) low physical activity

How to measure frailty

Fried vs Rockwood approach II

- **Rockwood** approach: the Frailty Index (FI) measures the proportion of accumulated deficits in an individual and could include:
 - symptoms
 - signs
 - **disabilities**
 - **health conditions (diseases)**
 - **health limitations**
 - laboratory test results

- used are the disabilities, health conditions, health limitations questions (domains) from US using the waves 1 to 9.

Research objective

- In a first step to construct a longitudinal FI to study the change in frailty over time in the general population from 50 years onwards.
- In a second step, frailty trajectories by ethnic group will be mapped out and analysed: to look for differences in the
 - starting points (level)
 - intensity of development of frailty over age (ageing effect)

Domain ealth limitations

- General health

In general, would you say your health is:

excellent, very good, good, fair, poor

- moderate activities
- several flights of stairs

yes, limited a lot / yes, limited a little / no, not limited at all

- Physical health limits amount of work
- Physical health limits kind of work
- Mental health accomplished less
- Mental health worked less carefully
- Pain interfered with work
- Felt calm and peaceful
- Had a lot of energy
- Felt downhearted and depressed
- Physical/mental health interfered with social life

All of the time / most of the time / some of the time / a little of the time / none of the time

Domain health conditions

- Has a doctor or other health professional ever told you that you have any of these conditions? Please just tell me all the conditions that apply
- *Asthma*
- Chronic bronchitis
- Emphysema
- Congestive heart failure
- Angina
- High blood pressure
- Heart attack or myocardial infarction
- Stroke
- Diabetes
- Arthritis
- Any kind of liver condition
- Cancer or malignancy
- Additionally, hypothyroidism and epilepsy are available but agreed not to use
- Not mentioned/No vs Mentioned/Yes

Diagnosed (mental) health conditions (dementia, other neurological conditions) with cognitive impairment are only available in later waves (years)

Domain difficulties and disabilities

Dou you have any health problems or disabilities that mean they have substantial difficulties with any of the following areas of their life?

- Mobility
- Moving objects
- Manual dexterity
- Contenance
- Hearing
- Sight
- Communication or speech problems
- Memory or ability to concentrate
- Recognising physical danger
- Physical co-ordination
- Difficulties personal care
- Other health problem or disability

Not mentioned/No vs Mentioned/Yes

Constructing a FI with 10 steps

- 1) Select every variable that measures a health problem.
- 2) Exclude variables with more than 5% missing values.
- 3) Recode the responses to 0 (no deficit) through 1 (deficit).
- 4) Exclude variables when coded deficits are too rare ($< 1\%$) or too common ($> 80\%$).
- 5) Screen the coded variables for association with age.
- 6) Screen the coded variables for correlation with each other.

Constructing a FI with 10 steps

- 1) Count the variables retained least (should at least 30 variables).
- 2) Calculate the FI scores.
- 3) Test the characteristics of the FI.
 - a right-skewed frequency distribution,
 - scores less than 0.7 for at least 99% of the samples,
 - a positive association with age,
 - typically, higher mean FI scores in females than males,
- 4) Use the FI as a continuous variable in analyses.

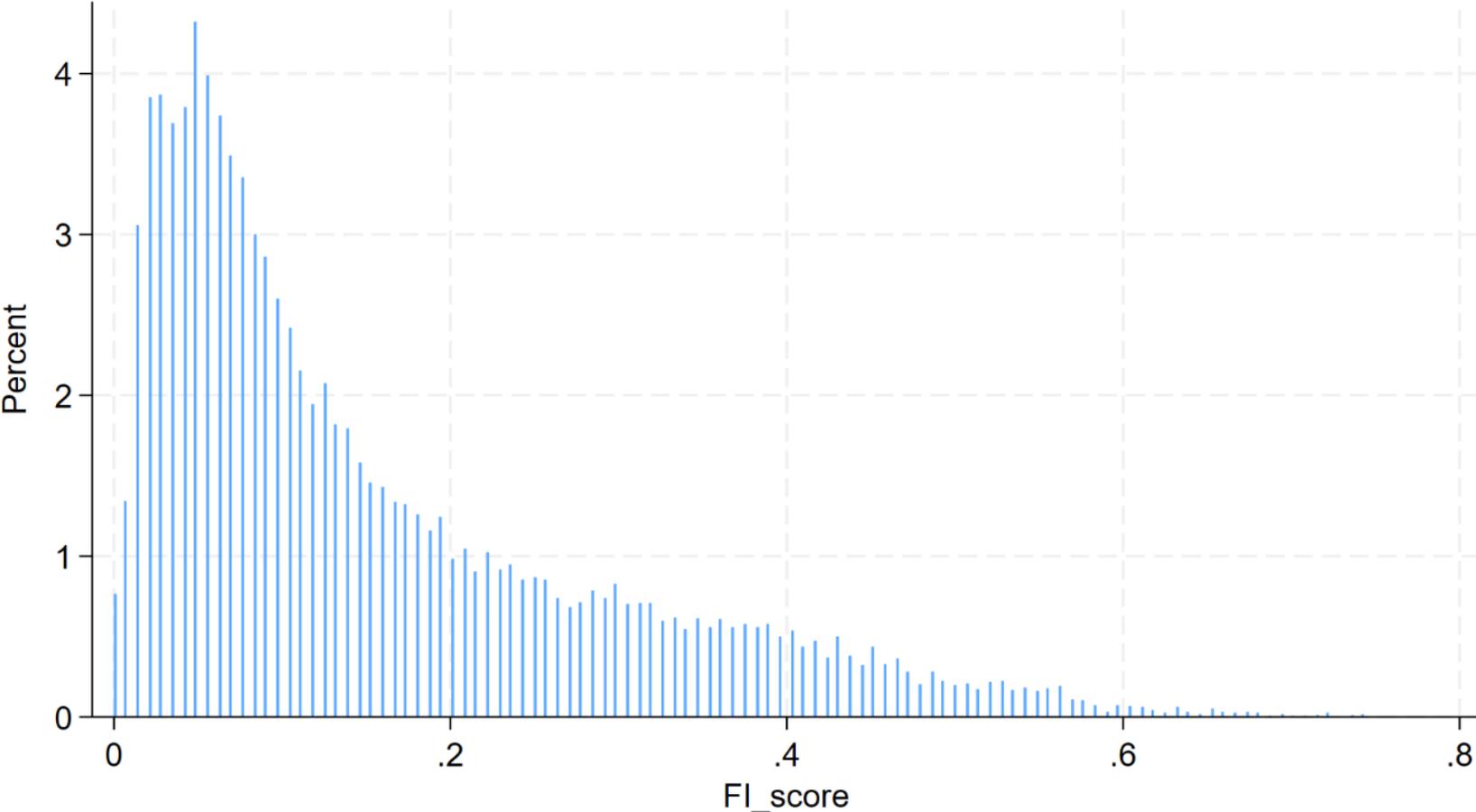
Calculation of the FI score from US

- Objective is to construct a FI score from items of 3 domains (12x health conditions + 12x health limitations + 12x disabilities).
- $FI = \frac{\text{sum of FI items}}{\text{number of non-missing FI items}}$

Descriptive statistics of the US sample in wave 1

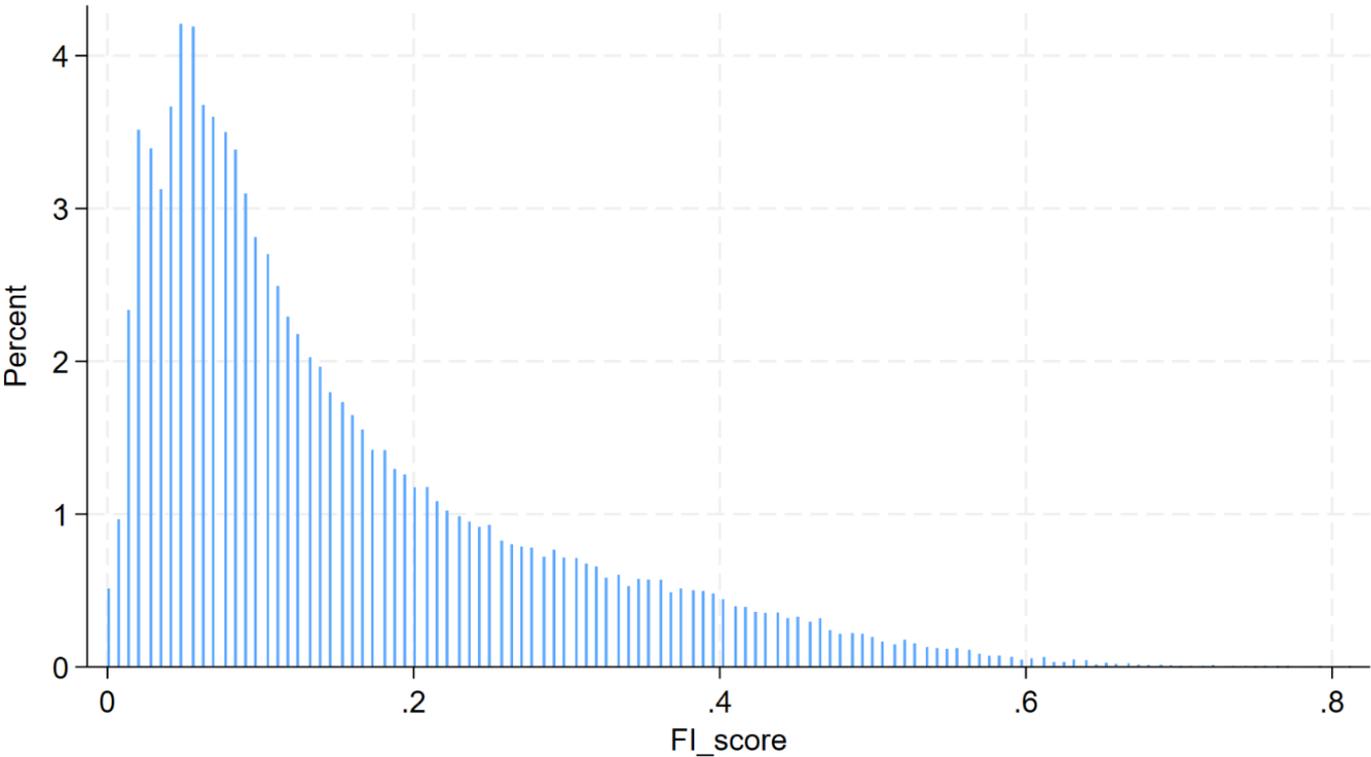
	Age in categories			
	50-64	65-79	80 and above	Total
N	10,470 (53.4%)	6,694 (34.2%)	2,434 (12.4%)	19,597 (100.0%)
Age at interview	56.9 (4.4)	71.3 (4.3)	84.7 (3.9)	65.3 (10.7)
Sample origin				
UKHLS GB 2009-10	9,884 (94.4%)	6,397 (95.6%)	2,358 (96.9%)	18,639 (95.1%)
UKHLS NI 2009-10	280 (2.7%)	175 (2.6%)	56 (2.3%)	512 (2.6%)
EMB sample 2009-10	306 (2.9%)	122 (1.8%)	20 (0.8%)	447 (2.3%)
Country of residence				
England	8,785 (83.9%)	5,555 (83.0%)	2,056 (84.5%)	16,396 (83.7%)
Wales	472 (4.5%)	372 (5.6%)	127 (5.2%)	971 (5.0%)
Scotland	932 (8.9%)	592 (8.8%)	194 (8.0%)	1,718 (8.8%)
Northern Ireland	280 (2.7%)	175 (2.6%)	56 (2.3%)	512 (2.6%)
Sex				
Male	5,156 (49.3%)	3,144 (47.0%)	913 (37.5%)	9,213 (47.0%)
Female	5,313 (50.7%)	3,550 (53.0%)	1,521 (62.5%)	10,384 (53.0%)
Ethnicity				
White (ref.)	9,879 (94.4%)	6,450 (96.4%)	2,392 (98.3%)	18,721 (95.5%)
Indian	179 (1.7%)	70 (1.0%)	12 (0.5%)	261 (1.3%)
Pakistani	67 (0.6%)	24 (0.4%)	3 (0.1%)	94 (0.5%)
Bangladeshi	25 (0.2%)	11 (0.2%)	1 (0.0%)	36 (0.2%)
Caribbean	74 (0.7%)	50 (0.7%)	14 (0.6%)	137 (0.7%)
African	55 (0.5%)	16 (0.2%)	2 (0.1%)	72 (0.4%)
Other	138 (1.3%)	51 (0.8%)	9 (0.4%)	198 (1.0%)
Mixed in any form	52 (0.5%)	24 (0.4%)	2 (0.1%)	78 (0.4%)

FI score with complete information from 36 items from wave 1



19,230 respondents with 19,230 observations in wave 1

FI score with complete information from 36 items from all 9 waves

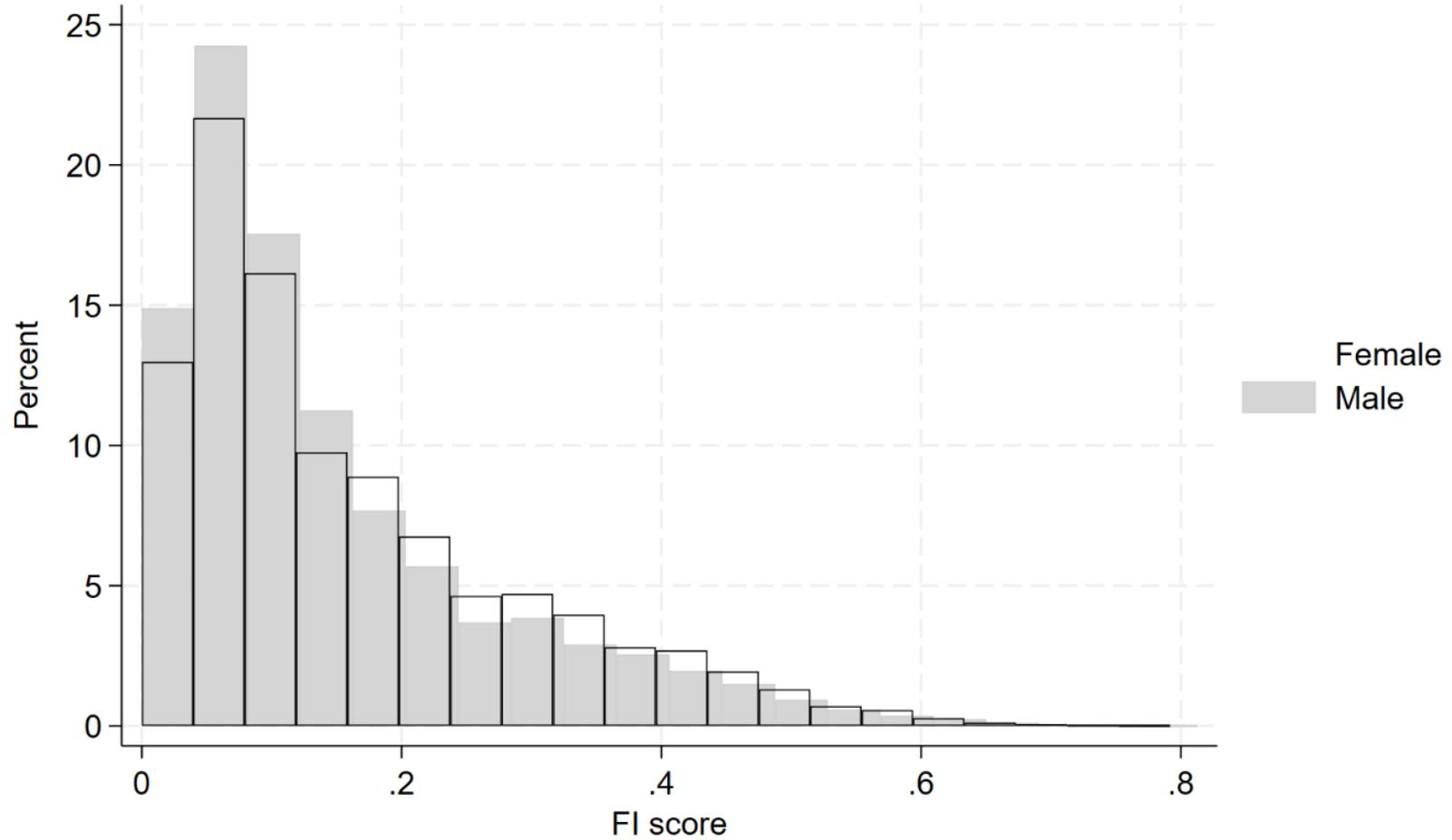


20,801 respondents with 102,622 observations

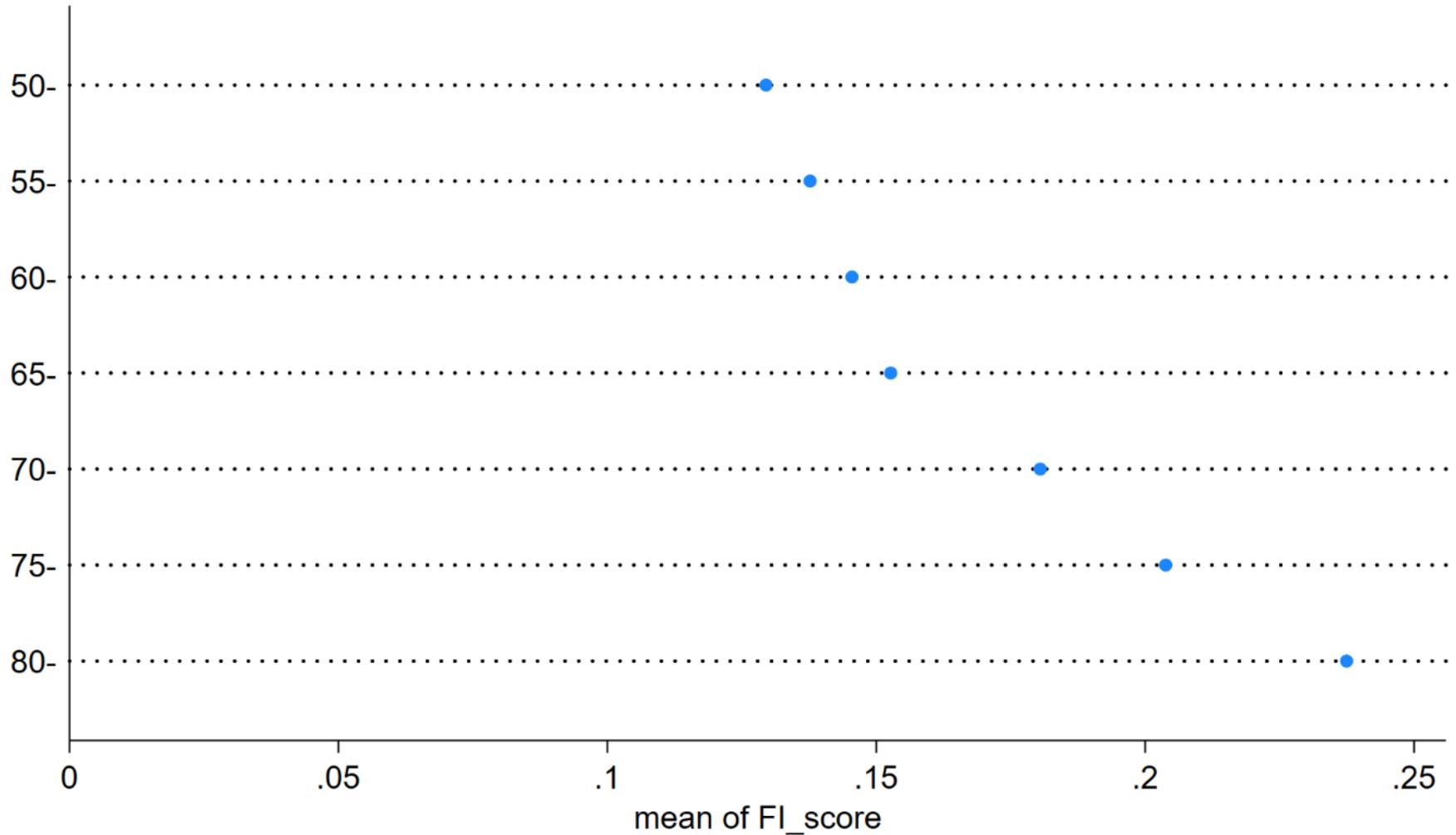
FI categorisation by age group in all 9 waves

	50-64	65-79	80 and above	Total
	N=48,473	N=43,880	N=10,269	N=102,622
FI categories:				
Non-frail (FI ≤ 0.08)	21,822 (45.0%)	14,360 (32.7%)	1,463 (14.2%)	37,645 (36.7%)
Pre-frail (0.08 < FI < 0.25)	18,998 (39.2%)	20,500 (46.7%)	4,936 (48.1%)	44,434 (43.3%)
Frail (0.25 ≤ FI ≤ 1.00)	7,653 (15.8%)	9,020 (20.6%)	3,870 (37.7%)	20,543 (20.0%)

FI score by sex



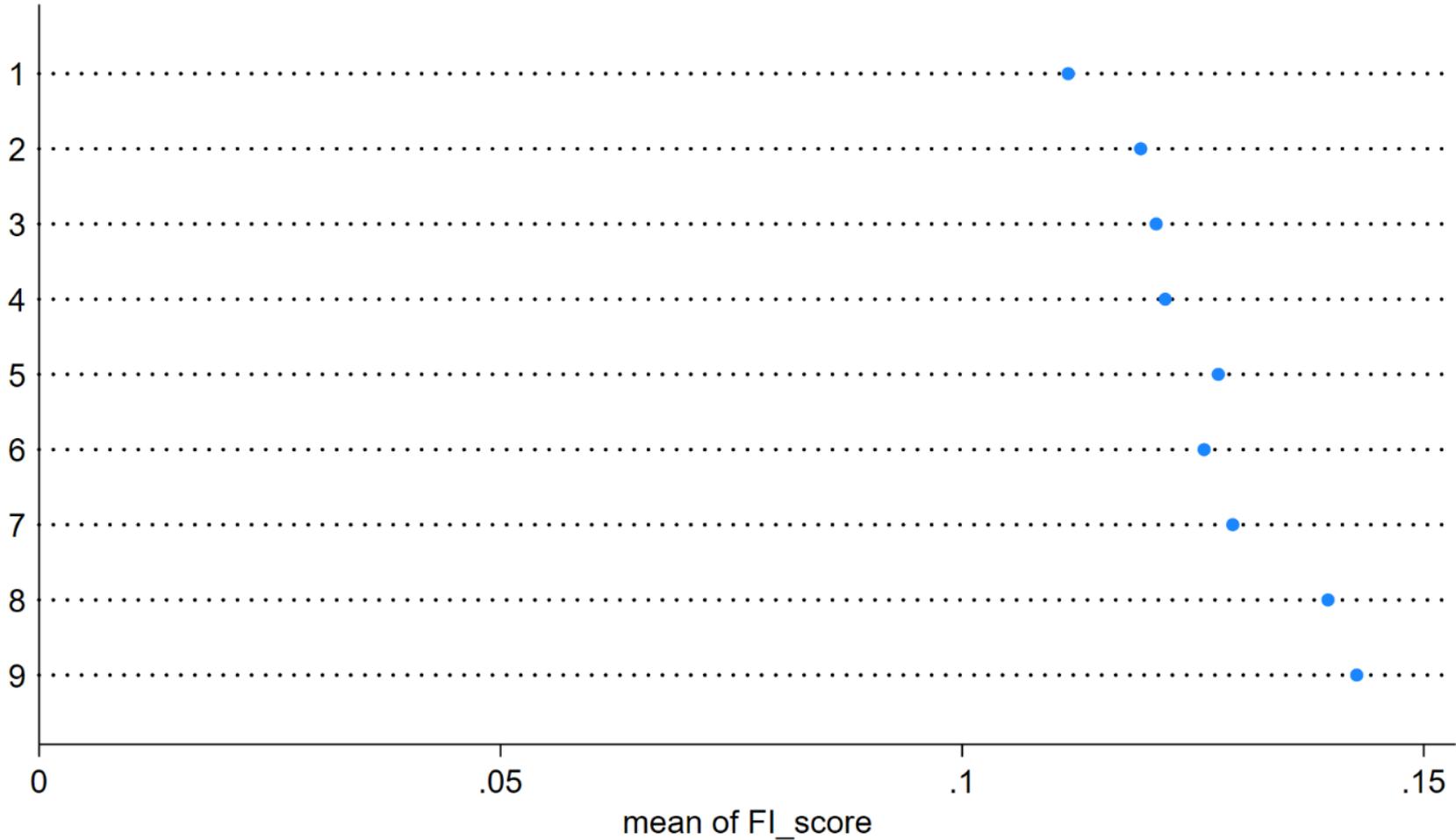
FI scores and cohort age in the unbalanced panel



FI scores over waves 1-9 in the unbalanced panel



FI scores over 9 waves in the balanced panel



Estimation strategy multilevel model

- The multilevel model consists of repeated observations nested within individuals.
- Starting with a multilevel model with cohort age and ageing (waves) as fixed effects and random intercepts in an unbalanced panel.
- Complete case analysis.
- First, further specifications with random intercepts and random slopes for the cohort age and age (wave) will follow.
- Second, further analyses considering missing items with a reduced FI score (e.g. 24 items) and multiple imputation will follow (Grund et al. 2018).

Multilevel model

FI score	Coefficient	Robust std. err.	z	P> z	[95% conf. interval]	
Age cohort categories	0.0220	0.0005	43.004	0.000	0.0210	0.0230
Wave centered square	0.0048	0.0001	39.657	0.000	0.0046	0.0051
Interaction term Age cohort categories*Wave centered square	0.0010	0.0001	15.684	0.000	0.0009	0.0011
Age cohort categories square	0.0032	0.0003	12.104	0.000	0.0027	0.0037
Wave centered square	0.0000	0.0000	1.388	0.165	-0.0000	0.0001
Constant	0.1745	0.0014	127.186	0.000	0.1718	0.1772

Age categories 50-54,55-59,60-64,65-69 (centered),70-74,75-79,80+, wave centered at wave 5, individual random intercepts.

Conclusions and next steps

- A FI can be constructed from US.
- Our constructed FI has the desired properties.
- It can be used for analysing the development of frailty over time.
- Estimation of the multilevel model shows the cohort ageing effect and the interaction effect as Marshall et al. (2015).
- The next steps will be to create growth trajectories of frailty and to analyse the development of frailty for the 5 different minor ethnicities.
- Analysing different multilevel specifications.

Thank you for your attention!

Please give feedback!

Any questions?