Technical Report:

Development of a frailty index using Understanding Society

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Abstract: A frailty index (FI) is a tool based on surveys to measure the frailty level of individuals at particular points in time (cross-sectionally) and over time (longitudinally). Using population data could help researchers better understand what causes frailty and how it changes over the lifecourse for different people. This working paper outlines how a frailty index has been developed using data from Understanding Society. The FI was constructed using 36 self-reported items across different domains in the dataset, including health conditions, health limitations and disabilities. The FI uses population data from the Great Britain and Northern Ireland, Ethnic Minority Boost and the Immigrant and Ethnic Minority Boost samples. The analysis was restricted to respondents with complete information for all items in a wave. To validate the constructed FI, associations with age and sex were tested. The analysis shows that the FI is a valid measure of frailty in Understanding Society.

Keywords: biological ageing, frailty index, measurement tools, older people

JEL classification: C81, I10, I19

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Data Citation: Wave 1 to 13 data are available from the UK Data Archive: University of Essex, Institute for Social and Economic Research. (2023). Understanding Society: Waves 1-13, 2009-2022 and Harmonised BHPS: Waves 1-18, 1991-2009. [data collection]. 18th Edition. UK Data Service. SN: 6614, http://doi.org/10.5255/UKDA-SN-6614-19

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Tables

Figures

Appendix

1 Introduction

Frailty can be described as a grouping of both common and clinically significant symptoms and other health indicators that increase over time in later life. Frailty is defined by a decline in both overall physical function and physiologic reserve of organ systems. Frailty is associated with higher health and social care utilisation, for example related to increased risk of falls, fractures, hospitalisation, institutionalisation, and mortality. Different instruments have been developed to measure frailty which can be grouped into two main categories (1):

1. The frailty phenotype developed by Linda Fried (2) consists of 5 components: unintentional weight loss, weakness or poor handgrip strength, self-reported exhaustion, slow walking speed and low physical activity. This approach considers frailty as separate from disabilities and comorbidities.

2. The frailty index (FI) developed by Kenneth Rockwood (3) is based on accumulation of deficits across various domains such as health conditions, health limitations, disabilities, symptoms, biomarkers, etc. with a minimum of at least 30 variables. This score counts the number of health deficits observed for individuals and a higher number of deficits indicates a higher level of frailty. FI scores have desirable statistical properties because frailty scores are on a continuous scale, based on a larger number of included variables, and have narrower prediction intervals. There is generally good agreement between different deficit accumulation FIs, which helps with external validity (1).

Comparing these different approaches, some heterogeneity exists in the degree to which various frailty scores estimate frailty and in the identification of individuals as frail. The accumulation of deficits and the Fried phenotype approaches are most used for measuirng frailty in population-based datasets (4). The Fried phenotype and accumulation of deficits approaches of measuring frailty are moderately well correlated (5). For our analysis an accumulation of deficits approach was chosen, and a new FI constructed because the analysed dataset contains questions about different aspects of health deficits.

To address the knowledge gap about the level and progress of frailty in ethnic minority groups, we constructed an FI in Understanding Society, a large population-based panel study which oversamples ethnic minorities in the UK, to make results more generalisable for the whole population. The available and used UKHLS dataset consists of 13 waves and further waves are collected in coming years.

It would be possible to create the FI starting from wave 1 or starting from wave 10. This is relevant because questionnaire content for some FI candidate items has changed and especially the questioning of the health condition items has changed in wave 10. We opted to construct the FI starting from wave 1 until wave 9 because of the higher number of respondents interviewed in wave 1 and the possibility to use more waves in a longitudinal analysis because of the change of the FI health conditions candidate items in wave 10.

The aim of this paper is to describe the construction of an FI in Understanding Society. First, the FI construction method is described using an accumulation of deficits approach. Second, the data are described including the different samples, which domains have been used for the construction of the FI and how the variables have been coded. Third, in the results section descriptive statistics are presented. Then, checks and tests are made for the different FI candidate items before including them in the final index, including:

- Missingness
- Variable that are too rare or too common
- Associations with age and sex
- Checking internal correlation of FI candidate items with each other.

In the last section it is discussed how different criteria of validity are fulfilled.

Using the method by Searle et al. (3) and an updated guideline from Theou et al. (6), an FI was constructed for respondents of age 50 and above using the UK Household Longitudinal Study dataset. The following assumptions have to be fulfilled for health deficits to fit the inclusion criteria to be part of an FI (7):

1) Included index items should measure decline across multiple organ systems. An FI typically includes items that measure symptoms, signs, health conditions, diseases, and functional limitations.
2) The health deficits should have an association with health status and should not be purely age-related or lifestyle (e.g. smoking) related. The health deficit should not be ubiquitous in the baseline collection, as for example, long-sightedness is almost universal in midlife, but increases with age. Additionally, the chosen deficits should not saturate too early to avoid ceiling effects. Reductions in health deficits are possible at advanced ages due to survivor effects. The correlation between age and the prevalence of deficits on the potential FI item candidates can be tested with Spearman’s correlation

coefficient. There must be independence between the health deficits, and their correlation has to be less than 0.95.

3) The selected health deficits should be not too rare or too common. Dichotomous health deficits should have more than 1% prevalence but should have not more than 80% prevalence. For categorical health deficits, the combined proportion of individuals with some level of the deficit should be at least 1% and the proportion of respondents with a full deficit should be no more than 80%. The FI should have a minimum of 30 deficits.
4) A health deficit should not contain too many missing values at item level. Ideally, a variable should have no more than 5% missing data. When constructing the FI for multiple waves, the 5% criterion would apply for each time point. If the dataset has not enough variables that fulfil this criterion the threshold for missing data can be increased, but this reduces the number of participants for which the FI score can be calculated with the full number of items.
5) An FI score should not be calculated for respondents who have more than 20% of the FI items missing.
6) A health deficit item must be available in the main interview at different panel waves. If the single FI is used serially on the same respondents, the items that are used for the construction of the FI need to be the same from one iteration to the next.

2 Data and Methods

2.1 Sample and Participants

Understanding Society, also called the UK Household Longitudinal Study (UKHLS) started in 2009/2010 (wave 1) with three samples: the UKHLS sample which consists of the UKHLS Great Britain and UKHLS Northern Ireland samples, also called together the UKHLS General Population Sample (GPS) and the Ethnic Minority Boost (EMB) sample. Currently 13 waves are available, and the last one was collected in 2023. The GPS started with members aged 16 plus from approximately 40,000 households at wave 1 (8,9). A key feature of the study is that it enables a better study of minority populations due to oversampling of these groups in the EMB sample added to the GPS in wave 1. The EMB sample was designed in such a way that at least 1000 respondents of each of the main ethnic minority groups (Caribbean, African, Pakistani, Indian and Bangladeshi) were interviewed in wave 1. As a second further sample addition, in wave 2 the former British Household Panel Survey (BHPS) sample members were integrated as an additional sample and their first interview was in wave 2. However, the BHPS

samples are not included in this study as they do not contain all the information needed to construct an FI. As a further third sample addition, the Immigrant and Ethnic Minority Boost (IEMB) sample was added in wave 6. This sample adds to the diversity of the study by including immigrants and all ethnic minority groups and not only the five ones in the EMB sample, and this sample is also included in our analysis.

Survey topic areas covered include socio-demographic indicators, health, work, education, income, and family characteristics. Households recruited at their first interview are visited yearly to collect information on changes to their household and individual circumstances (10). Interviews are either carried out as face-to-face or over telephone by trained interviewers, or online. For in-person interviews, most household and individual are completed during the interview, but there is also a self-completion questionnaire which is on paper for the first two waves and as a Computer Self-Assisted Interview (CASI) for subsequent waves.

The datasets are publicly available through the UK Data service at https://doi.org/10.5255/UKDA-Series-2000053 (11) (accessed on 28 June 2024). All data collections were approved by the University of Essex Ethical Committee and respondents gave informed consent. The syntax code scripts are available from the Understanding Society website (https://www.understandingsociety.ac.uk/documentation/mainstage/syntax/user-deposited-syntax/#).

2.2 FI candidate variables

Potential candidates were selected from three domains: health conditions, disabilities, health limitations with a total of 36 variables (12 in each domain). The health conditions and disabilities were part of the individual questionnaire section whereas health limitations were part of the self-completion questionnaire. A longitudinal follow up of questions permits the construction of a population-based FI that measures the level and growth of frailty over time. Respondents below age 50 are excluded. Only the first nine waves were used because the variable definitions for health conditions were changed in wave 10 for arthritis, diabetes, cancers. In addition, the separate updating information for the specific health conditions was not available in wave 10. The full list of selected variables for the FI is in the appendix, including their value labels and the corresponding numeric values (Appendix 1).

2.2.1 Health Conditions

The first domain included self-reported health conditions items (‘Has a doctor or other health professional ever told you that you have any of these conditions?’):

- asthma,
- arthritis,
- congestive heart failure,
- angina,
- heart attack or myocardial infarction,
- stroke,
- emphysema,
- chronic bronchitis,
- any liver condition,
- any malignancy or type of cancer,
- diabetes,
- hypertension or high blood pressure.

Information about the health conditions was asked in a different way for new respondents (entrants) and continuing respondents: firstly, new respondents (entrants) of all waves except in wave 2 were asked if a specific health condition exists and the age of onset. Secondly, from wave 2 until wave 9 it has been asked if new (updated) information about a certain health condition is available for continuing respondents. Thirdly, respondents were asked additional questions in wave 10 if they ever had a specific health condition and the age of onset. Additionally, health condition questionnaire items have been changed from wave 10 onwards, distinguishing different subtypes of arthritis, diabetes and malignancy/cancer.

The coding health conditions was done as follows: firstly, the information was used for a new entrant of having or not having a specific health condition. Secondly, the updating information from the following waves for the different health condition was used if a respondent reported a new specific health condition using the variable hcondn1 to hcondn16 (12): the coding was changed from not having to having this specific health condition for this specific and the following waves. Thirdly, additional information from the question to respondents from wave 10 could have been potentially used if a respondent reported ever having had a certain health condition and the age of onset. This information could potentially be used if this specific health condition was not reported in the first interview or in the updating process.

Priority was given to the information from the first interview or the updated information from a specific wave because the possibility of a recall bias exists in wave 10 and because not all respondents who enter in earlier waves reach wave 10.

One weakness of UKHLS is that no information was collected in waves 1 to 9 if a respondent with existing health conditions is still suffering from this issue in the following waves. This additional information is only collected from wave 10.

2.2.2 Health limitations

The second domain is health limitations. The different items using the information from the SF-12 in the self-completion questionnaires:

- general health,
- health limitations moderate activities,
- climbing several flights of stairs,
- physical health limitations amount of work,
- kind of work,
- health limitations mental and
- health meant accomplished less,
- mental health meant worked less carefully,
- health limitations pain interfered with work,
- felt calm and peaceful, having energy,
- downhearted and depressed,
- physical or mental health interfered with social life.

Questions for the domain health limitations have also been changed in the mode of how these items have been collected. In the first wave the mode for this domain was face-to-face, but from wave 2 onward this changed to self-completion. Information is available if the respondent had also agreed to self-completion for the SF-12 module or if the interview mode was telephone or web. One item of the health limitation domain (general health) was asked in parallel for wave 2 to 5 using the face-to-face mode (by the interviewer) and also using as an alternative the self-completion mode. The values for the item general health in the face-to-face mode and the self-completion mode were compared with each other (see Appendix 5). Both values of the general health items have been relatively similar. Therefore, for the item general health the values from the self-completion responses for the waves 2 to 5 have been chosen. For waves 6 onwards values have been combined from both modes of item responses according to the documentation (https://www.understandingsociety.ac.uk/documentation/mainstage/variables/sf1/): if the item general health was not missing preference was given to the self-completion mode values. If missing values for the self-completion mode existed these values were replaced by the face-to-

face mode values (for example, relevant in the case if the interview was done via proxy respondents).

2.2.3 Disabilities

The third domain are disabilities or difficulties (limitations) in 12 activities of daily living (ADL) with a reported presence or absence: namely

- mobility with moving around at home and walking,
- lifting, carrying or moving objects,
- manual dexterity,
- continence,
- hearing apart from using a standard hearing aid,
- sight apart from wearing standard glasses,
- communication or speech problems,
- memory or ability to concentrate, learn or understand,
- recognising when are in physical danger,
- physical co-ordination,
- difficulties with own personal care,
- other health problem or disability.

Items in the domain disabilities and difficulties have changed with respect to routing over waves. A filter question was used from wave 1 to wave 7: ‘Has (the respondent) a long-standing illness or disability‘ and only if answered with ‘Yes‘ the following 12 different disabilities and difficulties were asked (‘Does this/Do these health problem(s) or disability(ies) mean that you have substantial difficulties with any of the following areas of your life?’). Beginning from wave 8 the filter question for the disabilities and difficulties questions was removed in order to capture people who may have one of the conditions listed but answered ‘No‘ to the filter question.

One of the assumptions for using a single FI over time is that the items need to be the same or similar from one wave to the next wave. Leaving out the filter question from wave 8 onward could potentially violate this assumption. However, the frequencies of disabilities and difficulties increase only slightly for the waves 8 and 9 in comparison to previous waves (see Appendix 4).

Indicators of health status such as the General Health Questionnaire (GHQ) have been excluded from the FI calculation because the content of the GHQ questionnaire has substantial overlap with the SF12 questionnaire.

2.3 Coding and frailty categorisation

Each item with a binary coding is given a score between 0 and 1: 0 means that no deficit is present and 1 means the presence of a deficit. Ordinal variables with three levels were assigned to three levels (0, 0.5, 1) and ordinal variables with five ordinal levels were assigned to five levels (0, 0.25, 0.5, 0.75 or 1) to reflect differences.

Independence of FI candidates and potential exclusions were examined by analysing by item pair correlations using Spearman's rank correlation coefficients. Also, the association of the FI candidates with age was analysed. At each wave, the FI score for each participant is calculated as the sum of deficits present divided by the total number of deficits considered (3,6): FI score for one respondent in a certain wave=sum of 36 deficits for a person in a certain wave/36 if there were no answers on deficits missing. Descriptive statistics have been calculated for how many FI items are missing. FI scores were calculated for cases in which information for all of the FI items were available (complete case) and will be compared for cases with missing and imputed data (13). For each interview wave the FI score calculation is repeated.

FI scores can be compared either by using the mean FI scores or the proportion of respondents in different FI categories. For the categorisation of FI scores the following three categories have been chosen non-frail (FI =< 0.08), pre-frail (0.08 < FI < 0.25, frail (0.25 =< FI =< 1.00) (3–5,14).

2.4 Statistical analyses

The newly constructed FI was tested for a positive association with age, a right-skewed frequency gamma distribution and higher mean FI scores for women than men (15). The proportion of FI scores should be less than 0.7 for at least 99% of the sample (6). The distribution of the constructed FI was analysed cross-sectionally and was then analysed longitudinally for the relationship between the constructed FI and cohort age (age at panel entry) and wave (ageing over time). The longitudinal analysis was done for unbalanced panels and balanced panels. In an unbalanced panel not every respondent has to be in every wave (e.g. caused by late entry, dropouts or death), whereas in a balanced panel every respondent is present in every wave. Mean FI scores for respondents with an age ≥50 in 2010 were calculated without transformation. Non-linear trends of higher FI values with increasing age have been observed previously in both cross-sectional and longitudinal samples (16). For this reason, it was

analysed using fractional polynomials if a non-linear association of the FI with age existed (12). The rate of accumulated deficits can be calculated by analysing the slope of the natural logarithm of the FI score and age (3) and FI scores should increase with a rate of approximately 0.02 to 0.03 per year and this is also be tested.

3 Results

3.1 Descriptive statistics

Appendix 2 shows the sample derivation in the unbalanced panel with 9 waves with number of respondents aged 50 and older and with complete items. It shows how many respondents have entered and exited the survey. About 92.4% respondents entered in wave 1 and 7.6% in the following waves. About 46.5% respondents exited in wave 9 and 53.5% in the following waves. Appendix 3 gives the descriptive statistics of the continuous and categorical variables of the weighted sample in wave 1. Mean age was 65.3 and the standard deviation (SD) was 10.7 years. About 83.7% of respondents had an English residence, 5.0% a Welsh residence, 8.8% a Scottish residence and 2.6% a Northern Irish residence, 53.0% of the respondents were female, with 68.1% living in a partnership. About 95.5% of respondents had a white ethnicity, Indian 1.3%, Pakistani 0.5%, Bangladeshi 0.2%, Caribbean 0.7%, African 0.4%, mixed or other ethnicities 1.4%.

Appendix 4 gives the prevalence estimates of all FI items of the three domains functional disabilities or difficulties, health conditions and health limitations including the missing items from the unbalanced panel for the different nine waves. The prevalence estimate for all three domains can increase, decrease or fluctuate over time because of dropouts and new respondents who enter the panel.

3.2 Missing data

The amount of missing data in the unweighted sample for respondents with age 50 and over ranged between 0.1% and 22.7% by wave. There were recognisable patterns of missingness for the three different domains. If FI items are missing it is usually not only one item of a domain missing for a wave, but typically the whole domain. The lowest proportion of missing items for health conditions and health limitations is in wave 1 because the interviews were completed face-to-face; interviews could be also carried out by phone from wave 3 or online from wave 7. For the health conditions, there was a slight increase of missingness over the waves which happened if no updating information was available. There was a slight drop in missing data for

the domains for disabilities and health conditions from wave 5 to wave 6 because the new respondents from the IEMB sample were interviewed the first time in wave 6. Health limitations have the highest missing values in wave 2 and wave 6. The highest missing proportion of 22.7% in wave 2 for the FI item “physical health limits kind of work” can be explained by the necessity of agreement to self-completion, possible change from face-to-face to telephone interview, and an older population of age 50 and older. Respondent of the IEMB sample were not asked for health limitations in wave 6.

3.3 Checking criteria for inclusion in the final FI score

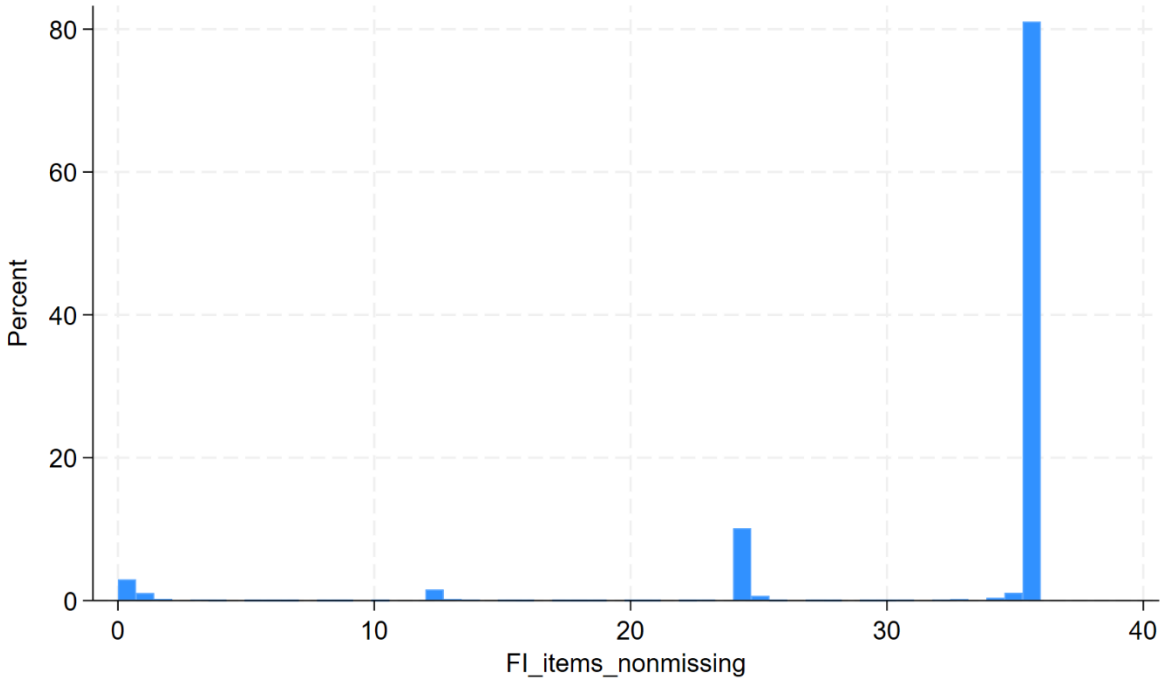
The FI items relating to the health condition asthma, and the health limitations feeling calm and peaceful, feeling downhearted and depressed have a negative association with age: for asthma -0.06, for the health limitation feeling calm -0.10 and for feeling downhearted and depressed -0.08. These FI items have been included in the constructed FI because similar items have already be included in validated FI indices as for the health condition asthma (17) and both health limitations FI items are related to psychological wellbeing such as feeling depressed or sadness (18).

Table E1 gives the Spearman’s rank correlation coefficients for the FI candidates for all waves. The highest Spearman correlation coefficient between-items was 0.86 (FI items health limitations work and health limitations kind of work). This is still below the value of 0.95 which is recommended for exclusion if the correlation between FI items exceeds this value. Therefore, no potential items were excluded according to the recommendation of Theou et al. (6).

3.4 Descriptive statistics of the FI score

Figure 1 gives the pattern of missing data for the FI items. About 81.0% of the respondents have complete information for all 36 items. About 10.1% of the respondents had 12 FI items missing, 1.5% 24 items missing and 3.0% all 36 items missing. If the information is only available from two domains there is an unsteady behaviour (increase or decrease) of the FI score. For example, the domain health limitations was not asked in wave 6 for respondents of the IEMB sample and this domain was only asked for these respondents in the following waves. As a consequence, the calculated FI score shows an abrupt increase in the FI score for respondents from wave 6 to wave 7.

Figure 1: Number of FI items with complete information



In the following sections the results are presented for cases with complete information for all the 36 items. Figure 2 gives the distribution of the FI score if all 36 FI items are non-missing for wave 1 and the Figure 3 gives the distribution of the FI score for all 9 waves.

Figure 2: FI score with complete information from 36 items from wave 1 and age>=50

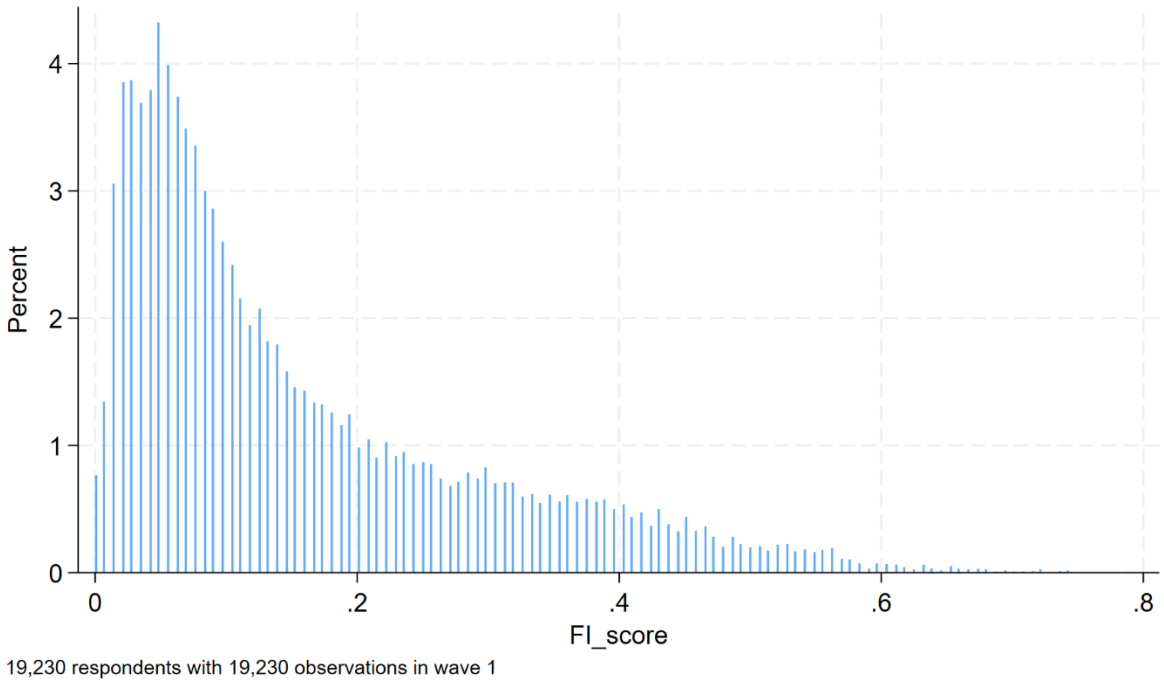


Figure 3: FI score with complete from 36 items all 9 waves and age>=50

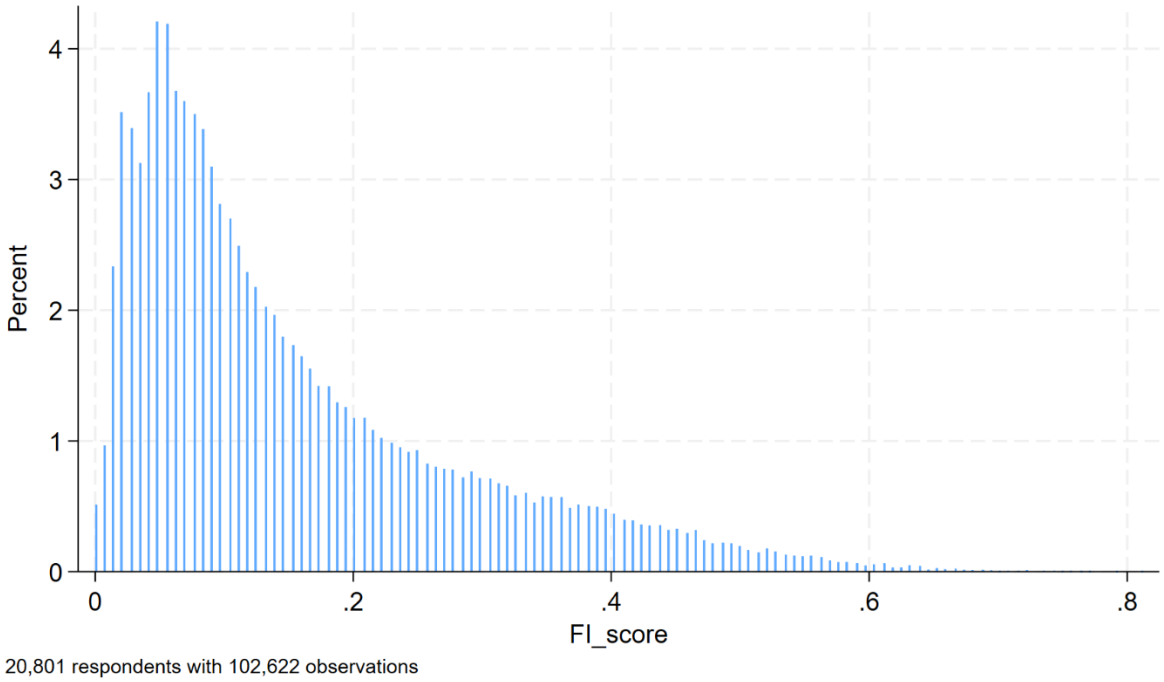


Table 1 gives the FI categories non-frail, pre-frail and frail for the three different age groups (50-64, 65-79, 80 and older). It can be seen also that the frequencies in the pre-frail and frail categories increase with age.

Table 1: FI categories in the unbalanced panel with 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%)

Data are presented as n (%). FI categories according to (19).

3.5 Association of the FI score with sex and age

Figure 4 also shows the non-linear relationship between the FI score and age using a fractional polynomial.

Figure 4: Fractional polynomial for FI and age at interview

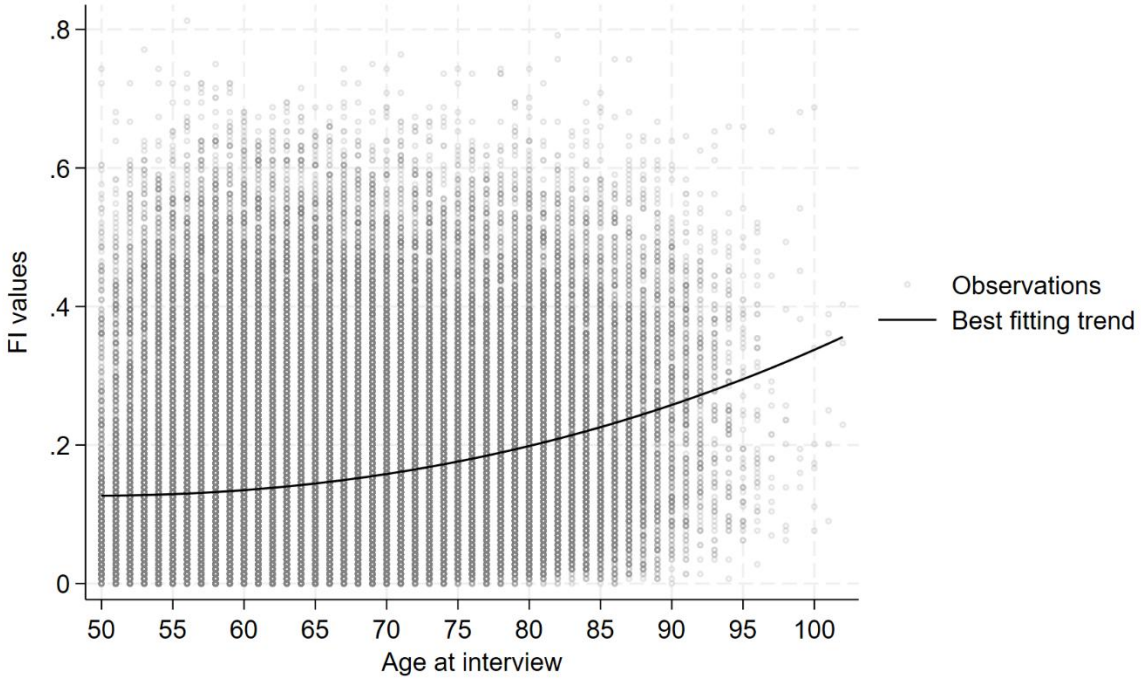


Table 2 show the mean FI score in the different waves 1 to 9.

Table 2: FI score by wave in the unbalanced panel of 9 waves

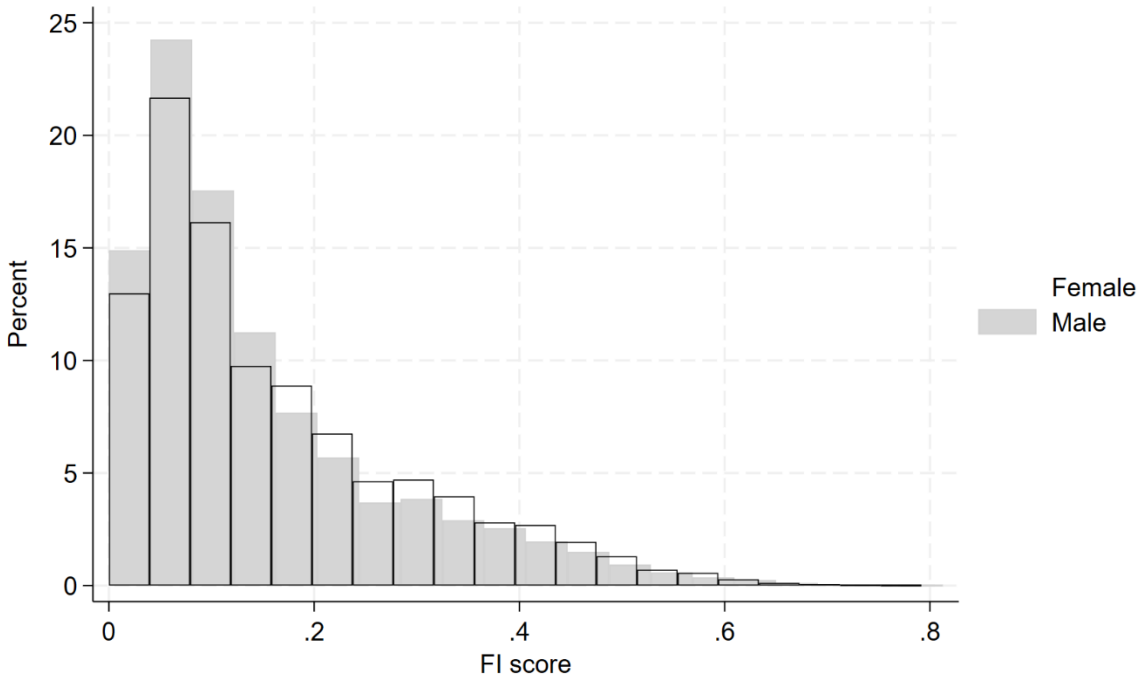
	wave = 1 N=19,230	**wave = 2 N=11,975**	**wave = 3 N=11,793**	**wave = 4 N=11,331**	**wave = 5 N=10,405**	**wave = 6 N=9,899**	**wave = 7 N=10,002**	**wave = 8 N=9,425**	**wave = 9 N=8,562**
FI score	0.16 (0.14)	0.1 5 (0.13)	0.15 (0.13)	0.15 (0.13)	0.16 (0.13)	0.15 (0.13)	0.15 (0.13)	0.16 (0.13)	0.16 (0.13)

Data are presented as mean (SD).

Figure 5 shows the distribution of the FI score by sex. Figure 6 shows the association with cohort age (age of entry in the survey) for different age categories (50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+). Figure 7 shows the mean FI scores for the unbalanced panel of 9 waves. Figure 8 shows the mean FI scores for the balanced panel of 9 waves. For the balanced panel respondents must remain in all 9 waves. There is an increase for the mean FI scores over time from wave 1 to wave 9, illustrating mean FI score increases with increasing age as expected. Therefore, new entry and attrition of respondents and selection effects have an influence on the mean FI score when the results of the unbalanced and balanced panel are compared with each

other. Figure 9 shows the mean FI scores for different cohort ages in the balanced panel of 9 waves.

Figure 5: FI score by sex in the unbalanced panel with 9 waves



The FI score increases only very slightly comparing wave 1 to 9 and fluctuates between different waves. Dropout rates can be different for respondents with low or high FI scores and attrition or selection effects can play a role and new entrants enter the survey from wave 2 to 9. For these reasons, the mean FI does not increase monotonically over wave 1 to 9 in an unbalanced panel and showing the ageing effect. To analyse further the relevance of these effects the development of the mean FI score is also analysed for the balanced panel and results are compared with the unbalanced panel.

Figure 6: FI scores for different cohort ages in the unbalanced panel

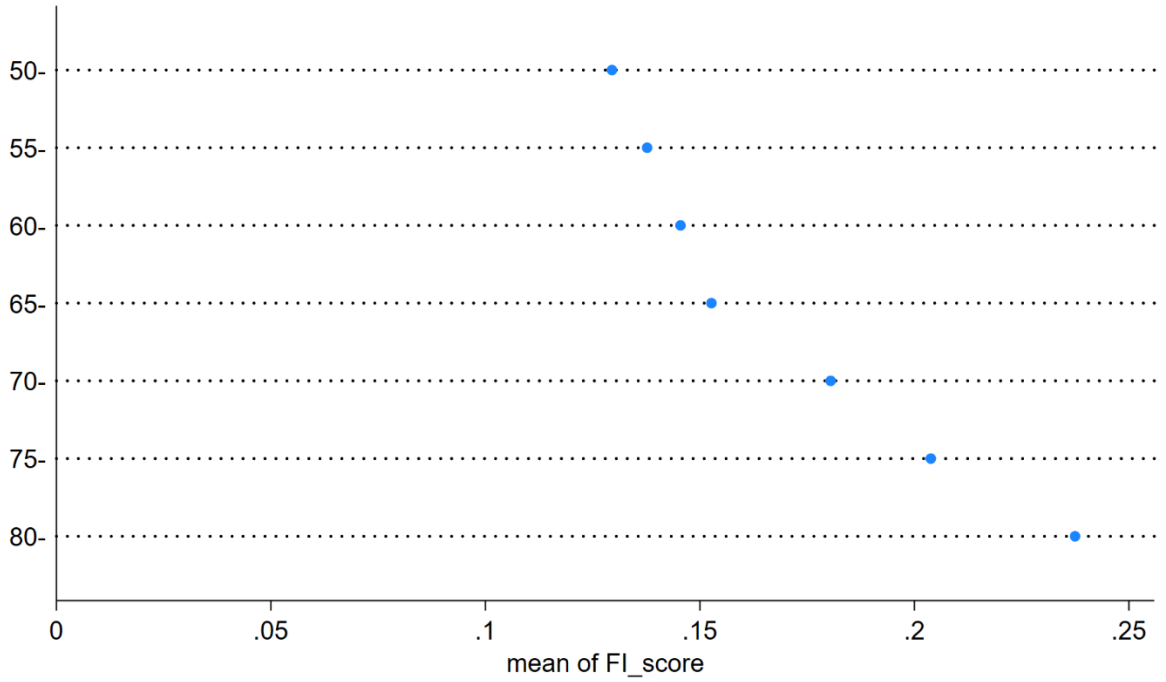


Figure 7: FI scores over waves 1-9 in the unbalanced panel

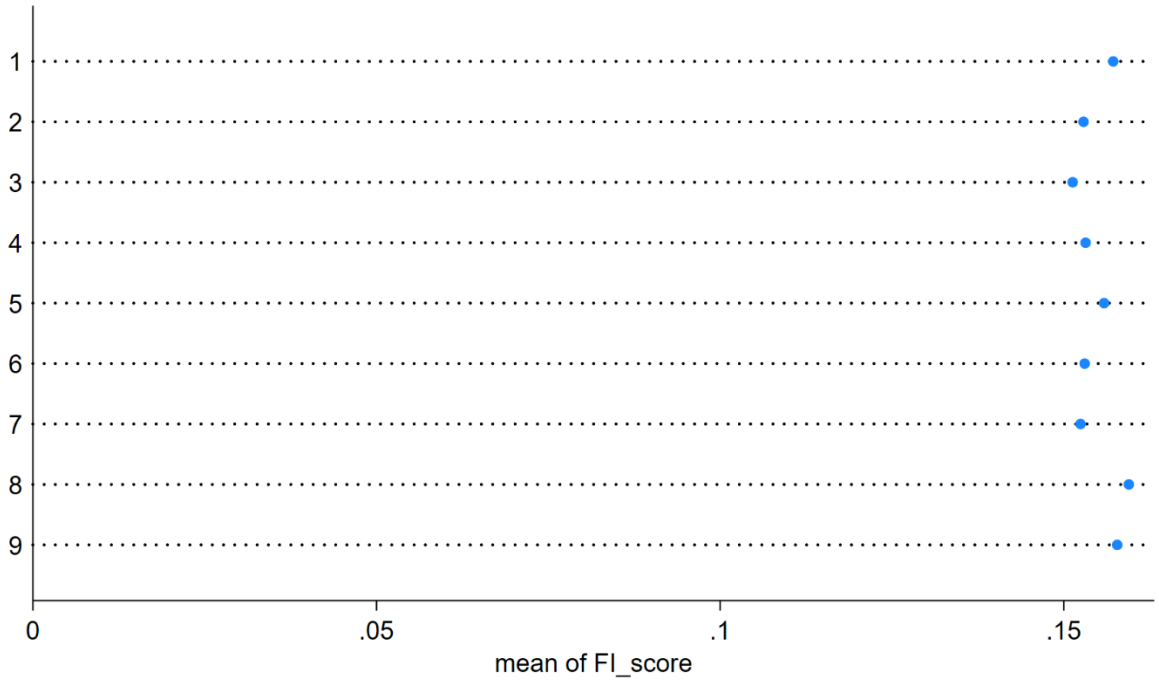


Figure 8: FI scores for every year of ageing in the balanced panel

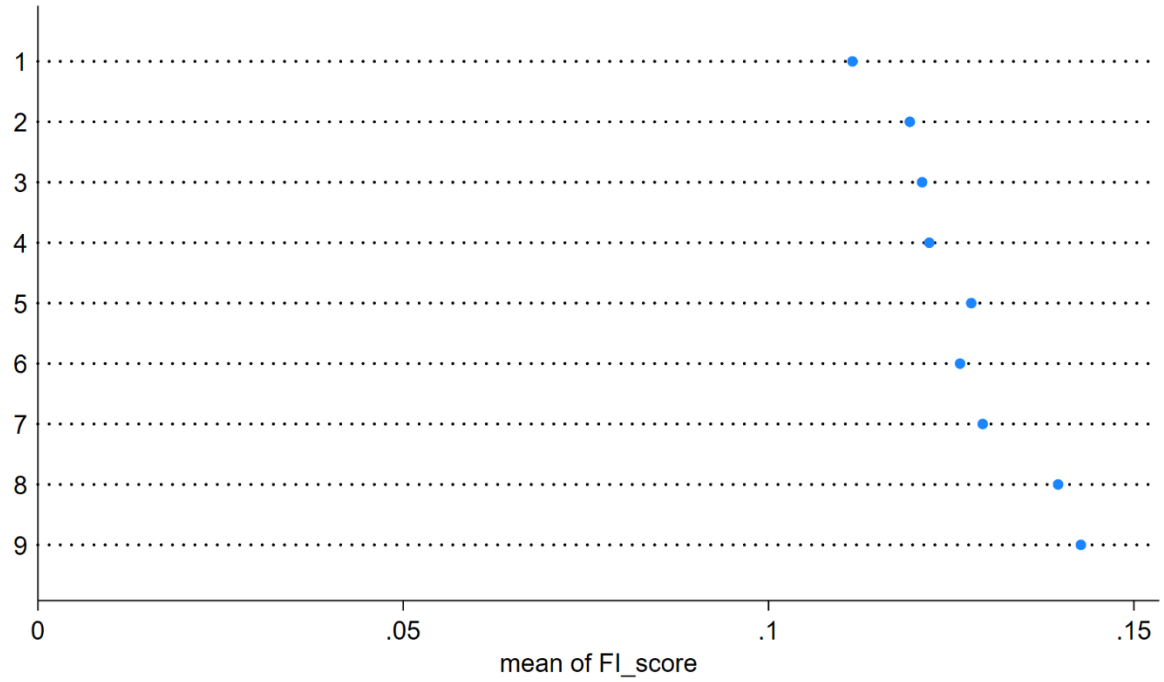
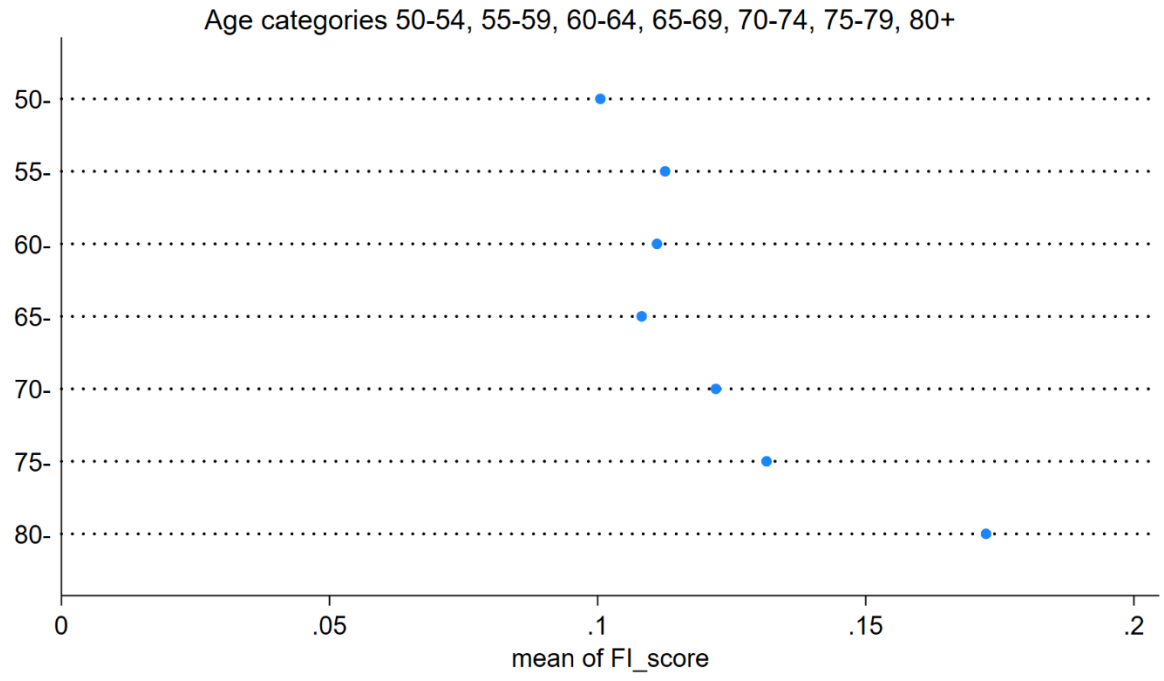


Figure 9: FI scores for different cohort age groups in the balanced panel



4 Discussion and conclusion

The constructed FI has to fulfil different aspects of validity, especially content validity, construct and criterion validity (20).

First, content validity (face validity) is fulfilled because our FI includes multiple determinants which cause frailty, and our FI score covers different organs and systems and frailty. The FI candidate items are also measured dynamically, because one characteristic of our FI is that health limitations, disabilities and difficulties are dynamically modelled over time, and they can reverse from existing to non-existing over time. One of the weaknesses of our constructed FI is that items of the domain health conditions are considered non-reversible. For the first 9 waves of the UKHLS dataset it is not possible to analyse the changes of a respondent from having a specific existing health condition to not having this specific health condition. However, most or all health conditions can be considered as chronic. A second weaknesses of the newly constructed FI is the fact that it contains no candidate FI item for a health condition which is related to a cognitive decline such as dementia. Additionally, FI items could be potentially not truly be independent from each and could be interacting with each other.

A missing domain of an FI can cause problems (21–23). Shi et al. (2017) have found that the removal of one domain out of seven domains (comorbidities, performance, cognition, physical tasks, activities of daily living (ADLs), instrumental activities of daily living (IADLs), nutrition) shifted the mean FI distribution of 0.18 to 0.13 (removing comorbidities) to 0.20 (removing ADLs) and the frailty prevalence was also shifted (FI $\geq$ .25) from 16.0% for removing comorbidities to 28.7% for removing ADLs. A missing domain can cause problems and undermine the predictive performance (22).

Second, construct validity is fulfilled because the constructed FI scores increase with an increasing starting cohort age of the respondents. The FI score increases over time in a balanced panel as the respondents become older. This is in agreement with other population-based studies for which it was also shown that age is correlated with higher FI scores (24). In contrast, this relationship is not always consistent using clinical samples (15,19). All items of the constructed FI score are self-reported items and self-reported items are typically positively correlated with being female. This explains the result in our analysis and other studies that females have higher average FI score values than men when using self-reported items for the FI construction (25). As in other population-based studies it is also found in our study that the frequency distribution of the FI is right-skewed (26). The 99^{th} percentile score is 0.55 and this is in agreement with the requirement that at least 99% should have an FI score less than 0.7 (27). The logarithm of the

FI score increases by 2.4% with one year of ageing and other population-based samples have found a range between 3% and 6% per year (15,16,28). This will also allow us to use our FI for a longitudinal analysis and to compare it with other studies.

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6 Appendix

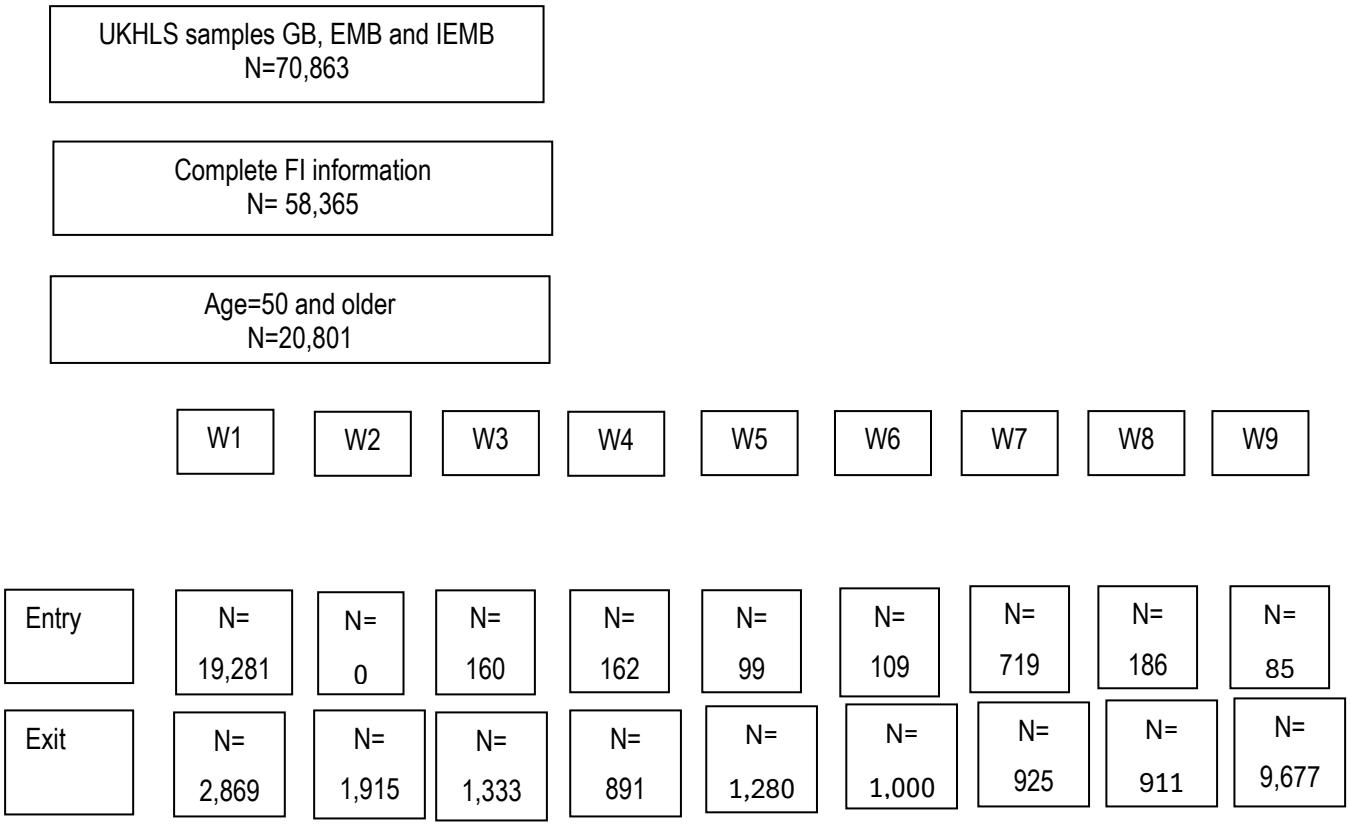
Appendix 1: Overview over included items and recoded values for the FI

Category	Item in the FI score and variables	Scaling in questionnaires	Recoding FI score
Health conditions	Angina (hcond5)	0 (not mentioned) 1 (mentioned)	0 1
	Arthritis (hcond2)	0 (not mentioned) 1 (mentioned)	0 1
	Asthma (hcond1)	0 (not mentioned) 1 (mentioned)	0 1
	(Chronic) bronchitis (hcond11)	0 (not mentioned) 1 (mentioned)	0 1
	Diabetes (hcond14)	0 (not mentioned) 1 (mentioned)	0 1
	Emphysema (hcond8)	0 (not mentioned) 1 (mentioned)	0 1
	Heart attack or myocardial infarction (hcond6)	0 (not mentioned) 1 (mentioned)	0 1
	Congestive heart failure (hcond3)	0 (not mentioned) 1 (mentioned)	0 1
	Hypertension/high blood pressure (hcond16)	0 (not mentioned) 1 (mentioned)	0 1
	Any kind of liver condition (hcond12)	0 (not mentioned) 1 (mentioned)	0 1
	Malignancy or cancer (hcond13)	0 (not mentioned) 1 (mentioned)	0 1
	Stroke (hcond7)	0 (not mentioned) 1 (mentioned)	0 1
Functional	Mobility (moving around at home and walking) (disdif1)	0 (not mentioned) 1 (mentioned)	0 1
	Lifting, carrying or moving objects (disdif2)	0 (not mentioned) 1 (mentioned)	0 1
	Manual dexterity (using hands to carry out everyday tasks) (disdif3)	0 (not mentioned) 1 (mentioned)	0 1
	Continence (bladder and bowel control) (disdif4)	0 (not mentioned) 1 (mentioned)	0 1

	Hearing (apart from using a standard hearing aid) (disdif5)	0 (not mentioned) 1 (mentioned)	0 1
	Sight (apart from wearing standard glasses) (disdif6)	0 (not mentioned) 1 (mentioned)	0 1
	Communication or speech problems (disdif7)	0 (not mentioned) 1 (mentioned)	0 1
	Memory or ability to concentrate, learn or understand (disdif8)	0 (not mentioned) 1 (mentioned)	0 1
	Recognising when you are in physical danger (disdif9)	0 (not mentioned) 1 (mentioned)	0 1
	Your physical co-ordination (e.g. balance) (disdif10)	0 (not mentioned) 1 (mentioned)	0 1
	Difficulties with own personal care (disdif11)	0 (not mentioned) 1 (mentioned)	0 1
	Other health problem or disability (disdif12)	0 (not mentioned) 1 (mentioned)	0 1
SF12 Variables	General health (sf1 and scsf1)	1 (Excellent) 2 (Very good) 3 (good) 4 (Fair) 5 (Poor)	0 0.25 0.5 0.75 1
	Health limits moderate activities (sf2a and scsf2a)	1 (Yes, limited a lot) 2 (Yes, limited a little) 3 (No, not limited at all)	1 0.5 0
	Health limits several flights of stairs (sf2b and scsf2b)	1 (Yes, limited a lot) 2 (Yes, limited a little) 3 (No, not limited at all)	1 0.5 0
	Last 4 weeks: Physical health limits amount of work (sf3a and scsf3a)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	1 0.75 0.5 0.25 0
	Last 4 weeks: Physical health limits kind of work (sf3b and scsf3b)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	1 0.75 0.5 0.25 0
	Last 4 weeks: Mental health meant accomplished less (sf4a and scsf4a)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time)	1 0.75 0.5 0.25

		5 (None of the time)	0
	Last 4 weeks: Mental health meant worked less carefully (sf4b and scsf4b)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	1 0.75 0.5 0.25 0
	Last 4 weeks: Pain interfered with work (sf5 and scsf5)	1 (Not at all) 2 (A little bit) 3 (Moderately) 4 (Quite a bit) 5 (Extremely)	0 0.25 0.5 0.75 1.0
	Last 4 weeks: Felt calm and peaceful (sf6a and scsf6a)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	0 0.25 0.5 0.75 1.0
	Last 4 weeks: Had a lot of energy (sf6b and scsf6b)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	0 0.25 0.5 0.75 1.0
	Last 4 weeks: Felt downhearted and depressed (sf6c and scsf6c)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	1 0.75 0.5 0.25 0
	Last 4 weeks: Physical or mental health interfered with social life (sf7 and scsf7)	1 (All of the time) 2 (Most of the time) 3 (Some of the time) 4 (A little of the time) 5 (None of the time)	1 0.75 0.5 0.25 0

Appendix 2: Flow chart and sample derivation in the unbalanced panel with 9 waves



30

Appendix 3: Descriptive statistics of continuous and categorial variables in the unbalanced panel with 9 waves: weighted frequencies from new entrants 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%)
Highest level education				
None of the above	3,646 (34.8%)	3,812 (56.9%)	1,676 (68.9%)	9,134 (46.6%)
University/higher edu.	3,146 (30.0%)	1,308 (19.5%)	322 (13.2%)	4,775 (24.4%)
A-levels	759 (7.2%)	253 (3.8%)	61 (2.5%)	1,073 (5.5%)
O-levels	2,914 (27.8%)	1,318 (19.7%)	371 (15.2%)	4,603 (23.5%)
Missing	5 (0.0%)	3 (0.0%)	4 (0.2%)	12 (0.1%)
Partnership status				
No partnership	2,546 (24.3%)	2,114 (31.6%)	1,590 (65.3%)	6,249 (31.9%)
Partnership	7,922 (75.7%)	4,580 (68.4%)	843 (34.6%)	13,345 (68.1%)
Missing	2 (0.0%)	0 (0.0%)	1 (0.0%)	3 (0.0%)
Residence				
urban area	7,483 (71.5%)	4,689 (70.0%)	1,760 (72.3%)	13,932 (71.1%)
rural area	2,987 (28.5%)	2,005 (30.0%)	673 (27.7%)	5,666 (28.9%)
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%)

Continuous variables are presented as mean (SD) and categorical variables are presented as n (%).

Appendix 4: Descriptive statistics of FI candidates by wave in the unbalanced panel including missing FI items

	wave = 1 N=50,994	wave = 2 N=42,533	wave = 3 N=38,327	wave = 4 N=36,511	wave = 5 N=34,762	wave = 6 N=35,772	wave = 7 N=33,091	wave = 8 N=30,646	wave = 9 N=27,897
Mobility (moving around at home and walking)									
0	81.5%	80.6%	80.4%	79.5%	79.3%	81.3%	88.8%	87.0%	87.1%
1	12.1%	11.3%	11.1%	11.3%	11.1%	10.7%	11.2%	12.7%	12.6%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Lifting, carrying or moving objects									
0	79.1%	79.5%	79.7%	78.8%	78.9%	81.8%	89.0%	87.2%	86.8%
1	14.5%	12.5%	11.8%	12.0%	11.5%	10.2%	10.9%	12.6%	12.9%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Manual dexterity (using your hands to carry out everyday tasks)									
0	88.4%	87.1%	86.9%	86.0%	85.9%	87.9%	95.3%	94.5%	94.7%
1	5.2%	4.8%	4.6%	4.8%	4.5%	4.1%	4.6%	5.2%	5.0%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Continence (bladder and bowel control)									
0	90.4%	88.8%	88.7%	87.7%	87.3%	89.5%	97.1%	96.0%	95.4%
1	3.2%	3.1%	2.8%	3.1%	3.1%	2.5%	2.9%	3.8%	4.3%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Hearing (apart from using a standard hearing aid)									
0	90.4%	89.3%	88.9%	88.3%	87.9%	89.4%	97.6%	96.6%	96.5%
1	3.2%	2.6%	2.7%	2.5%	2.5%	2.5%	2.4%	3.2%	3.3%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Sight (apart from wearing standard glasses)									
0	90.8%	89.5%	89.1%	88.4%	88.0%	89.7%	97.5%	96.8%	96.7%
1	2.8%	2.5%	2.4%	2.3%	2.4%	2.3%	2.4%	3.0%	3.1%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Communication or speech problems									
0	92.4%	91.0%	90.5%	89.8%	89.5%	91.0%	98.6%	98.4%	98.4%
1	1.2%	1.0%	1.0%	0.9%	0.9%	1.0%	1.3%	1.3%	1.3%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Memory or ability to concentrate, learn or understand									
0	88.6%	87.9%	87.3%	86.6%	86.1%	88.3%	95.4%	94.9%	94.6%
1	5.0%	4.0%	4.2%	4.2%	4.3%	3.7%	4.5%	4.8%	5.1%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Recognising when you are in physical danger									
0	92.8%	91.2%	90.8%	90.0%	89.7%	91.3%	99.2%	99.0%	98.9%
1	0.8%	0.7%	0.7%	0.8%	0.7%	0.7%	0.8%	0.8%	0.8%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Your physical co-ordination (e.g. balance)									
0	89.0%	87.7%	87.5%	86.2%	85.9%	88.2%	95.7%	95.2%	95.1%
1	4.6%	4.2%	4.0%	4.6%	4.5%	3.8%	4.2%	4.6%	4.6%

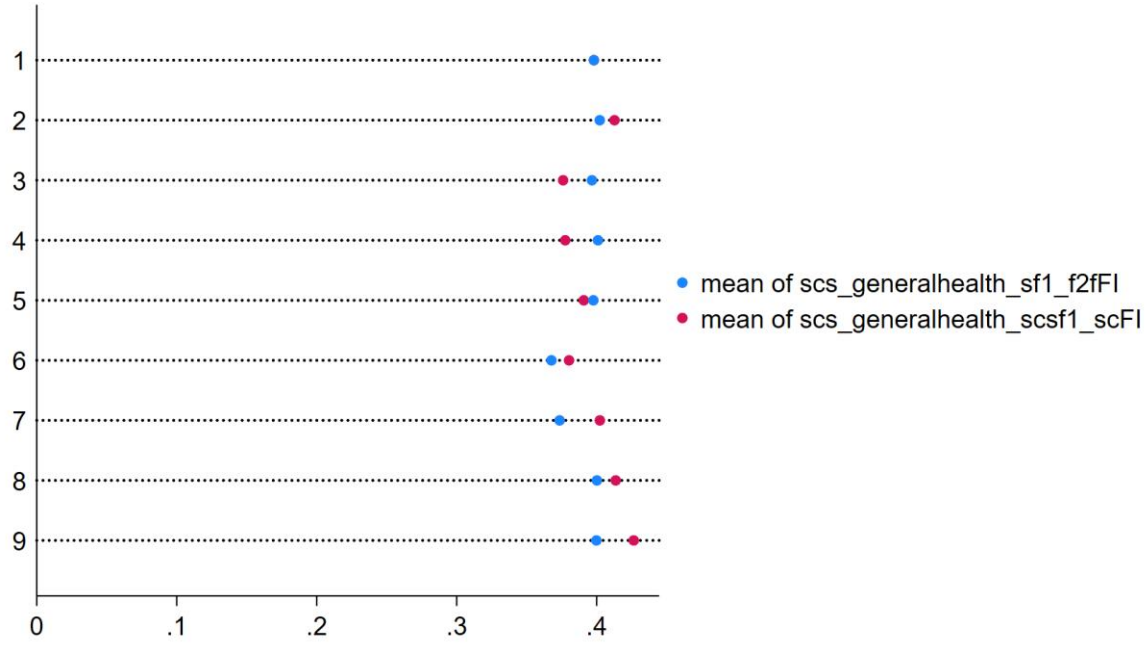
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Difficulties with own personal care									
0	90.0%	88.7%	88.7%	87.7%	87.5%	89.5%	96.7%	96.4%	96.4%
1	3.6%	3.3%	2.8%	3.1%	2.9%	2.5%	3.3%	3.4%	3.3%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Other health problem or disability									
0	88.3%	86.8%	86.7%	85.7%	85.3%	86.3%	94.1%	92.2%	91.4%
1	5.3%	5.2%	4.8%	5.1%	5.1%	5.7%	5.9%	7.6%	8.3%
Missing	6.4%	8.1%	8.5%	9.2%	9.6%	8.0%	0.1%	0.3%	0.3%
Angina									
0	90.7%	80.6%	81.6%	80.8%	80.7%	82.9%	83.4%	85.3%	86.3%
1	2.7%	2.7%	2.7%	2.5%	2.3%	2.1%	2.0%	1.9%	1.9%
Missing	6.6%	16.7%	15.8%	16.7%	17.1%	15.0%	14.6%	12.8%	11.8%
Arthritis									
0	80.1%	69.4%	70.6%	70.2%	70.2%	73.1%	73.9%	75.2%	75.9%
1	13.3%	14.1%	13.8%	13.3%	13.0%	12.1%	11.8%	12.1%	12.4%
Missing	6.6%	16.6%	15.6%	16.5%	16.9%	14.8%	14.4%	12.7%	11.7%
Asthma									
0	81.1%	71.7%	72.3%	71.6%	71.3%	73.9%	74.1%	75.5%	76.2%
1	12.3%	11.8%	12.2%	12.1%	12.0%	11.4%	11.6%	11.8%	12.2%
Missing	6.6%	16.5%	15.4%	16.3%	16.7%	14.7%	14.3%	12.7%	11.6%
Bronchitis									
0	91.5%	81.3%	82.3%	81.5%	81.2%	83.5%	84.0%	85.8%	86.8%
1	1.9%	1.9%	1.9%	1.7%	1.6%	1.4%	1.3%	1.3%	1.4%
Missing	6.6%	16.7%	15.8%	16.8%	17.1%	15.1%	14.7%	12.9%	11.8%
Diabetes									
0	87.7%	77.5%	78.4%	77.7%	77.6%	79.6%	80.1%	81.8%	82.7%
1	5.6%	5.8%	5.9%	5.7%	5.5%	5.5%	5.4%	5.5%	5.6%
Missing	6.6%	16.7%	15.7%	16.6%	16.9%	14.9%	14.5%	12.7%	11.7%
Emphysema									
0	92.7%	82.5%	83.5%	82.6%	82.2%	84.4%	84.9%	86.6%	87.6%
1	0.7%	0.7%	0.7%	0.6%	0.6%	0.5%	0.5%	0.5%	0.5%
Missing	6.6%	16.8%	15.8%	16.8%	17.1%	15.1%	14.7%	12.9%	11.8%
Heart attack/MI									
0	91.3%	81.1%	82.1%	81.2%	80.9%	83.2%	83.7%	85.5%	86.5%
1	2.1%	2.2%	2.1%	2.0%	2.0%	1.8%	1.7%	1.7%	1.7%
Missing	6.6%	16.7%	15.8%	16.7%	17.1%	15.0%	14.6%	12.9%	11.8%
Congestive heart failure									
0	92.8%	82.7%	83.6%	82.7%	82.3%	84.4%	84.9%	86.7%	87.8%
1	0.5%	0.6%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%
Missing	6.6%	16.8%	15.8%	16.8%	17.2%	15.1%	14.7%	12.9%	11.8%
Hypertension									
0	75.9%	65.2%	65.1%	64.1%	63.3%	66.1%	65.7%	66.4%	66.2%
1	17.5%	18.3%	19.4%	19.6%	20.1%	19.4%	20.2%	21.1%	22.3%
Missing	6.6%	16.5%	15.4%	16.3%	16.6%	14.5%	14.2%	12.5%	11.5%
Liver condition									
0	92.2%	81.9%	82.9%	82.0%	81.6%	83.8%	84.2%	85.9%	87.0%
1	1.2%	1.3%	1.3%	1.2%	1.2%	1.1%	1.2%	1.2%	1.2%
Missing	6.6%	16.8%	15.8%	16.8%	17.2%	15.1%	14.6%	12.9%	11.8%
Malignancy/cancer									
0	90.2%	79.7%	80.6%	79.7%	79.4%	81.6%	82.1%	83.8%	84.7%
1	3.2%	3.6%	3.6%	3.6%	3.5%	3.3%	3.3%	3.4%	3.5%
Missing	6.6%	16.7%	15.8%	16.7%	17.1%	15.1%	14.6%	12.8%	11.8%
Stroke									
0	91.7%	81.5%	82.5%	81.7%	81.4%	83.6%	84.1%	85.9%	87.0%
1	1.7%	1.8%	1.7%	1.5%	1.5%	1.4%	1.3%	1.3%	1.2%
Missing	6.6%	16.8%	15.8%	16.7%	17.1%	15.1%	14.6%	12.8%	11.8%
General health									
0	18.8%	10.5%	15.5%	15.6%	13.9%	16.3%	12.9%	12.3%	10.6%
.25	31.9%	26.9%	28.5%	29.9%	28.6%	30.6%	31.2%	31.2%	30.8%

.5	27.5%	26.3%	21.8%	21.2%	23.4%	24.3%	27.5%	29.5%	31.6%
.75	14.3%	11.3%	11.0%	11.4%	11.5%	11.3%	12.6%	13.4%	14.3%
1	7.2%	4.1%	4.1%	4.6%	4.5%	4.8%	4.7%	5.2%	5.3%
Missing	0.2%	20.8%	19.0%	17.2%	18.2%	12.8%	11.0%	8.4%	7.4%
Health limitations moderate activities									
0	74.6%	55.8%	60.0%	60.2%	58.5%	53.9%	65.2%	67.0%	68.4%
.5	10.8%	15.4%	14.4%	15.1%	15.4%	15.3%	15.6%	16.1%	16.0%
1	8.1%	7.6%	6.5%	7.5%	7.9%	6.9%	8.1%	8.4%	7.9%
Missing	6.6%	21.2%	19.1%	17.3%	18.3%	23.9%	11.2%	8.6%	7.7%
Health limitations climbing several flights of stairs									
0	70.3%	52.4%	57.4%	59.7%	58.3%	53.4%	62.6%	63.4%	63.8%
.5	13.1%	14.9%	15.5%	14.6%	15.1%	15.0%	17.0%	18.0%	18.6%
1	9.9%	8.5%	8.0%	8.4%	8.4%	7.7%	9.0%	9.8%	9.6%
Missing	6.6%	24.2%	19.1%	17.3%	18.3%	23.9%	11.4%	8.8%	7.9%
Physical health limitations amount of work									
0	59.2%	45.4%	47.2%	47.2%	45.2%	42.3%	51.4%	52.1%	53.1%
.25	10.6%	13.9%	14.7%	15.5%	15.9%	14.6%	14.5%	14.9%	15.5%
.5	12.4%	10.9%	10.8%	11.4%	11.8%	11.1%	12.8%	13.6%	13.2%
.75	6.7%	5.1%	5.2%	5.1%	5.3%	5.3%	6.3%	6.4%	6.2%
1	4.4%	3.4%	3.0%	3.4%	3.5%	2.8%	3.8%	4.2%	4.1%
Missing	6.6%	21.3%	19.1%	17.3%	18.3%	23.9%	11.2%	8.7%	7.9%
Physical health limitations kind of work									
0	62.7%	46.6%	49.5%	51.8%	49.8%	46.3%	55.0%	55.5%	56.5%
.25	10.0%	12.1%	13.7%	13.6%	14.0%	13.0%	13.2%	13.8%	14.1%
.5	10.4%	9.2%	10.1%	9.7%	10.1%	9.7%	11.4%	12.0%	11.8%
.75	6.0%	4.3%	4.6%	4.2%	4.4%	4.2%	5.2%	5.5%	5.4%
1	4.4%	3.3%	2.9%	3.5%	3.4%	2.8%	4.0%	4.3%	4.2%
Missing	6.6%	24.6%	19.1%	17.3%	18.3%	24.0%	11.2%	8.8%	8.0%
Health limitations mental health meant accomplished less									
0	65.6%	49.7%	50.4%	52.0%	49.4%	46.6%	54.5%	55.6%	56.2%
.25	11.5%	14.4%	15.6%	15.1%	16.2%	15.0%	15.6%	15.9%	16.0%
.5	10.2%	9.5%	9.8%	9.9%	10.6%	9.4%	11.6%	12.2%	12.3%
.75	4.3%	3.4%	3.4%	3.8%	3.7%	3.5%	4.8%	4.9%	4.8%
1	1.7%	1.6%	1.6%	1.9%	1.8%	1.6%	2.3%	2.5%	2.7%
Missing	6.7%	21.4%	19.1%	17.3%	18.3%	23.9%	11.2%	8.8%	7.9%
Health limitations mental health meant worked less carefully									
0	69.2%	50.4%	49.4%	54.1%	51.6%	49.2%	58.0%	58.9%	60.1%
.25	10.9%	13.7%	17.9%	15.6%	16.6%	14.8%	14.6%	15.1%	14.9%
.5	8.6%	8.1%	9.5%	8.9%	9.4%	8.3%	10.3%	11.0%	10.9%
.75	3.3%	2.5%	2.9%	2.7%	2.7%	2.7%	3.9%	3.9%	3.8%
1	1.2%	1.2%	1.1%	1.3%	1.3%	1.0%	1.9%	2.2%	2.3%
Missing	6.7%	24.1%	19.2%	17.3%	18.4%	24.0%	11.3%	8.9%	8.0%
Health limitations pain interfered with work									
0	55.4%	45.0%	44.7%	45.7%	44.5%	41.2%	47.6%	48.9%	49.4%
.25	17.7%	17.9%	18.2%	19.3%	19.7%	19.8%	23.9%	24.9%	25.3%
.5	7.8%	6.2%	7.0%	7.1%	7.1%	6.3%	8.1%	8.1%	8.3%
.75	8.2%	7.1%	6.8%	7.0%	6.7%	6.4%	6.7%	6.9%	6.7%
1	4.2%	2.7%	4.1%	3.5%	3.7%	2.4%	2.6%	2.7%	2.7%
Missing	6.6%	21.1%	19.1%	17.3%	18.3%	23.9%	11.1%	8.6%	7.7%
Health limitations felt calm and peaceful									
0	11.6%	5.7%	6.2%	6.4%	5.8%	5.8%	8.7%	9.2%	8.9%

.25	43.1%	40.4%	37.9%	38.9%	37.9%	37.6%	42.3%	42.4%	43.0%
.5	24.4%	22.5%	24.2%	24.6%	25.3%	21.4%	24.4%	25.7%	25.6%
.75	9.5%	8.1%	9.7%	10.0%	10.0%	8.6%	10.0%	10.3%	11.0%
1	4.8%	2.1%	2.9%	2.8%	2.6%	2.7%	3.5%	3.6%	3.7%
Missing	6.6%	21.0%	19.2%	17.3%	18.4%	23.9%	11.1%	8.7%	7.8%
Health limitations having energy									
0	8.9%	4.6%	5.0%	4.5%	3.9%	3.6%	5.4%	5.8%	5.0%
.25	35.6%	33.6%	34.3%	34.0%	33.2%	31.9%	34.4%	33.6%	33.9%
.5	28.9%	25.7%	26.2%	28.0%	28.2%	25.4%	29.2%	30.9%	31.0%
.75	12.5%	10.7%	11.3%	11.5%	11.6%	10.7%	13.7%	14.5%	15.0%
1	7.4%	4.2%	4.2%	4.7%	4.7%	4.4%	6.1%	6.5%	7.2%
Missing	6.7%	21.2%	19.2%	17.3%	18.4%	23.9%	11.1%	8.7%	7.8%
Health limitations felt downhearted and depressed									
0	45.1%	31.3%	31.6%	33.4%	31.3%	32.6%	36.2%	36.7%	35.5%
.25	26.3%	26.7%	27.3%	26.7%	28.2%	24.6%	27.3%	28.0%	29.0%
.5	15.3%	15.3%	16.1%	16.3%	16.2%	13.7%	17.6%	18.2%	19.2%
.75	5.1%	4.2%	4.5%	4.8%	4.6%	4.1%	5.8%	6.2%	6.4%
1	1.6%	1.4%	1.3%	1.4%	1.3%	1.0%	1.9%	2.2%	2.1%
Missing	6.6%	21.2%	19.1%	17.3%	18.4%	23.9%	11.1%	8.7%	7.9%
Health limitations physical/mental health interfered with social life									
0	65.2%	49.3%	50.4%	51.9%	50.3%	48.1%	52.3%	52.5%	53.4%
.25	11.1%	13.4%	14.1%	13.9%	14.3%	13.0%	15.6%	16.6%	16.7%
.5	9.6%	10.2%	10.5%	10.8%	10.7%	9.8%	13.2%	14.0%	13.7%
.75	4.8%	4.0%	3.8%	4.0%	4.2%	3.5%	5.0%	5.2%	5.3%
1	2.6%	2.1%	2.0%	2.1%	2.2%	1.7%	2.8%	3.1%	3.1%
Missing	6.7%	21.1%	19.2%	17.3%	18.4%	24.0%	11.1%	8.6%	7.7%

Data are presented as %.

Appendix 5: FI item score general face-to-face vs self-completion



https://www.understandingsociety.ac.uk/documentation/mainstage/dataset-documentation/variable/sf1 + scsf1 and variable note