Assessment of Long-Term Frailty Trajectories: Evidence from the Nurses' Health Study

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Background

Frailty is a dynamic characteristic, yet the literature on long-term frailty trajectories is limited.

Longitudinal studies of frailty are challenging due to data requirements (large sample size and consistent frailty assessments) as well as methodological challenges. Key methodological challenges include **handling of missing data** and **consideration of truncation due to mortality during follow-up**.

Objectives

1. Construct a frailty index (FI) in the Nurses' Health Study (NHS) to enable robust longitudinal frailty research
2. Characterize decades long changes in frailty status in the NHS from 1992 – 2016 using methods that **appropriately handle mortality** and **account for missing data**
3. Determine whether baseline frailty characteristics define subgroups with different long-term FI trajectories

Methods

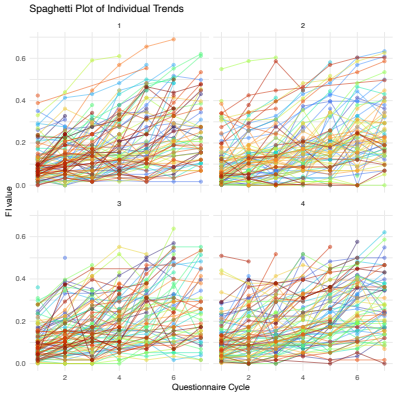
We constructed a 29-item FI using deficits related to health status and function, weight, mood and memory, geriatric syndromes, and diagnoses.

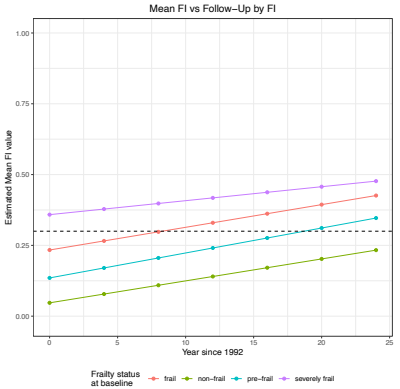
Our outcome models were **partly conditional on death** to account for mortality (GEE models, independence working correlation structure) with a linear term for year.

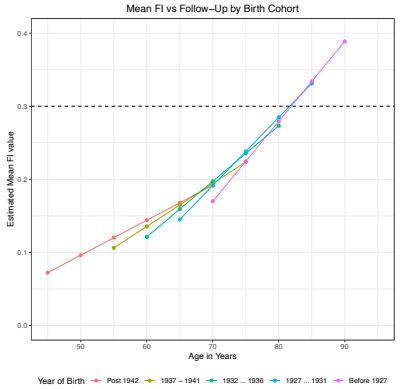
Prior to mortality, **missing data were handled via two-stage multiple imputation** to address missing FI deficits in years where a survey was returned (stage 1) and missing FI values (stage 2) in years where no survey data were available. Study attrition was addressed via inverse probability of censoring weights.

Models were stratified by baseline frailty and birth cohort. Among those non-frail at baseline, we stratified and presence vs absence of deficits in each domain to assess whether domain of deficit was predictive of FI trajectories.

Results







89,312 female nurses with mean age 58.8 [range: 46 - 71] at baseline were included.

Mean FI increased by 0.007 annually in the population, although individuals exhibited heterogenous trajectories (Figure 1).

The group that was **prefrail at baseline demonstrated the most rapid FI increase** (0.0085 per year). Moderately and severely frail individuals demonstrated the slowest increase (0.0048 per year) (Figure 2).

Trajectories differed by birth cohort. At similar ages, **younger birth cohorts were slightly more frail**, although **FI increase was more rapid in older birth cohorts.** At older ages, all birth cohorts were similarly frail.

Trajectories did not differ based on presence vs absence of deficits in specific domains among both robust and pre-frail individuals.

Conclusions

In the Nurses' Health Study, FI values increased steaily from 1992 – 2016.

Prefrail individuals had the most rapid FI increase, andmay represent a particularly vulnerable group in terms of deterioration in frailty status.

No single domain was predictive of rapid FI increase.

Differences in life course risk factors for frailty, as well as differences in frailty risk by age, may drive differences in FI trajectories by birth cohort. Future work using age-period-cohort models may be appropriate to disentangle these effects.

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