

Chapter 10

Physical Function and Activity

INTRODUCTION

The questions asked in the 2nd examination are the same as those asked during the baseline examination so that the two examinations will be comparable and so it will be possible to calculate changes in the responses between the two assessments.

Furthermore it is desirable to harmonize LLFS and the Framingham Heart Study (FHS) data. Measures of physical function in LLFS are similar to those used in the FHS but the response options are different in FHS:

- 0 = NO HELP NEEDED, INDEPENDENT
- 1 = USES DEVICE, INDEPENDENT
- 2 = HUMAN ASSISTANCE NEEDED, MINIMALLY DEPENDENT
- 3 = DEPENDENT
- 4 = DO NOT DO DURING A NORMAL DAY
- . = UNKNOWN

Therefore the questions from LLFS exam 1 remain unchanged to enable longitudinal analyses and a list with use of devices are added to enable recoding of the LLFS answers to make it comparable to the FHS coding.

To be able to analyze possible changes in variables measured in the two LLFS visits, one has to have a table with the records of the dates of repeated measurements, as well as the values of the measured variables (**continuous or categorical**) for each study participant. Raw differences ($\text{delta} = \text{value at visit 2} - \text{value at visit 1}$) will be calculated and recorded for all variables. In addition to this, if necessary (e.g., for **continuous and composite** measures), the annual changes (this could be $\text{delta}/\text{length of interval in years}$ or $365.25 * \text{delta}/\text{length of interval in days}$) will be evaluated and recorded to accommodate varying intervals between assessments.

To evaluate **incidence rates** of diseases, one has to have a table with a record of the type of disease and the onset date of the disease if it happened between the two visits.

This chapter deals with social capabilities, physical function, vision and hearing, and activity participation, all of which are **categorical** measurements. Changes for them could be coded, e.g., 1 if "no" at visit 1 and "yes" at visit 2; 0 if no change between visits 1 and 2, and -1 if "yes" at visit 1 and "no" at visit 2. If more detailed categories are used instead of yes/no (e.g., no difficulty, some difficulty, major difficulty, cannot do) then this can be generalized to quantify the differences between the categories in the two visits, e.g., 2 if (as in the above example) "no difficulty" at visit 1 and "major difficulty" at visit 2. So this is just a simple difference between value at visit 2 and value at visit 1 if coding 0=no, 1=yes (respectively, 0=no difficulty, 1=some difficulty, 2=major difficulty, 3=cannot do) is used.

These measurements as well as changes in the variables will be analyzed using the relevant statistical approaches fully described in the **Research Strategy section** of the renewal application. Following the Research Strategy the changes between visit 1 and visit 2 in all Health Aging Phenotypes (HAPs) listed in the Field Center application sections C.1.a.5 and C.1.b will be evaluated. The trajectory patterns will be evaluated using "Growth Curves" approach utilizing General Linear Mixed Models (GLMMs) which analyze all subject's longitudinal data simultaneously by taking into account 1) heterogeneity among individuals' profiles, 2) correlated errors among members within the same LLFS families; 3) serially correlated within-individual errors over time, when errors close to each other in time are more similar than those further apart; and 4) measurement errors. GLMM formulation allows for estimating subject-specific parameters that can then be used as heritable traits for genetic studies. The sensitive measures (e.g. grip strength, pulmonary function, cognitive testing) are selected to detect

differences in trajectories even in the relatively younger participants in the LLFS offspring (generation, G2). **For quantitative traits**, a Gaussian linear mixed effects models will be used (in SAS MIXED, GLIMMIX; R: lme / lme4). **For qualitative data** a Generalized Estimating Equations approach (GENMOD in SAS; or geepack in R) or a mixed-effects models for non-Gaussian data via SAS's NLMIXED or GLIMMIX using a logistic link (Demidenko et al., 2004; Verbeke et al., 2009) will be used. The LLFS team also developed Bayesian growth models with random effects to study the rate of change of physical and cognitive functions of extremely old subjects in R and OpenBugs, and latent variable GLMMs that accommodate addition heterogeneity if needed (Hjelmborg et al., 2008; Andersen et al, 2012). **Incidence rates** of disease will be examined in both generations, G1 and G2 using a Cox mixed model to adjust for within-family correlation. Onset-type variables will be analyzed using mixed models, and deaths will be coded as censored variables to accommodate competing risks. The advanced statistical methods developed in LLFS to analyze onset of disease and survival in exceptionally old people, novel methodologies to account for accelerated hazard using Bayesian methods with random effects (Andersen et al., 2012), and frailty models (Yashin and Iachine 1999) will be used.

The changes in two **composite indices** of healthy aging that predict mortality will be estimated. The first one is the Healthy Aging Index which uses tertile scores in five organ systems and identified individuals with very low mortality risk in the CHS study (Sanders et al., 2013). Another is the Scale of Aging Vigor (SAVE) (Newman et al., 2012) that expands the scoring of the CHS frailty scale to identify the most vigorous participants. Changes in the **composite traits** constructed by using factor analyses (Matteini et al., 2010) will also be investigated.

Multivariate survival analyses will be used to capture dependence among HAPs including correlated gamma-frailty models (Yashin, et al, 1999) and a stochastic process model for evaluating dynamic regularities of aging-related changes in biomarkers and their effects on HAPs and longevity (Yashin et al., 2013). Detecting influential factors of HAPs on longevity may improve predictive value.

BACKGROUND AND PURPOSE

This panel assesses the participant's perception of his/her ability to carry out activities of daily living. It asks about the participant's current social capabilities as well as the ease with which specific activities can be completed. It also asks about changes in frequency of engaging in the activity as well as changes in the way in which the activity is carried out.

ADMINISTRATION

This form can be either administered by the study staff at the in-person examination, distributed to the participant at the in-person examination and completed on their own, or mailed to those not seen in person. If self-administered, participants will be asked to carefully complete the survey and return it to the appropriate Field Center in the supplied self-addressed, stamped envelope. Upon receiving the completed survey, study staff will review the document for accuracy, and if needed, will contact the participant by telephone for clarification.

DEFINITIONS

Physical Function:

Difficulty in performing tasks - Performing the task requires more than a minimal amount of effort, or causes symptoms such as shortness of breath, emotional stress, etc.

Activities:

1. Getting out of a bed or chair, rising from a sitting or lying position to a standing position or transferring from bed to chair.
2. Bathing - Getting water, soap, towel and other necessary items and washing oneself.
3. Walking around your home - Walking from room to room or within one room of the person's principal residence.
4. Walking one quarter of a mile and one mile - Participant walks this distance without stopping for more than five minutes.
5. Walking up 10 steps and 20 steps - Ascending from one story of a building to another without stopping for more than one minute.

Physical Activity: Movement produced by skeletal muscles which results in energy expenditure.

METHODS

Social Capabilities: Questions 1 and 2 attempt to measure the participant's ability to socialize *with people outside of one's home/living facility*. Contact with family members who live with the participant do not count as social interaction nor do daily interactions with staff/other residents in a nursing home or other assisted living-type facilities. However, arranged 'visits', 'get-togethers', 'social events', etc. would count as social activities in that these 'events' go above and beyond normal, daily and unarranged contact with people. The participant will choose the best response which most closely estimates how often s/he interacts with others and how often s/he spends an entire day alone in a typical week. A typical week is one in which no unusual activities/obligations have occurred. Please use the Response Form in **Appendix B** for Question 1.

Physical Function: Questions 3-9 involve the participant's current functional status. Please note the skip patterns on this form. For questions 3a to 9a, participants should check the appropriate box to indicate whether s/he has difficulty completing the specified task.

For questions 3b, 4b, 5b, etc., participants should check the appropriate box to indicate how much difficulty [he/she] experiences when getting in/out of bed or chairs, bathing or showering, walking across a small room, etc. Please use the Response Form provided in **Appendix B** for Q3b, 4b, 5b, 6b and 8b.

For example, if a participant responds to Q3a (difficulty rising from bed/chair) as "Yes", [he/she] should then proceed to answer Q3b. If the participant selects any other category other than "yes" [he/she] will skip Q3b and Q3c and proceed directly to Q4a, for Q3 and to Q5a for Q4.

If "No" to Q3a, then the person should skip to Q4a. If "No" to Q4a, skip to Q5a, if "No" to Q5a, skip to Q6a. If "No" to Q6a, then the person should skip to Q6d. The same pattern holds for Q8a, which skips to Q8d.

For Q3c-6c and 8c, indicate whether or not the participant receives help to complete the specified task. Please note skip patterns.

Vision and Hearing: The focus of Questions 10 and 11 is to assess the participant's ability to see and hear. The participant will reply with either Yes or No for whether [he/she] wears glasses/contact lenses (Q10a) or hearing aid (Q11a). The participant is then asked to rate his/her vision (Q10a) with corrective lenses if worn and hearing (Q11b) with hearing device if used by circling one of the 5 available categories ranging from Excellent Vision or Hearing to Very Poor.

Activity Participation: Questions **12a-b** assess the participant's current participation in activities over the past two weeks. The respondent is first asked to indicate whether s/he has walked outside the home in the past two weeks by choosing Yes or No. If the participant selects "Yes", s/he will proceed to **Q12b** to indicate the number of days s/he walked in the past two weeks by selecting one of the categories and then proceed to **next question, Q13**. If the participant selects "No", s/he will skip to **Q12c** to indicate why s/he did not do any walking in the past two weeks. If neither category is applicable, the respondent may check "Other" and specify the reason.

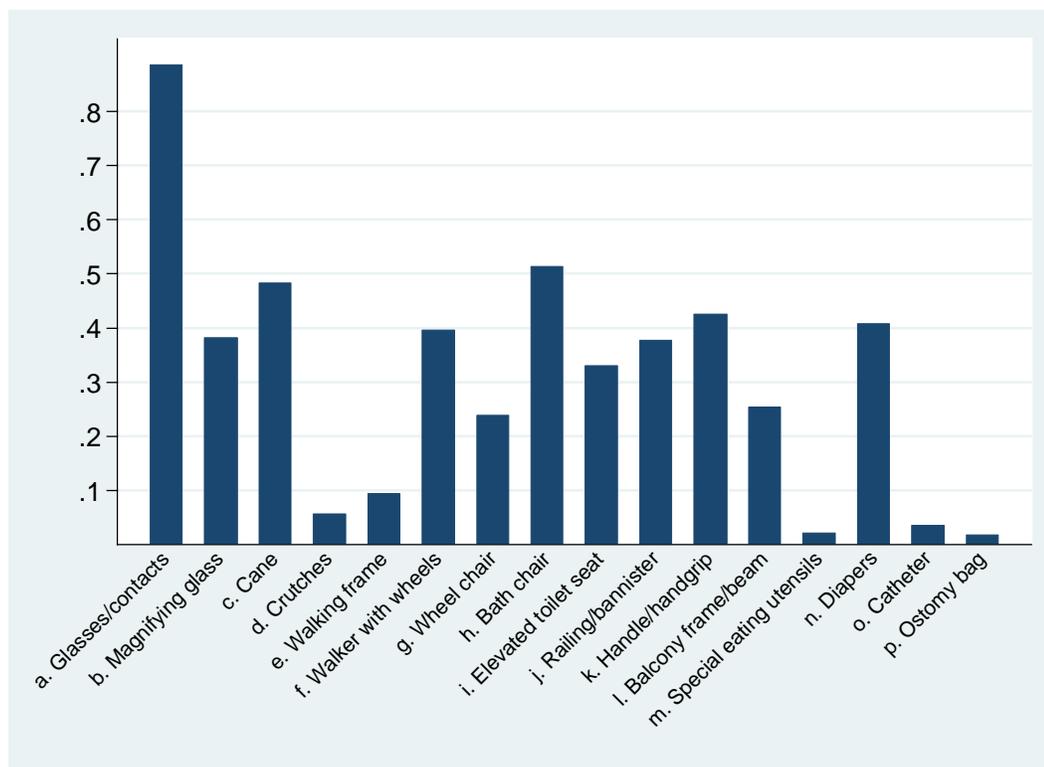
Typical Day Rest and Activity: Questions 13-17 assess the participant's current level of rest and activity over the course of a typical day during the past year. The five activity levels are: time sleeping, time in sedentary activity (sitting), time in slight activity (walking/standing), time in moderate activity (housework), and time in heavy activity (heavy housework, heavy yard work, intensive sports). The sum of these 5 questions must total 24. This is adapted from the Framingham Heart Study questionnaire to allow for harmonization of activity levels between our studies.

Assistive devices: Especially elderly people may be using a lot of different aids to cope with their daily life. For **Q18** ask the participant whether s/he is currently using some of the aids/assistive devices on the list beginning with: hearing aid, glasses/contact lenses, cane etc. Mark each item used with a YES and move to the next item.

Assistive devices in the Danish 1905-Cohort – ages 92-93

Ordinarily, do you use any of the following aids?	Yes	No
a. Glasses/contact lenses	1996 (88.6)	257 (11.4)
b. Magnifying glass	861 (38.2)	1391 (61.8)
c. Cane	1088 (48.3)	1163 (51.7)
d. Crutches	127 (5.6)	2123 (94.4)
e. Walking frame	200 (9.4)	1926 (90.6)
f. Walker with wheels (rollator)	891 (39.6)	1360 (60.4)
g. Wheel chair	537 (23.8)	1715 (76.2)
h. Bath chair	1147 (51.3)	1089 (48.7)
i. Elevated toilet seat	742 (33.1)	1502 (66.9)
j. Railing/bannister	845 (37.7)	1395 (62.3)
k. Handle/handgrip	953 (42.5)	1290 (57.5)
l. Balcony frame/beam	571 (25.4)	1675 (74.6)
m. Special eating utensils	48 (2.1)	2202 (97.9)
n. Diapers	912 (40.7)	1327 (59.3)
o. Catheter	73 (3.6)	1977 (96.4)
p. Ostomy bag	36 (1.8)	2013 (98.2)

Graph of the table



Fatigability: The concept of fatigability classifies fatigue in relation to a defined activity of a specific intensity and duration. This conceptualization offers a potentially less biased, more objective approach to measuring the degree to which someone is limited physically due to fatigue. This is especially important in studies of older adults, who in an effort to reduce or avoid fatigue, may modify their exertion level (e.g., slow down and/or shorten task duration) to maintain a tolerable effort, i.e., engage in self-pacing. The 10-item Pittsburgh Fatigability Scale (Glynn et al 2014) is a valid and reliable measure of perceived fatigability in older adults. In the validation sample, total PFS physical fatigability_score was closely associated with reported exertion at the end of a standard task as well as with measures of walking performance. Importantly, PFS score was strongly associated with a validated performance-based measure of physical fitness, the 400m component of the long distance corridor walk. The PFS has been designed and validated to serve as an adjunct to performance-based fatigability measures for identifying older adults at risk of mobility limitation in clinical and research settings.

It is proposed to assess fatigability by using the Pittsburgh Fatigability Scale:

Instructions for the form: The form can either be administered by the study staff at the in-person examination, distributed to the participant at the in-person examination and be completed on their own, or mailed to the participant in advance to the examination. If self-administered, participants will be asked to carefully complete the survey and return it to the field center in the supplied self-addressed, stamped envelope. If it is collected by the clinic staff, they should review the form for completeness and if there are any missing answers, then ask the participant so the form is completed accurately. The form cannot be completed by proxy.

Instructions for the form: The following questions ask you to indicate the level of **physical** and **mental** fatigue (i.e. tiredness, exhaustion) you expect or imagine you would feel immediately after completing each of the ten listed activities.

For each activity (a-j) please circle responses for both physical and mental fatigue between 0 and 5, where "0" equals no fatigue at all and "5" equals extreme fatigue.

In the last column indicate if you have done the activity in the past month. If you answer "No", please make your best guess for the fatigue questions (see Example 2 below). **Please fill out all three columns for every activity even for those that you do not do.** Also pay careful attention to the duration (e.g., 30 minutes) and intensity (e.g., moderate, brisk) of each activity.

Item by item questions (19-28 on panel):

19. Leisurely walk for 30 minutes.
20. Brisk or fast walk for 1 hour.
21. Light household activity for 1 hour (*cleaning, cooking, dusting, straightening up, baking, making beds, dishwashing, watering plants*).
22. Heavy gardening or yard work for 1 hour (moving (push), raking, weeding, planting, shoveling snow).
23. Watching TV for 1 hour.
24. Sitting quietly for 1 hour.
25. Moderate to high-intensity strength training for 30 minutes (*hand-held weights or machines greater than 5 lbs., push-ups*).
26. Participating in a social activity for 1 hour (*party, dinner, senior center, gathering with family/friends, playing cards*).
27. Hosting a social event for 1 hour (*not including preparation time*)
28. High-intensity activity for 30 minutes (*jogging, hiking, biking, swimming, racquet sports, aerobic machines, dancing, Zumba*).

Pittsburgh Fatigability Scale Scoring Instructions

Physical Fatigability Score: Calculated by summing the physical fatigue rating for each activity (a-j). Score range (0-50) with higher score=greater physical fatigability.

Mental Fatigability Score: Calculated by summing the mental fatigue rating for each activity (a-j). Score range (0-50) with higher score=greater mental fatigability.

EQUIPMENT

None. Enter data on paper form.

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