3mc2008 – Proceedings ©

Collecting Physical Measure and Biomarker Data on Cross-National Studies

Heidi Guyer[1], Mary Beth Ofstedal[2], Carli Lessof[3], Kate Cox[3], Hendrik Juerges[4]

[1] Survey Research Operations, Survey Research Center, University of Michigan
[2] Health and Retirement Study, Survey Research Center, University of Michigan
[3] National Centre for Social Research, London
[4] Mannheim Research Institute for the Economics of Aging Mannheim University

Introduction

The collection of physical measures and biomarkers in population-based studies of aging and health has become increasingly common in recent years. While these measures have had a long history in epidemiological studies, few of those studies are nationally representative or longitudinal or have adequate sample size of key population subgroups (e.g., racial and ethnic minorities, older adults). The incorporation of physical measures and biomarkers in large-scale population surveys has been facilitated, in part, because much has been learned over the last decade with regard to the biological pathways to poor health, allowing for a more targeted approach to biomarker collection. In addition, the collection of these measures from a community population has become easier and less expensive. For example, as a result of recent technological developments, it is now possible to obtain information on key biomarkers from dried blood spots, as opposed to whole blood (McDade, Williams and Snodgrass, 2007).

Physical measures and biomarkers add depth to traditional survey-based measures and provide more objective measures against which self-reports can be validated. While the self-reported data on health conditions, function, and risk factors collected in these surveys provide data that are useful for describing population-based health transitions, self-reported data have some limitations. The collection of biomarkers and physical measures enables researchers to understand and reduce the bias of self-reported health, especially for those sub-groups who do not get regular health care or screenings and, thus, may not be aware of the presence of health conditions. The effect of national policy changes can be measured as well. Biomarkers are useful for adjusting observed differences by gender, socio-economic status, and other traits for unobserved frailty in a population, and they can provide insight into prior exposures to infection and earlier life circumstances. Moreover, having these measurements in the context of a panel survey that contains a rich history of information on family, health, work, and economic status is particularly valuable for studying socio-economic disparities in health.

Different approaches have been used to collecting these measurements in national surveys. The U.S. National Health and Nutrition Examination Survey uses an approach in which detailed clinical measurements are conducted by medical professionals in a mobile examination center. This approach yields extensive physical and biological measurements in a highly standardized setting, but at a very high cost. Other studies have arranged for physical examinations of respondents at a local hospital or clinic (the Social Environment and Biomarkers of Aging Study in Taiwan and the National Survey of Health and Development in Great Britain). This approach offers the potential for very sophisticated measurements, for example in terms of full-body bone density measurement, at relatively high cost and with some risk of lower participation rates. Some studies aim for a compromise where study nurses are sent to the respondents' home (the Health Survey for England and the bio-medical study of the 1958 British birth cohort study).

This allows for slightly less sophisticated measurements, some of which require medical training and facilitates the collection of full blood samples. In contrast, an increasingly common and cost-effective approach is to have lay interviewers conduct these measurements with respondents in their homes as part of the interview. This latter approach has been adopted by the National Social Life, Health and Aging Project and the Health and Retirement Study, both in the United States, as well as the Survey of Health, Ageing and Retirement in Europe. This approach has the considerable advantage of lower cost and higher participation and, as technology advances, of facilitating a growing number of measurements.

This paper focuses on three large-scale panel surveys of older adults: the Health and Retirement Study in the United States, the English Longitudinal Study of Ageing in England, and the Survey of Health, Ageing and Retirement in Europe, which spans 14 countries. These surveys were designed to be comparable, with the goal of supporting cross-national analysis. Each of the surveys includes a set of physical performance, anthropometric, and/or biomarker measures to augment the self-reported data on health status. The surveys differ to some extent in their approaches to collecting these measurements and in the scope of the measures that are conducted. The goal of this paper is to compare the three studies with respect to the physical measures and biomarkers that are collected; training and data collection methods, protocols, and equipment used to conduct the measurements; and participation of respondents in this component of the study.

International comparisons of results from population based studies are increasingly more common as we explore the impact of different financial and retirement structures, health care models, and the impact such things as social support systems and health habits have on the population. An example of such comparisons conducted with two of the studies highlighted in this paper found that adults over the age of 50 are less healthy than respondents of the same age in England [1]. Other studies have looked at how different countries are preparing for an aging society and the economic impact it will have on various systems including pension systems, social security and health care provision. The inclusion of physical measures and biomarkers in comparable international studies allows not only for the comparison of prevalence rates of various measures of health status, but also the possible influence of different systems or structures (such as a socialized health care system versus a privatized health care system) on status and possibly on related outcomes as well.

Background and Overview of the Three Studies

Health and Retirement Study

The Health and Retirement Study (HRS) is an ongoing panel survey of a nationally representative sample of over 20,000 men and women over the age of 50 in the United States. The HRS began in 1992 as a longitudinal study of a pre-retirement cohort of individuals born in 1931-1941, and their spouses of any age. It was joined in 1993 by a companion study, the Study of Asset and Health Dynamics of the Oldest Old (AHEAD), comprised of a cohort of persons born before 1924 and their spouses of any age. In 1998, the study design was modified to convert the HRS sample from a set of specific cohorts into a steady state sample that would represent the entire U.S. population over age 50. This was achieved by adding new cohorts in

1998 to fill in the age range (over 50) and by adding a new six-year cohort of persons entering their 50s every six years thereafter.

The HRS conducts core interviews every two years using a mixed-mode design of telephone and face-to-face interviews (supplemental studies are conducted in the off-years using mail and Internet modes). The primary mode used for baseline interviews and for sample members age 80+ is face-to-face. Up through 2002, the primary mode for followup interviews with sample members under age 80 was telephone. Starting in 2004, the proportion of face-to-face interviews increased substantially so that 60-70 percent of all interviews are conducted in-person each wave. The study began with a sample of community-dwelling individuals residing in the U.S.; however, followup interviews are attempted with all sample members regardless of where they live, including those in institutions, as well as those who have moved out of the country.

The primary focus of the HRS is on the intersection between health, retirement, and economic status in later life. The survey provides detailed information on each of these topics, as well as on employment history and availability of pensions, work disability and related benefits, family composition and resource transfers, and health insurance and utilization of health services.

HRS began experimenting with collecting physical measures and biomarkers in pilot projects beginning with collection of dried blood spots in the 2003 Diabetes Mail Survey and with a small set of physical performance tests and anthropometric measurements in the 2004 core interview. These pilot efforts led to a full-scale implementation of physical measures and biomarkers in the 2006 wave, in what is referred to as an enhanced face-to-face interview.

English Longitudinal Study of Ageing

The English Longitudinal Study of Ageing (ELSA) is a study of people aged 50 and over and their partners in England. The first wave of ELSA was in 2002. The sample for ELSA is taken from households which participated in the Health Survey for England (HSE), which is an annual cross-sectional study that includes an interview and nurse visit. The original ELSA sample was taken from participating households from three years of the HSE: 1998, 1999 and 2001. At Wave 3 of ELSA (2006), the process of supplementing the original cohort began with the addition of a new cohort of people aged 50 to 53 in order that the sample would remain representative of people aged 50 and over[1]. This sample was taken from participating households in the HSE surveys from 2001 to 2004. At Wave 4 (2008) additional sample up to the age of 75 is being included.

ELSA conducts core face-to-face interviews every two years and a nurse visit every four years (every even wave). A self-completion questionnaire is administered at each Wave and additional self-completions, for example using anchoring vignettes, are administered from time to time as part of the interview or nurse visit. For example, anchoring vignettes were administered at the Wave 3 interview. Starting in Wave 3 (2006), a small number of short telephone interviews are attempted if participants are unwilling or unable to complete an interview in-person.

[1] Because of an error made in selecting the top-up sample, people aged 53 years old will be included at Wave 4.

To be eligible at their first ELSA interview, respondents must be living in a private household in England, however follow up interviews are attempted with sample members who have moved to other parts of Britain and with those who have moved into institutions.

ELSA is a multidisciplinary study which collects data on respondents' health, work, finances and social participation. A timed walk measure is included in the interview at each wave. The first ELSA nurse visit, which contains a number of physical performance measures and biomarkers, was conducted at Wave 2 (2004). This includes a blood sample and for respondents aged under 80 who are willing, this follows a period of fasting. Many ELSA respondents had also had a nurse visit, which consisted of many of the measures included in ELSA, as part of the HSE before they took part in ELSA.

Survey of Health Aging and Retirement in Europe

SHARE is modelled closely after the U.S. Health and Retirement Study and the English Longitudinal Study of Ageing. Yet, SHARE delivers another dimension: It is the first European data set to combine extensive cross-national information on socio-economics status, health, and family relationships of the elderly population (Börsch-Supan et al. 2005).

At this point, SHARE has collected two waves of data in 14 countries, representing Europe's economic, social, institutional, and cultural diversity from Scandinavia (Denmark, Sweden) across Western and Central Europe (Austria, Germany, France, Belgium, The Netherlands, Switzerland, Poland, Czech Republic) to the Mediterranean (Greece, Italy, Spain). Additional data was collected in Israel. All interviews are conducted in-person at each wave.

The SHARE data include health variables (e.g. self-reported health, physical functioning, cognitive functioning, physical measures such as grip strength and walking speed, health behaviour, use of health care facilities), psychological variables (e.g. psychological health, well-being, life satisfaction, control beliefs), economic variables (e.g. current work activity, job characteristics, job flexibility, opportunities to work past retirement age, employment history, pension rights, sources and composition of current income, wealth and consumption, housing, education), and social support variables (e.g. assistance within families, transfers of income and assets, social networks, volunteer activities, time use).

SHARE has made great efforts to deliver truly comparable data, so we can reliably study how differences in cultures, living conditions and policy approaches shape the life of Europeans just before and after retirement. In addition to physical measures, SHARE also includes health and other vignettes in order to study and correct for cross-national differences in reporting behavior. Probability samples have been carefully drawn in each participating country. The questionnaire has been translated according to a protocol ensuring functional equivalence and was administered by a Computer Assisted Personal Interview (CAPI) plus a drop off self-completion questionnaire. Further methodological details of the study are contained in Börsch-Supan and Jürges (2005).

Table 1 shows the time periods and primary modes of data collection--either face-to-face (FTF) or telephone (TEL)--for each of the three studies from 1992 – 2010.

Table 1. Study Timelines

Year	HRS	ELSA	SHARE
1992	Wave 1; original HRS cohort (born 1931-1941); 95% FTF		
1993	Wave 1; AHEAD cohort (born < 1923); 60% TEL		
1994	Wave 2; original HRS cohort; 90% TEL		
1995	Wave 2; AHEAD cohort; 65% TEL		
1996	Wave 3; original HRS cohort; 90% TEL		
1998	Wave 4 (CODA and War Baby cohorts added); 70% TEL	Initial HSE fieldwork and biomedical tests (1998-2001)	
2000	Wave 5; 85%		
2001		HSE fieldwork and biomedical measures for Wave 3 refreshment sample (2001-2004)	
2002	Wave 6; 80% TEL	Wave 1; ELSA fieldwork, face to face interviews and self-completion	
2004	Wave 7 (Early Baby Boom cohort added); 70% FTF; 20% received a subset of measures	Wave 2; ELSA fieldwork, face to face interviews with self-completion; nurse visit with 10% receiving experimental Ryff self-completion questionnaire	Wave 1 (12 countries), FTF, walking & grip
2006	Wave 8; 50% enhanced-FTF with 10 measures; 10% regular FTF	Wave 3; ELSA fieldwork, face to face interviews and self-completion; one third also receive health vignette self-completion, and one-third work vignette self-completion	Wave 2 (12 countries) Wave 1 (2 countries) FTF, walking, grip, breath, chair stand
2007		Wave 3: life history interview with life history self-completion	
2008	Wave 9; 50% enhanced-FTF with 10 measures; 10% regular FTF	Wave 4: ELSA fieldwork, face to face interview with self-completion and nurse visit	Wave 3(2): Life history interview (13 countries), grip strength

2010	Wave 10 (Mid Baby Boom cohort added); 50% enhanced-FTF; 15-20% regular FTF	Wave 5: ELSA fieldwork, face to face interviews with self-completion	

Measurements and Data Collection Protocols

The measurements collected in each study are shown in Table 2. The numbers in parentheses indicate the order in which the measurements were administered in the most recent wave. Grip strength, lung strength and walking speed are collected in all three studies. Blood pressure, balance tests, height, weight, waist and the two biomarkers, blood and saliva, are collected in HRS and ELSA. The chair stand is conducted by ELSA and SHARE. Hip circumference is measured only in ELSA. Self-reported measures of height and weight are collected on all three studies. In addition, self-reported grip strength, lung strength and balance are collected in HRS in order to examine the association between self-assessment and actual performance and provide a means of adjusting for respondents who do not participate in the physical measures. Interviewers conduct all of the measures for both HRS and SHARE. In ELSA, interviewers conduct only the walking speed measurement, and all other measurements are administered by a nurse in a separate visit.

HRS began conducting a subset of the measurements on a small subsample (~20%) in 2004. In 2006, 50% of sample members were randomly selected for the enhanced face-to-face interview, which includes the physical measures and biomarkers; the other 50% of the sample will receive the enhanced face-to-face interview in 2008. Respondents in the enhanced face-to-face sample who reside in a nursing home, are interviewed by a proxy respondent, or for whom a telephone interview is conducted in lieu of an in-person interview were not asked to complete the physical measures and biomarkers. However, interviewers make an effort to obtain self-interviews and to conduct interviews in the assigned mode for the enhanced face-to-face sample whenever possible.

ELSA first began conducting physical measures in the 1990s on the HSE. In 2004, ELSA participants who complete the main interview for the given wave are invited to participate in a nurse visit, which generally takes place within 2-4 weeks of the interview. Only age-eligible sample members are given the nurse visit as routine, non-age eligible and new partners are not offered the nurse visit. As a consequence, respondents who have participated fully throughout the study will be providing their fourth measure of walking speed (measured by interviewers at all four waves of ELSA), their third measurement of anthropometry, blood pressure and blood (measured by nurses at HSE and ELSA waves 2 and 4) and their second measure of lung function, additional physical performance measures and saliva (ELSA nurse visits at waves 2 and 4). Walking speed has been conducted as part of the main interview in every wave of ELSA as it is conducted by interviewers.

SHARE began to collect physical measures in the first wave of data collection (2004), with all respondents in all countries. Interviewers administered grip strength and walking speed in 2004. The measures were expanded to include lung strength and the chair stand in 2006. In place of the main interview, SHARE is conducting a Life History Interview in 2008 and will only conduct grip strength in that wave.

Table 2. Measures Collected by Study and Wave

Measure	HRS	ELSA	SHARE
Blood Pressure	2006, 2008 (1)	HSE, 2004, 2008 (1)	---
Grip Strength	2004, 2006, 2008 (3)	2004, 2008 (2)	2004, 2006, 2008 (1)
Lung Strength	2004, 2006, 2008 (2)	HSE, 2004, 2008 (8)	2006 (4)
Walking Speed	2004, 2006, 2008 (5)	2002, 2004, 2006 (1 – main interview)	2004, 2006 (2)
Balance Tests (Tandem, Semi-Tandem, Side by Side)	2006, 2008 (4)	2004, 2008 (9)	---
Chair Stand	---	2004, 2008 (11)	2006 (3)
Leg Raise	---	2004, 2008 (10)	---
Height	2006, 2008 (6)	HSE (main interview), 2004, 2008 (4)	2004 (self-reported)
Weight	2006, 2008 (7)	HSE (main interview) 2004, 2008 (5)	2004, 2006 (self-reported)
Waist Circumference	2006, 2008 (8)	HSE, 2004, 2008 (6)	---
Hip Circumference	---	HSE, 2004, 2008 (7)	---
Blood	2006, 2008 (10)	HSE, 2004, 2008 (3)	---
Saliva	2006, 2008 (9)	2004, 2008 (12)	---

Measurement Protocols

All of the three studies have coordinated with each other when developing field protocols and procedures to ensure as much consistency in training and implementation as practicable. In doing so, measurement error may be reduced, thus allowing for higher quality cross-study comparisons. The basic protocols and materials used for each of the three studies are described below.

- *Blood Pressure* was measured using an Omron HEM-780 Intellisense Automated blood pressure monitor with ComFit cuff for HRS and an Omron-HEM 907 automated monitor for ELSA. The respondent was seated during the measurement. Three measurements were taken. Systolic and diastolic blood pressure and pulse were recorded at each reading. ELSA respondents are asked to sit quietly for 5 minutes prior to the first measurement. Ambient air is also recorded in ELSA.
- *Grip Strength* was measured using a Smedley spring type hand dynamometer on all three studies. The dynamometer was fitted to the respondent's hand. The measure was conducted with the respondent standing and holding the dynamometer at a 90 degree angle. Two measurements were taken on each hand alternating between the left and right hand on HRS and SHARE whereas three measurements were taken per hand on ELSA. Respondents who had recent hand surgery, pain or inflammation did not complete this measure.

- *Lung Strength* was measured on both HRS and SHARE using a Mini Wright Peak flow meter with the respondent standing or seated if unable to stand. Three measurements were conducted on HRS and two measurements on SHARE studies. A Vitalograph Escort spirometer was used to measure peak expiratory force (lung strength) on ELSA. Three measurements are obtained. Respondent who had recent heart, chest or eye surgery, who were pregnant or who'd had a trachiostomy did not complete this measure.
- *Walking Speed* was measured by marking a course in a suitable space in the respondent's home with a tape measure and placing masking tape at the starting and ending points. The length of the course was 98.5 inches (250 cm) in HRS and SHARE, and 96 inches (244 cm) in ELSA. Respondents lined their feet up at the start of the course. The interviewer used a stopwatch to record the time from which the respondent's foot first crossed the starting point and touched the floor and the time their foot touched the floor after fully crossing the ending point. The respondent was asked to complete two timed walks (to one end, stop, and back). Walking speed was conducted with respondents aged 65 years or older on HRS, respondents aged 75 years or older on SHARE and those aged 60 or older on ELSA. Respondents who were not able to stand or to walk without the aid of another person did not complete this measure. Respondents were allowed to use walking aids (e.g., canes, walkers) during the measurement.
- *Balance* was measured using the semi-tandem, full tandem and side-by-side timed balance tests. For HRS, each respondent completed up to two of the tests. All respondents attempted the semi-tandem stand. If they were <u>able</u> to hold this stand for 10 seconds, they were then asked to do the full tandem stand. Respondents aged 65 or older were asked to hold the full tandem stand for 30 seconds, while those younger than 65 were asked to hold it for 60 seconds. Respondents who were <u>unable</u> to hold the semi-tandem for 10 seconds were asked to perform the side-by-side stand. Respondents who were unable to stand did not complete the balance tests.
- For ELSA, there are differences in the order of the assessments and the age threshold for the different durations of the tests. Respondents of all ages start with the side-by-side stand. If they are able to hold this for 10 seconds they are asked to do the semi-tandem stand. Respondents who are able to hold this for 10 seconds are asked to do the full tandem stand. Respondents under age 70 (compared to HRS's threshold of under 65) are asked to hold the stand for 30 seconds (vs. 60 seconds for HRS). Respondents age 70 or over are asked to hold the stand for 10 seconds (vs. 30 seconds for HRS). For the side by side, semi-tandem and full-tandem stands, respondents are **not** permitted to practice first.

  ELSA uses an additional measure of balance, the *leg raise*, in order to capture higher levels of performance among the more physically able respondents. The *leg raise* assessment was administered to all individuals under the age of 70 who passed the side-by-side balance test. First they were asked to raise one leg for 30 seconds. If they completed this assessment they were asked to close their eyes and then raise one leg for 30 seconds. For the one-leg stand, respondents are allowed one practice.
- *Chair Stand* provides an additional measure of balance. This is a timed test in which the respondent is timed while standing up from a sitting position and sitting down again five times, while holding their arms crossed over their chest. A hard back chair available in the respondents home, such as a kitchen chair, is used. On SHARE, the chair stand was conducted with respondents aged 74 years or younger and one measurement was conducted. On ELSA, a single chair rise is first conducted to screen for the repeated chair rise. For the repeated chair rise, respondents age 69 and under completed 10 chair rises while those age 70 and over completed 5 rises. Where 10 rises are completed, the nurse records the time that the first 5 rises take, and the time that all 10 rises take.
- *Height* was measured on HRS with the respondent standing against a wall with their shoes off. A rafter's square was placed on the respondent's head and an adhesive note was placed behind the respondent's head to mark the height. The respondent stepped away from the wall and their height was then measured from the floor up using a tape measure. On ELSA, height is measured using a portable stadiometer. The respondent is instructed to remove their shoes and to stand on the stadiometer plate looking straight ahead. The respondent is instructed to keep their eyes focused on a point straight ahead, to breathe in

deeply and to stretch to their fullest height. The interviewer uses a laminated card showing the Frankfort plane to tilt the respondent's head until it is at the correct angle for the height measurement to be taken. The head plate is adjusted, the respondent steps off the stadiometer and the nurse records their height. ELSA collects seated height during the nurse visit as well. Respondents who were unable to stand did not complete this measure.

- *Weight* was measured using a Healthometer 830KL scale on HRS and a Tanita THD-305 on ELSA. Respondents were instructed to remove sweaters, jackets, bulky clothing, things from their pockets and their shoes. One measurement was taken. Respondents whose self-reported weight (which was asked earlier in the interview) was greater than 300 pounds on HRS or 286 pounds (130 kg) on ELSA were not asked to complete this measurement. Respondents who were unable to stand did not complete this measure.
- *Waist* was measured on HRS at the height of the navel using a soft measuring tape. The respondent was instructed to remove bulky clothing, point to their navel and to place the tape measure around their waist at the height of the navel. They were then asked to inhale and then exhale, expanding the tape measure at the exhale. The measurement was taken at that point. On ELSA, the waist is defined as the point midway between the iliac crest and the costal margin (lower rib). The levels of the costal margin and the iliac crest were located use the fingers of the right hand held straight and pointing in front of the participant to slide upward over the iliac crest. Two measurements were taken with the tape measure horizontal around the waist. Respondents were ineligible for this measure if they are chairbound or have a colostomy or ileostomy.
- *Hip Circumference* The hip circumference is defined as being the widest circumference over the buttocks and below the iliac crest. To obtain an accurate measurement the circumference was measured at several positions. The widest circumference was record. The respondent is ineligible for the waist and hip measurement if they are chairbound or have a colostomy or ileostomy
- *Saliva* is collected on HRS in order to extract DNA. On ELSA, saliva is collected to measure cortisol levels. In 2006 HRS collected saliva samples by having the respondent vigorously swish 10 ml of Scope mouthwash in their mouth for 45 seconds. They then deposited the mouthwash into a small plastic cup that was sealed and mailed to a laboratory. In 2008, a new technique, DNAGenotek, was used in which the respondent deposits saliva into a small disc-like container. The cap is screwed onto the disc releasing a preservative.

  On ELSA, saliva is only collected from respondents aged under 80 and the measure is relatively burdensome. Four saliva samples are collected throughout the day: when the respondent wakes up, 30 minutes after waking, at 7PM and just before they go to bed. The respondent is instructed to chew on a plastic-coated cotton swab until saturated. All four samples are then packaged and mailed by the respondent. As each sample is collected, respondents are asked to complete successive pages of a log book – a self-completion which collects a range of information such as the respondent's mood at the time of each sample.
- *Blood*[2] Dried blood spots were collected on HRS using a BD lancet and two filter paper collection cards. An alcohol swab was used to wipe the respondent's finger. Once it was dry, the finger was pricked in the

2

Blood samples at ELSA Wave 2 were collected to facilitate measurement of **fibrinogen** (a protein necessary for blood clotting; high levels are also associated with a higher risk of heart disease); **total cholesterol** (increased risk of heart disease); **HDL cholesterol** (the 'good' cholesterol which is protective for heart disease); **triglycerides** (which together with total and HDL cholesterol provide a lipid profile which can give information on the risk of cardiovascular disease); **ferritin and haemoglobin** (measures of iron levels in the body); **C-reactive protein** (indicates inflammatory activity in the body and is associated with risk of heart disease);

upper side pad of the finger. The first drop that formed was wiped away to remove coagulating materials. Blood drops were then formed and dropped onto the collection cards. Up to six spots were collected. The cards were left to dry for 10-15 minutes and then placed in foil packets with a dessicant. These were then placed in a plastic mailer with a biohazard warning and mailed to the laboratory.

Nurses conduct fasting whole blood draws on ELSA where possible for respondents under 80, and non-fasting blood draws for all others that give consent. Venepuncture is performed with a green twenty one gauge vacutainer needle or butterfly with the respondent either seated or laying down. Six tubes of blood are drawn for a total of 24 mL of blood.

Training

1. Health and Retirement Study

Project managers trained field interviewers on all measures conducted. The training consisted of reviewing a DVD, the study manual, and data collection booklet prior to attending training. At training, a two-hour lecture and demonstration provided guidance on the appropriate procedures and protocols for each of the measures. Interviewers then spent two to four hours practicing all measures with a partner alternating between playing the role of the respondent and the role of the interviewer. Interviewers were trained in Universal Precautions and first aid tips. All interviewers were required to successfully complete an in-person certification interview with a trainer prior to collecting these measures in the field. A total of 176 interviewers were trained on HRS as well as fifteen field supervisors who completed interviews as well. Most months, 124 – 144 interviewers were active on the project.

2. English Longitudinal Study of Ageing

The field interviewers are trained by a small team of researchers to do the timed walk. Interviewers are trained to do this measure at each wave. In the initial training, the procedure was explained and demonstrated by the researcher and then the interviewers spent thirty minutes practicing the timed walk measurement in small groups. Interviewers who have been trained on this measure at a previous wave are given a shorter refresher training session (about 30 minutes) involving the same elements at subsequent waves. Interviewers are also given a written protocol which they read and can refer to when needed. About 250 interviewers are trained at each wave.

All the other measures are taken by field nurses. All the nurses are fully trained. The nurses are trained to do the ELSA measures by researchers and nurse supervisors over a two day session. During the training each measure is explained and demonstrated to the nurses, who then practice each measure in pairs or small groups. Nurses are also given a written protocol which they read and can refer to when needed. About 250 interviewers are trained at each wave. A total of 97 nurses were trained on ELSA Wave 2.

3. Survey of Health Aging and Retirement in Europe

---

apolipoprotein E (involved in the transport of cholesterol and plays a protective role); **fasting glucose and glycated haemoglobin** (indicating the presence or risk of type 2 diabetes and associated with an increased risk or heart disease) and **genetics** (to facilitate analysis of biological aspects of the ageing process). At Wave 4, ELSA no longer collected triglycerides or apolipoprotein E but did collect the **white cell count** (WCC) and **mean corpuscular haemoglobin** or MCH (which, when looked at in combination with ferritin and haemoglobin can indicate anaemia) as well as **insulin-like growth factor 1** or IGF-1 and **dehydroepiandrosterone sulfate** or DHEAS (hormones that help control reactions to stress and regulate various body processes including digestion, the immune system, mood, and energy usage). On HRS, blood samples are collected to measure hemoglobin A1C, total cholesterol, HDL cholesterol, and C-reactive protein.

The SHARE training follows a two-phased training model (see Alcser et al. 2007). In the first phase, SRC trainers provide a centralized training (train-the-trainer, TTT) for all participating countries. Prior to each data collection effort, each country sends 2-3 trainers from the survey agency that carries out the actual fieldwork to the training. The first phase training is scripted and conducted in English: translation of all training materials is carried out by each survey agency in consultation with translation professionals as needed, prior to local interviewer training.

A key reference source for trainees at the central and local levels is the SHARE Interviewer Project Manual. This manual supplements the training by providing a comprehensive reference to all of the SHARE protocols, including those for physical measurements. Further, training videos are used to illustrate the correct administration of physical measurements.

Overall, about 1,200 interviewers are trained across Europe prior to fieldwork. Certification procedures are designed to have each interviewer demonstrate the ability to conduct each of the four physical measures conducted in SHARE.

Information Provided to Respondents

Each study faced decisions with respect to what to share with respondents about the measurements and at what stage. Of the three studies, ELSA is most comprehensive in terms of information that is given to respondents. ELSA respondents are provided with information pamphlets about the measures and the DNA sample at the end of the interview, before the nurse visit is scheduled. In contrast, HRS and SHARE respondents are not informed about the measures until just before they are administered in the interview. At that stage, interviewers introduce and demonstrate the measures that are to be conducted. HRS also has an information brochure about the measures that interviewers provide to respondents just prior to or during the measurements. In SHARE, the interviewers describe each of the measures, but no written material is provided to respondents.

Both HRS and ELSA provide results of the measurements (or at least some of the measurements) to respondents. In ELSA, respondents are given a card on which their height, weight, waist, hip, and blood pressure measurements are recorded. The card also includes a website address where they can calculate and get guidance on body mass index (BMI). This card is provided by the nurse at the end of the assessment. In addition, within 4-6 weeks of the nurse visit, ELSA respondents receive a letter with their blood results (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, fibrinogen, C-reactive protein, ferritin, glucose, glycated haemoglobin, haemoglobin). Blood, blood pressure and lung function results are also sent to the family doctor with the respondent's permission.

HRS respondents are sent a letter containing results of the blood pressure measurements and blood tests (hemoglobin A1c, total cholesterol and LDL cholesterol) within 4-6 weeks of the interview. The letter contains information on the American Diabetes Association's recommended guidelines for hemoglobin A1c and the American Heart Association's recommended guidelines for lipids. In addition, HRS interviewers may inform respondents of their results on other measurements (blood pressure, performance tests, anthropometric measurements) during or after the measures are completed, but no written record of those results is provided. If the lowest blood pressure reading for a respondent is dangerously high (systolic > 160 or diastolic > 110), the interviewer leaves a card containing the blood pressure results with the respondent instructing him/her to consult a physician as soon as possible. ELSA, similarly, has a strict protocol for high blood pressure readings. SHARE does not conduct any of the measurements for which ELSA and HRS report results, so SHARE does not provide results to respondents.

Consent Procedures

In the HRS, respondents are required to read and sign a consent form before any measures are conducted. Three separate consent forms are used: 1) a physical measures consent form covering blood pressure, grip strength, lung strength, walking speed, balance stands, height, weight and waist measurements; 2) a consent form for the saliva sample, including extraction/storage of DNA; and 3) a consent form for the dried blood

spots. Each form was introduced by the interviewer just prior to the measure(s) that it covered. Interviewers read the consent form to respondents who are unable to read it themselves. The consent form must be signed by the respondent him/herself and the interviewer in order for consent to be valid. Two copies of each consent form were signed, first by the respondent and then by the interviewer. One copy was left with the respondent and the other returned to the main office. After obtaining consent for a given component, the interviewer described the procedures to the respondent and demonstrated how the measure was conducted.

In ELSA, verbal consent is obtained for the physical measures (walking speed during the interview, as well as all of the physical measurements taken during the nurse visit). However, a series of signed consents are required for the blood and saliva samples (covering storage and use of the samples), as well as for provision of blood pressure, lung function and blood results to the respondent's General Practitioner (GP). On SHARE, verbal consent is obtained for the physical measures.

Outcomes

We examined several different outcomes to see how the studies compared with regard to overall participation in the physical measures and biomarkers, interviewer variability in participation rates, and the distribution of results for measures that were common across the three studies.

Cooperation and Response Rates for Physical Measures and Biomarkers
Table 3 presents cooperation and response rates for each measure for each of the three surveys. The cooperation rate is defined as the percent of respondents who completed the specified measure (or at least one trial of the measure, when more than one trial was conducted), among those who were asked to complete it. In contrast, the response rate is defined as the percent of respondents who completed the measure, among all respondents in the wave who were targeted to receive it.

In SHARE, all respondents who completed an interview and met eligibility criteria were asked to complete the physical measures, therefore the eligible and asked samples are the same. Likewise, for the walking speed measurement in ELSA, all respondents who completed an interview were asked to do the walking speed measurement. As a result, there is no difference in the cooperation and response rates for SHARE or for the walking speed measurement for ELSA.

For the other measures in ELSA, only respondents who participated in the nurse visit were asked to complete the measurements. Thus, the denominator for the cooperation rate includes respondents who participated in the nurse visit (n=7,666), whereas the denominator for the response rate includes all respondents who completed an interview in the wave and were eligible for a nurse visit. There were 9,432 productive ELSA interviews at Wave 2, of which 125 or 1.3% were by proxy and so were not eligible for a nurse visit. We also restricted the nurse sample to core members only (respondents who were eligible in their own right, rather than by virtue of being the partner of a core member. This excluded another 619 individuals (6.6%) from the eligible sample leaving 8688 eligible for a nurse visit.

For HRS, the eligible sample is defined as all living, non-institutionalized respondents who were in the enhanced face-to-face sample and who completed an interview in the wave. As noted previously, of this group, respondents who completed their interview by telephone rather than face-to-face and those who were interviewed by proxy were not asked to do the physical measures and biomarkers. This accounted for 10% of all eligible respondents.

Table 3. Cooperation and Response Rates for Measures Administered

Measure	**HRS** 2006		**ELSA** 2004		**SHARE** 2006	
	Coopera-	**Response**	**Coopera-**	**Response**	**Coopera-**	**Response**

	tion rate	rate	tion rate	rate	tion rate	rate
Blood Pressure	89.0	79.8	98.6	87.0	--	--
Grip Strength	88.5	79.3	98.5	86.9	92.1	92.1
Lung Strength	88.8	79.6	91.6	80.9	89.6	89.6
Walking Speed	81.5	73.0	88.8	88.8	59.2	59.2
Balance Tests	84.2	75.4	96.0	84.7	--	--
Chair Stand	n.a.	n.a.	87.5	77.2	84.5	84.5
Height	88.7	79.5	97.4	85.9	--	--
Weight	87.5	78.4	97.0	85.6	--	--
Waist	87.9	78.8	92.3	81.5	--	--
Hip	n.a.	n.a.	96.8	85.4	--	--
Blood	80.6	72.3	81.3	71.7	--	--
Saliva	83.1	69.8	69.8	60.9	--	--
Sample size	8,374	9,341	7,666	8,688	32,301	32,301

Notes for Table 3: Not all tests were conducted with all sample members given the exclusion criteria described above. For ELSA, 9,432 were eligible for the walking speed test because this was conducted by interviewers. Fewer than the 8,688 participants who took part in the nurse visit were eligible for the saliva sample because this was administered to those under 80 (6753 individuals). Due to age-eligibility criteria, 6,058 SHARE sample members were asked to complete the walking speed measure and 26,236 sample members were asked to complete the chair stand.

Cooperation rates range from 59% for walking speed in SHARE to 99% for blood pressure in ELSA. The low cooperation rate on walking speed in SHARE is due primarily to lack of a suitable space in the respondent's home for conducting the measure. (Many respondents live in small apartments that don't have unobstructed walkways of adequate length.) This problem is also mentioned by ELSA interviewers but appears to be less common or have less impact. In ELSA, nurses often report that the chair stand measure often cannot be carried out because of the lack of a standard kitchen or dining room chair. (Many respondents only have soft chairs in their home such as an armchair or sofa). For most measures, cooperation rates tend to range from the mid 80s to mid to high 90s.

In general, cooperation rates are extremely high in ELSA. This has to do with the fact that respondents who are asked to complete the measures (the denominator for the cooperation rate) are those who agreed to participate in the nurse visit, so they are selective of more cooperative respondents. When non-participation in the nurse visit is taken into account, ELSA tends to have slightly lower response rates than SHARE on most measures (grip strength, lung strength, chair stand), though similar or somewhat higher response rates than HRS. Response rates on the blood sample are very similar for HRS and ELSA; this is surprising given that ELSA collects a whole blood sample, whereas HRS collects dried blood spots.

Both ELSA and SHARE tend to have lower baseline and follow-up interview response rates than HRS, and this may account for some of the difference in cooperation and response rates across surveys. Thus, those who are asked to do physical measures in ELSA and SHARE may be a more compliant group to start with. Additionally, ELSA and SHARE respondents are more familiar with the tests as the results are based on the second (or third) wave in which the respondents were asked to do the measures. For HRS, 2006 was the first time most respondents were asked to do physical measures or biomarkers. ELSA and SHARE respondents who did not like doing these measurements may have already dropped out of the study.

Table 4. Country-specific Response Rates for SHARE

Country	Grip	Lung	Walking	Chair stand

Austria	87.4	86.6	52.5	80.9
Germany	91.9	89.5	41.1	85.6
Sweden	94.3	94.5	69.5	88.0
Netherlands	95.2	95.8	77.6	91.2
Spain	86.8	86.8	50.0	82.1
Italy	86.0	80.2	50.8	74.9
France	88.4	80.5	58.6	81.8
Denmark	96.6	95.2	76.9	93.7
Greece	90.8	86.7	52.9	82.3
Switzerland	96.3	95.0	72.8	92.4
Belgium	95.4	94.1	67.3	88.7
Czechia	94.8	92.2	53.9	85.2
Poland	92.2	89.8	46.4	73.3
Total	92.1	89.6	59.2	84.5

Table 4 provides SHARE response rates for each measure by country. The rates tend to vary by country and by measure. As previously described, the overall response rate on the walking speed measure was the lowest of the four measures (59.2%) primarily due to the fact that the age-eligibility criteria is higher on SHARE than for HRS or ELSA. Respondents aged 75 or older may be more likely to be frail, unable to walk or unsure about the test. Likewise, interviewers may be less likely to persuade an older respondent to complete the walking speed if they are older. An additional limitation reported by SHARE interviewers was the lack of space to conduct the test (though this is also reported by ELSA interviewers). Response rates for all other measures were greater than 80% with the highest response rate obtained for grip strength (92.1%). The Netherlands and Denmark obtained the highest response rates on the four measures. Grip strength response rate was lowest in Italy (86.0%) and highest in Denmark (96.6%). Lung strength response rate was lowest in Italy (80.2%) and highest in the Netherlands (95.8%). Walking speed response rate was lowest in Germany (41.1%) and highest in the Netherlands (77.6%). The chair stand response rate was lowest in Poland (73.3%) and highest in Denmark (93.7%).

Interviewer Variability in Cooperation Rates

We also examined how cooperation rates varied across interviewers and nurses. Table 5 provides inter-quartile ranges for interviewer-specific cooperation rates for each of the measures. The inter-quartile range provides a measure of the average range in cooperation rates for the middle 50% of interviewers. For all measures in HRS and SHARE, and for walking speed in ELSA, the inter-quartile ranges are based on interviewers who conducted more than 2 interviews. For ELSA, inter-quartile ranges for all other measures are based on nurses who conducted more than 2 assessments.

For both HRS and SHARE, and for walking speed in ELSA, the inter-quartile ranges are fairly large, suggesting a high degree of variability in cooperation rates across interviewers. For example, the results for walking speed suggest that cooperation rates for interviewers whose rates fall in the middle 50% for this measure vary by 19 percentage points in HRS, 14 percentage points in ELSA, and 69 percentage points in SHARE. In ELSA, the inter-quartile ranges are extremely small for most measures. Cooperation rates for most measures in ELSA were very high, and the small inter-quartile ranges suggest that this was consistent across nurses. Inter-quartile ranges tend to be larger for measures that have lower cooperation rates, such as walking speed, blood and saliva for HRS, blood and saliva in ELSA, and walking speed and chair stand in SHARE. The inter-quartile range for the grip strength and the lung strength measures is similar for HRS and SHARE (example lung strength: .14 and .18) but much lower for ELSA (.014). This appears to be reflective of greater variability in cooperation rates when measures are conducted by interviewers than when they are conducted by nurses.

Table 5. Interviewer Variability in Cooperation Rates (interquartile ranges)

Measure	**HRS** 2006	**ELSA** 2004	**SHARE** 2006
Blood Pressure	0.12	0.019	--
Grip Strength	0.12	0.013	0.14
Lung Strength	0.14	0.014	0.18
Walking Speed	0.19	0.14	0.69
Balance Tests	0.14	0.039	--
Chair Stand	--	0.086	0.21
Height	0.11	0.025	--
Weight	0.13	0.032	--
Waist	0.11	0.038	--
Hip	--	0.040	--
Blood	0.18	0.098	--
Saliva	0.18	0.18	--

Notes for Table 5:
1) For HRS, the balance test refers to semi-tandem, the only balance test that was administered to all Rs.
2) For SHARE, results are based on preliminary data (release 0).

Distributions for Grip Strength and Walking Speed Results
Figures 1a through 2b provide key distributional statistics for grip strength and walking speed results for all three studies. Results from SHARE are provided for each country. The grip strength measurement is based on the highest value recorded from the measurements that were taken (generally two on each hand). Walking speed is measured as meters per second to adjust for slight differences in the length of the walking course across studies.

The median grip strength measurements for both men and women fall in a tight range (42 to 46 for men and 26 to 29 for women) for all countries except Spain (Tables 6a and 6b). The 25^{th} and 75^{th} percentiles follow a similar pattern. Spain represents something of an outlier with considerably lower results on grip strength for the three percentiles (25^{th}, 50^{th}, 75^{th}); this difference is particularly pronounced for men. There tends to be more variation in the minimum and maximum values across countries, with the minimum reading ranging from 1 to 12 for men and 2 to 10 for women, and the maximum reading ranging from 72 to 100 for men and 48 to 86 for women.

There is considerable variation in walking speed across countries (Tables 7a and 7b). Sweden and Denmark have the highest median walking speeds for men (.85 m/s), and Denmark and Switzerland have the highest for women (.82 and .80 m/s, respectively). The lowest median walking speed results are found in Spain and Greece, where the rates for both men and women are one-third to one-half lower than those in Denmark.

Figure 1a. Summary Statistics for Highest Grip Strength Measurement (kg) for Men

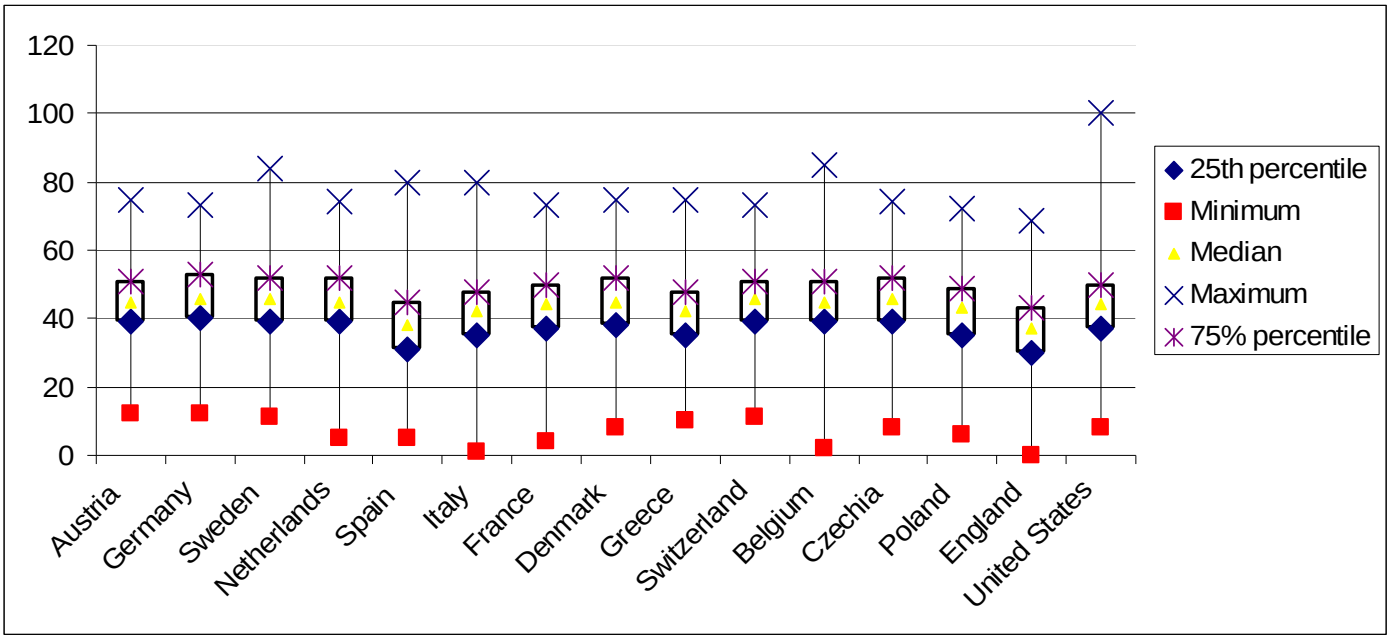


Figure 1b. Summary Statistics for Highest Grip Strength Measurement (kg) for Women

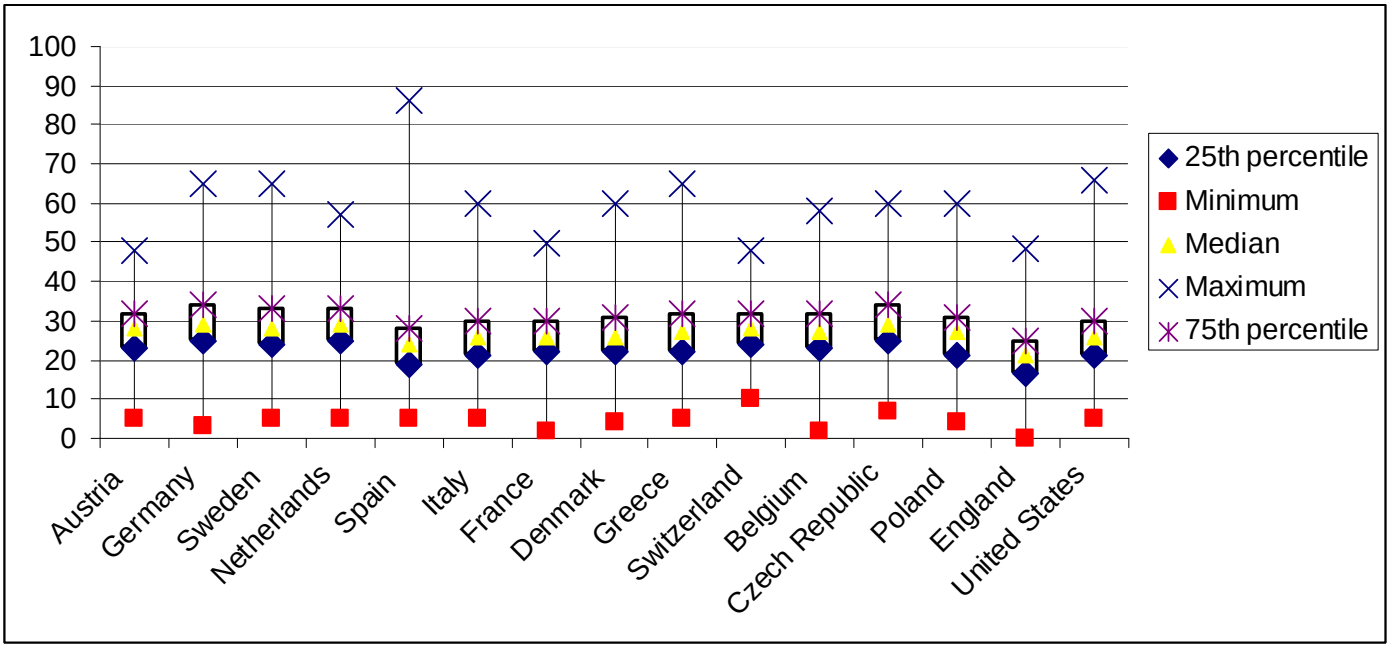


Figure 2a. Summary Statistics for Walking Speed (m/s) for Men

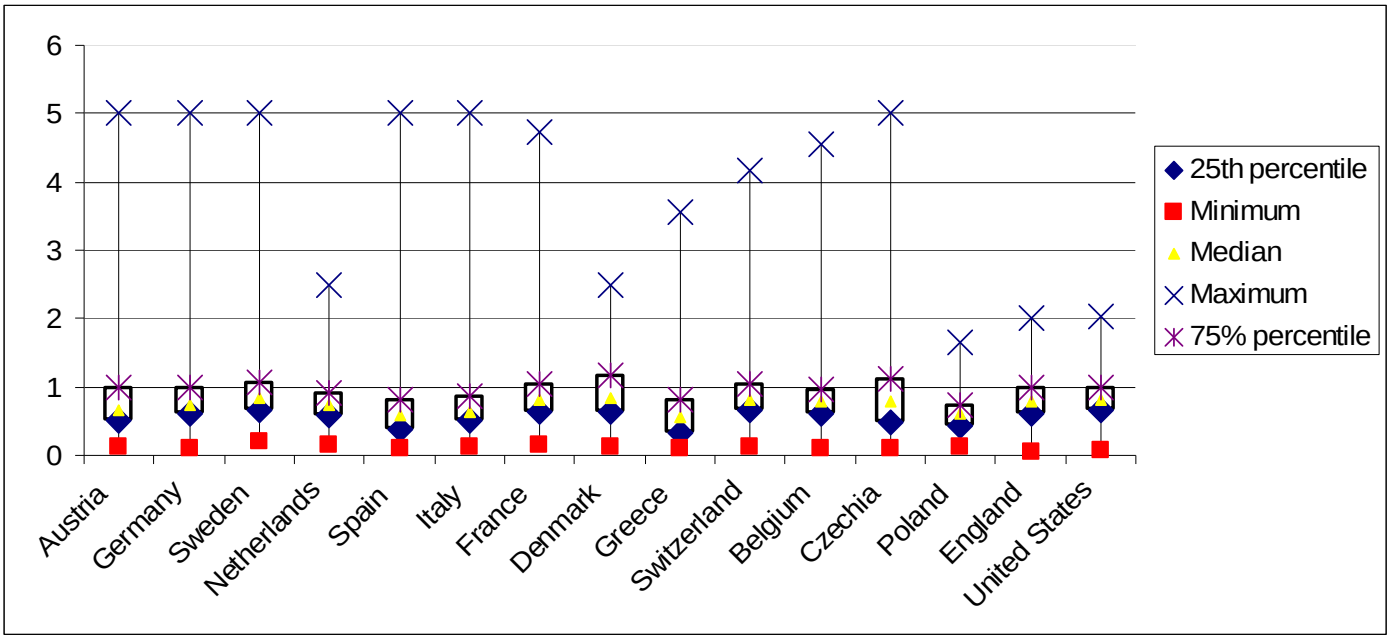
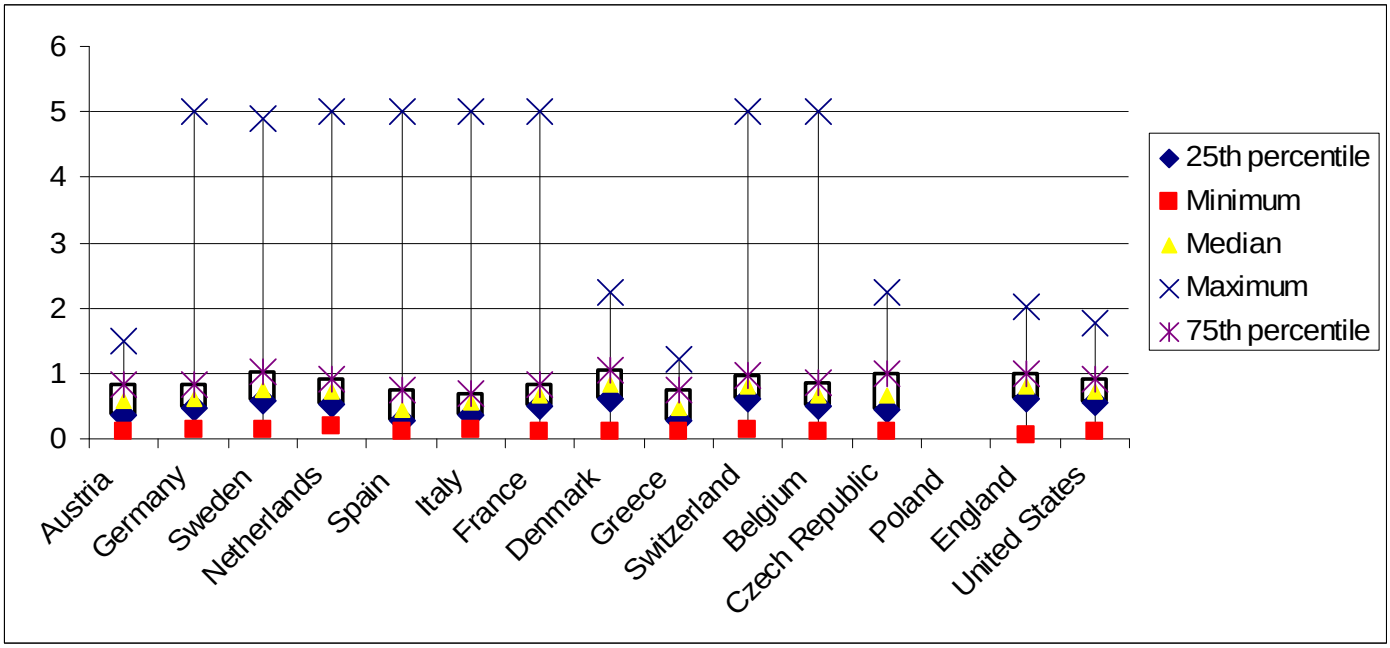


Figure 2b. Summary Statistics for Walking Speed (m/s) for Women



Discussion

Variability in both measurement level response rates and measurement results are observed across the three studies. This variation may be due to a number of factors including differences in the measurement protocols, differences in eligibility criteria, variation between interviewers, as well as population based differences. Differences in the personnel who administer the measures (nurses in ELSA versus interviewers in HRS and SHARE) may also play a role in the differences observed. The higher cooperation rates for height, weight and waist on ELSA compared to HRS may be at least partly a function of respondents being more comfortable having nurses conduct these measurements. These are standard measures carried out by nurses during most visits to the doctor. Respondents may not be as comfortable with an interviewer taking these measures, as it may be seen as more of an invasion of privacy since these tend to be sensitive measures. On the other hand, cooperation rates for the somewhat more invasive measures- blood and saliva- are more similar for HRS and ELSA. This is somewhat surprising in that we would expect respondents to be more comfortable having these measures performed by medical personnel. One possible explanation for the similarity of these rates is that both these measures are rather more burdensome for ELSA than HRS. For blood, HRS and ELSA obtain similar cooperation and response rates, but ELSA collects a full blood sample rather than blood spots. For saliva, ELSA respondents are left to complete four measurements on their own, on the day following the nurse visit or as soon as possible after that. The positive influence of having a nurse explain the measure appears to be lost.

The differences observed in the walking speed cooperation rates and measurement outcomes are likely due in large part to the age differences in the selection criteria but this warrants further investigation. Each of the three studies has different age-eligibility criteria for the walking speed test: ≥60 for ELSA, ≥65 for HRS and ≥75 for SHARE. While walking speed may decline with age, frailty and the need for walking aids increases with age. Thus it is not surprising that cooperation rates and average walking speed vary across the studies. The lower cooperation rate for walking speed in SHARE is also likely influenced by greater space restrictions in many respondents' homes, particularly those of older respondents.

Both ELSA and HRS obtain signed consent before obtaining the measures, provide literature on the measures and provide a report of results. Although the content of these materials varies between the two studies, it is possible that the additional information was encouraging to respondents or provided a distraction during the study thus increasing participation. The promise of results may also be seen as a "perk" to respondents and provides an incentive to conduct the measures. The results are shared with the respondent's doctor on ELSA but not on HRS. This difference is largely due to regulations based on the health care systems or the expectations of the relevant ethics committees in both countries. SHARE does not provide respondents with results or with literature regarding the measures. The cooperation rates are comparable across all three studies, with the exception of walking speed in SHARE, which may lead one to believe that the literature provided does not influence response. However, this is difficult to determine without a controlled experiment as there may be other factors in each study location that influence response.

As noted previously, there is some variation in protocols across the studies, and this may lead to variation in the measurements themselves. Because the measures are conducted by nurses rather than interviewers, ELSA tends to employ more precise and somewhat more invasive procedures. This is most notable in the measures of lung strength, height, waist, and the whole blood and saliva samples. The more precise measures do have a cost, however, as both the nurse's visits as well as the equipment used are significantly more expensive than the equipment interviewers use on HRS and SHARE. The costs versus the benefits must be taken into account when determining who will conduct the measures on a large, national study, as well what equipment will be used. The number of measures conducted also varies greatly across the studies. SHARE conducts four measures, HRS conducts ten and ELSA conducts thirteen. There is also variability in the number of repetitions conducted with the measures.

These results also demonstrate the need to focus on data quality during data collection as well as in the post-data collection phase. The measurement results presented here are based on preliminary data from the SHARE which may account for the greater variability. It appears that outliers exist for both walking speed and grip strength, which influences the distribution of the descriptive statistics. The outliers may be due to measurement error or to data entry error. Validation of data entry is a means of ensuring the quality of the data entry. On both HRS and SHARE, interviewers use a booklet while administering the measures. The measurements are recorded in the booklet and then directly data entered. Error may occur while conducting the measure, recording the result in the booklet, or transferring the result to the computer. All of this suggests the need for adequate interviewer training and certification, review of interviewer data, and re-training if necessary. Some measures may be subject to greater variation and error if they are not implemented according to the protocol more than others. For example, interviewers are trained to demonstrate the walking speed and to repeat the words 'please walk at your normal pace, just as if you were going to the shops'. Interviewers often observe that some respondents are inclined to 'race' and may need to be asked to repeat the measure. The extent to which respondents comply with the instructions may differ across countries and time. In any case, the variation may not reduce the value of the measure as much as it first appears since performance at the lower end of the spectrum, when respondents experience considerable decline, provides the most telling data and is easiest to measure accurately. It is possible that as new technologies such as the 'magic carpet' planned for the Irish longitudinal study of ageing (TILDA) are developed and refined, more accurate means of measurement may become portable.

These three studies provide an example of how anthropometric and biological measures can be conducted on large scale studies by trained interviewers. This offers a cost-effective approach to collecting these measures in areas in which incorporating a staff of trained nurses may be prohibitive due to the high costs. This is especially the case with studies taking place in geographically disperse areas, such as the United States or across multiple countries in Europe, where scheduling and deployment of medical staff presents logistical difficulties. It should be noted that the intent of this paper is not to compare the measurement results themselves between studies or countries nor to describe the frequency or incidence of physical impairments, but rather to compare general patterns of response rates and examine differences in measurement results.

When international or cross-study comparison is a central goal of research, it is important that training methods are standardized across studies, that the procedures are well documented, and that communication and collaboration with researchers takes place as early as possible. These factors will provide for more robust international comparisons and allow researchers to both observe differences and similarities while reflecting on the possible reasons for cross-cultural differences.

References

McDade, T.W., S. Williams & J.J. Snodgrass. 2007. What a drop can do: Dried blood spots as a minimally invasive method for integrating biomarkers into population-based research. *Demography* 44(4): 899-925.

Doll R, Peto H. Mortality in relation to smoking. 40 years observation on female British doctors. *BMJ* 1989;**208**:967–73.

Alcser, K. H., Benson, G.D., and Guyer, H.M. (2008, forthcoming). Training for SHARE Wave II. Ch. 8. Börsch-Supan, A.; Brugiavini, A.; Jürges, H.; Mackenbach, J.; Siegrist, J.; Weber, G. (eds.). *First Results from the Survey of Health, Ageing and Retirement in Europe – Wave II*. Mannheim, Germany: Mannheim Research Institute for the Economics of Aging.

Health, wealth and lifestyles of the older population in England: The 2002 English Longitudinal Study of Ageing Technical Report. Authors: Rebecca Taylor, Laura Conway, Lisa Calderwood, Carli Lessof, Hayley Cheshire, Kate Cox and Shaun Scholes. July 2007, National Centre for Social Research.

Health, wealth and lifestyles of the older population in England: THE 2002 ENGLISH LONGITUDINAL STUDY OF AGEING. Michael Marmot, James Banks, Richard Blundell, Carli Lessof and James Nazroo. ISBN: 1-903274-34-6, December 2002.

Websites for studies cited:

National Child Development Study (NCDS): http://www.cls.ioe.ac.uk/studies.asp?section=000100020003

Avon Longitudinal Study of Parents and Children (ALSPAC): http://www.alspac.bris.ac.uk/

English Longitudinal Study of Ageing (ELSA): http://www.ifs.org.uk/elsa/index.php

Survey of Health, Ageing and Retirement in Europe (SHARE): http://www.share-project.org/

Health and Retirement Study (HRS): http://hrsonline.isr.umich.edu/

National Health and Nutrition Examination Survey (NHANES): http://www.cdc.gov/nchs/nhanes.htm

National Social Life, Health, and Aging Project (NSHAP): http://www.norc.org/projects/National+Social+Life+Health+and+Aging+Project.htm

Acknowledgements

Support for the Health and Retirement Study research was provided by the National Institute on Aging (Grant No. U01 AG009740-18).

The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001- 00360 in the thematic programme Quality of Life). Additional funding came from the US National Institute on Ageing (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064). Data collection for wave 1 was nationally funded in Austria (through the Austrian Science Foundation, FWF), Belgium (through the Belgian Science Policy Office), France (through CNAM, CNAV, COR, Drees, Dares, Caisse des Dépôts et Consignations et le Commissariat Général du Plan) and Switzerland (through BBW/OFES/UFES. The SHARE data collection in Israel was funded by the US National Institute on Aging (R21 AG025169), by the German-Israeli Foundation for Scientific Research and Development (G.I.F.), and by the National Insurance Institute of Israel. Further support by the European Commission through the 6th framework program (projects SHARE-I3, RII-CT- 2006-062193, and COMPARE, CIT5-CT-2005-028857) is gratefully acknowledged. For methodological details see Boersch-Supan and Juerges (2005)."

ELSA has been developed through a collaboration between University College London, the Institute for Fiscal Studies, and the National Centre for Social Research (NatCen), with specialist advice provided by academics at the Universities of Cambridge, Nottingham, East Anglia and elsewhere. Funding for the first four waves of the study has been provided by the US National Institute on Aging, and a consortium of British Government Departments. ELSA has also received funding from the National Institutes of Health (Grant Number: 5R01 AG017644-08).

The authors would like to thank Maggie Mo and Susan Nunn from the National Centre for Social Research in London for their assistance with analysis of the ELSA data.