

MEETING ABSTRACTS

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European Workshop on Health and Disability Surveillance in Ageing Populations (EUWAP)

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INTRODUCTION

I1

European and global approaches to survey ageing populations and perspectives for joint approaches to measure age-related health outcomes

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Age-related diseases and functional decline put health care systems at a challenge. It is still unclear, whether a compression or extension of morbidity or some sort of balance is likely to be expected. Probably, different scenarios may either coexist or change depending upon both the type of health outcome (particular diseases, multi-morbidity and disability) and contextual factors (socioeconomic, cultural and political). Population-based studies at the national or regional level will provide valid and comprehensive information on age-related changes in population health, as continuous health monitoring will permit analyses of time trends. Prospective studies on lifetime health trajectories are necessary to identify determinants of healthy ageing and critical phases of decline. A premise to achieve all this including cross-national comparability is to establish a consensus platform for harmonising methods, key concepts and indicators.

Against this background, the 2nd European Workshop on Health and Disability Surveillance in Ageing Populations (EUWAP) held at the Robert Koch Institute (RKI) in Berlin, Germany on November 22-23, 2012, pursued two goals, (1) to take stock of existing European and global approaches for surveying ageing populations, and (2) to identify perspectives for joint future collaborations related to cross-national comparisons and the harmonisation of methods and indicators. The presentations and plenary discussions unfolded the large differences which currently still exist regarding concepts, indicators and instruments to assess healthy ageing as well as age-specific aspects of health, e.g. multi-morbidity, frailty, and disability to perform activities of daily living.

In her keynote lecture, Dorly Deeg highlighted the need for a priori harmonising concepts and instruments by illustrating difficulties arising from early post-harmonisation approaches in two European projects, the EU-funded Comparison of Longitudinal European Studies on Ageing (CLESA, 2001-2004) and more recently, the European Project on Osteoarthritis (EPOSA, 2009-2013). Large EU-funded research consortia such as the Survey of Health, Ageing and Retirement in Europe (SHARE) and the Consortium on Health and Ageing: Networks of Cohorts in Europe and the United States (CHANCES) have taken efforts to harmonise data collection. As reviewed by

Simone Croezen and co-authors, SHARE results have been compared with aggregate results from large national or cross-national health surveys, such as nationwide Health Interview Surveys (HIS), the European Health Interview Survey (EHIS), the European Social Survey (ESS), the European Union Labour Force Survey (EU-LFS) and the European Union Statistics on Income and Living Conditions (EU-SILC). Comparisons of SHARE results will be extended to both, aggregate and individual-level data from other national health surveys. CHANCES has implemented a specific work package (CHANCES Health Module), in order to establish a core set of health indicators that provide comparable data between all participating cohort studies. In their presentation, Simone Croezen and Martin Bobak outlined the main concepts and methods applied. The EU-funded research consortium of Collaborative Research on Ageing in Europe (COURAGE) implemented the WHO standard to assess disability and health (ICF; International Classification of Functioning, Disability, and Health). Matilde Leonardi summarised the COURAGE protocol which addresses research, policy and civil society for defining future directions in view of an ageing Europe. A global perspective was provided by Somnath Chatterji who in his presentation illustrated the WHO Study on global Ageing and Adult Health (SAGE). This study has been ongoing for more than a decade using instruments adapted from those of the World Health Survey (WHS) and sixteen other surveys on ageing. SAGE covers multiple domains of health and populations aged 50+ years in six middle and low income countries (China, Ghana, India, Mexico, Russian Federation, and South Africa). Cross-study comparisons with other large studies like SHARE are part of the SAGE concept.

Apart from differences between countries and cohorts, comparisons of results between different studies are hampered by the complexity of health concepts (e.g. multi-morbidity, functional capacity, and disability) and health determinants (e.g. health-related behaviour, quality of healthcare, and socioeconomic context conditions). More importantly, specific components of these concepts are changing over time requiring adaption of indicators and instruments, as Marti Parker emphasised.

Which social, psychological and biological factors are setting the course for healthy ageing already in young age and across the life-time are major questions focused by an inter-disciplinary project on Healthy Ageing across the Life Course (HALCyon) led by Diana Kuh. HALCyon encompasses data from nine birth cohorts in Great Britain. In the context of a life course perspective, health inequalities are one out of seven main priorities worked by Carol Jagger within FUTURAGE, an EU-funded project of 12 EU-countries and Israel which developed a road map for the next decade of ageing research in Europe.

Frailty and disability are important dimensions of health in older people, but are unevenly defined and measured. The above mentioned WHO classification of disabilities (ICF) is mainly focusing on physical functioning. KORA-Age, a longitudinal multi-disciplinary cohort study (region Augsburg, Germany) integrates functioning based on ICF into a comprehensive view

on prevalence and determinants of multi-morbidity, disability and successful ageing, as Eva Grill explained. According to the widely used Fried frailty index, three out of five characteristics (weakness, slowness, exhaustion, weight loss, physical inactivity) characterise a person as frail. However, a generally accepted definition is still pending. A modification of the Fried Frailty Criteria introduced by Hermann Brenner initiated a lively discussion. His modified index predicted a higher mortality even among 50-64 year olds based on ESTHER, a cohort study of older adults in Saarland, Germany.

An important indicator of both disability and frailty is slower gait speed. New data from the English Longitudinal Study on Ageing (ELSA), presented by Panayotes Demakakos revealed a bidirectional association between gait speed and depressive symptoms. How changes in self-rated health, health behaviour, social participation and related socioeconomic conditions are interacting, has been investigated in the German Ageing Survey (DEAS). As pointed out by Susanne Wurm, DEAS as an interview-based survey system including repeated nationally representative surveys of persons aged 40+ years, permits comparisons between different birth cohorts at the same age and provides the option to adapt to new indicators every six years. The continuous national health monitoring system at the RKI also permits time trend analyses, although comparisons are still limited to only a few points in time. As exemplified by Christa Scheidt-Nave in her presentation, several health indicators relevant to the population 65-79 years can be compared between the first wave of the German Health Interview and Examination Survey for Adults (DEGS1) conducted in 2008-2011 and the German National Health Interview and Examination Survey conducted more than a decade earlier in 1998.

EUWAP came at the right point in time and with the clear message to strengthen harmonisation efforts. For the future, even closer collaboration and net-working between the different research consortia are intended, in order to facilitate pooled analyses, cross-country comparisons, and validation studies.

Please see Additional file 1 for the programme of the EUWAP workshop.

KEYNOTE LECTURE PRESENTATIONS

K1

Where we are now – Monitoring health and disability in older European populations and what harmonisation efforts (CLESA, EPOSA) could tell

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In all countries of Europe, the population is ageing. This shift involves information needs on a variety of ageing-related themes. For better insight into similarities and differences among European countries, there is an increasing platform to support the added value of comparative analyses on ageing across the European Union. As many survey data on ageing exist, the most fruitful way forward is to share datasets and to harmonise concepts, indicators, and methods as much as possible. However, harmonisation may involve various difficulties. Two examples are given.

In the context of the EU fifth Framework Programme, the Comparison of Longitudinal European Studies on Ageing (CLESA, 2001-2004) project was among the first projects to attempt harmonisation of data on health and quality of life. Post-harmonisation was undertaken using population-based datasets in six countries. An example is given of the harmonisation process of the concept of ADL disability, which allowed the comparison of disability-free life expectancy across the six countries. A North-South gradient was found, showing shorter disability-free life expectancies in Spain, Italy and Israel as compared to Finland, Sweden and the Netherlands. This gradient was suggested to be caused by differences in educational level and in family culture.

The European Project on Osteoarthritis (EPOSA, 2009-2013) (<http://www.eposa.org>) on the personal and societal consequences of osteoarthritis in older people comprises a more recent attempt at harmonisation, using population-based cohort studies in six countries. Here, post-harmonisation was less successful in that the main variable, osteoarthritis (OA), was defined

in too different ways. The heterogeneity of OA definitions hampers comparing prevalence rates, and possibly, associations of OA with quality of life. Therefore, in a follow-up project, new data collection in the six cohorts was carried out, with pre-harmonisation of measurement instruments, including a standardised clinical assessment of OA. Preliminary findings show differences in OA prevalence, with higher rates in Southern Europe (Italy and Spain) than in middle and northern Europe.

In conclusion, post-harmonisation may be a cost-effective approach to use existing data, but may not always lead to comparable data. Even in case of pre-harmonisation, for any findings from multi-country studies, it should be considered to what extent differences observed are still linked to differences in data collection or are indicative of real cross-national differences.

SPEAKER PRESENTATIONS

S1

World Health Organisation's (WHO) Study on Global Ageing and Adult Health (SAGE)

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The numbers of older adults are growing rapidly globally with the rate of increase larger in less developed countries. As life expectancies increase around the world, it is a priority to determine if more of the extra years being added are healthy years or years that are likely to be spent in poor health.

The Study on Global Ageing and Adult Health (SAGE) of the World Health Organisation (WHO) (<http://www.who.int/healthinfo/sage>) is a longitudinal nationally representative household survey that includes respondents 50 years and older with a smaller, comparative cohort of adults aged 18-49 years in China, Ghana, India, Mexico, Russia and South Africa with a sample size of over 40,000 respondents selected using a multi-stage cluster design. Additionally, eight health and demographic surveillance sites (HDSS) in Bangladesh, Ghana, India, Indonesia, Kenya, South Africa, Tanzania and Viet Nam with an additional combined sample size of over 45,000 respondents are a part of SAGE. The Collaborative Research on Ageing in Europe (COURAGE) project has also used SAGE methods and instruments to collect data in Finland, Poland and Spain.

The objective of SAGE is to improve the empirical understanding of the health and well-being of older adults through provision of reliable, valid and cross-nationally comparable data over time on key outcomes and determinants. Wave 0 was completed in 2004 with Wave 1 finalised in 2010. Wave 2 of SAGE is planned for later in 2013 and Wave 3 in 2015. The biomarker component of SAGE includes performance tests and the collection of dried blood spots in Wave 1. Dried Blood Spot (DBS) samples have been collected from approximately 40,000 respondents and stored. The assays for haemoglobin, glycosylated haemoglobin (HbA1c), high sensitivity C-reactive protein (hsCRP), Epstein Barr Virus (EBV) and HIV are being carried out initially with additional assays planned for the future. Future waves of SAGE will consider the collection of DNA samples.

First results from SAGE reveal significant declines in health over the life span with female and poorer respondents being in worse health at all ages. Chronic health conditions are extremely prevalent. Risk factors such as tobacco use, inadequate physical activity, obesity and hypertension are all very common. Poor health is associated with declining subjective well-being and shrinking social networks.

This suggests that there is little evidence of healthy ageing in these populations and that a concerted response will be required from health systems to address the needs of this rapidly growing segment of the population.

S2

Comparing health outcomes in SHARE with other European surveys

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In the Survey of Health, Ageing and Retirement in Europe (SHARE) (<http://www.share-project.org>), health measures were constructed based on a careful consultation process of health experts and previous health surveys. However, there have been limited efforts to examine the comparability of health data in SHARE. Therefore, we aim to compare self-reports of health based on incidence and prevalence of health outcomes in SHARE to estimates from parallel national and trans-national health surveys.

Prevalence of health outcomes in SHARE measured at baseline (2004/2005) were compared to prevalence estimates from the European Health Interview Survey (EHIS) (2006-2009), national Health Interview Surveys (HIS) (1997-2003), the European Social Survey (ESS) (2004/2005), the EU Statistics on Income and Living Conditions (EU-SILC) (2005) and the disability ad hoc module added to the European Union Labour Force Survey (EU-LFS-disability) (2002). Components of each of these surveys provide an element of comparison for a particular health dimension in SHARE. Across countries, agreement between surveys was described for self-perceived health, long-standing illness, global activity limitations, diabetes, hypertension, asthma, lung diseases, depression and overweight by age group, gender and educational level.

First results show substantial variation in the comparability of health prevalence assessed by SHARE with other health surveys, depending on the health indicator of interest. For instance, a good agreement with SHARE was found for self-reported diagnosed diseases assessed by EHIS and for overweight based on self-reported weight and height by EHIS and HIS. On the other hand, for self-perceived health, the agreement between SHARE and other surveys was poor. Furthermore, agreement varied across countries, making country-specific comparisons between surveys less reliable. Lack of agreement between surveys is studied in more detail concerning systematic differences in survey design, sampling strategies, responses and assessment modes. Investigating time trends will evaluate whether differences in prevalence of health indicators between surveys will also affect agreement among trends over time in prevalence of health measures across age, gender and education. These additional analyses will complete this first assessment of the quality of SHARE data on health. Besides, this research will highlight the overlap and complementarity between SHARE and other national and trans-national health surveys. By recognising health measures that could be harmonised between surveys and measures that are more exclusive, we could exploit the opportunities offered by having multiple measures of health in different surveys.

S3

Collaborative Research on Ageing in Europe project's aims and main results

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The FP7 Collaborative Research on Ageing in Europe project (COURAGE) (<http://www.courageproject.eu>) collected data on the determinants of health and disability in an ageing population, with specific tools for the evaluation of the role of built environment and social networks on health, disability, quality of life and well-being. The aims of the project were to develop a survey protocol for European studies on ageing and determinants of disability in ageing, demonstrating its reliability and validity, and to demonstrate substantial innovations in ageing survey methodology, providing a cross-population analysis and a baseline for European and international longitudinal data collection.

The project's fieldwork was conducted, from May 2011 to March 2012, on a sample of 10,800 persons from Finland, Poland and Spain. Mean age was 59.27 for Finland, 57.62 for Poland and 60.44 years for Spain.

On the whole sample a trend of increase in functioning difficulties with age and with levels of household wealth was observed, with older subjects and those with lower wealth reporting more difficulties. Quality of life is perceived as better in Finland and in Spain than in Poland. The levels of quality of life decrease with the increase of age, and in Poland this decreasing is significantly higher.

People from Finland showed the highest well-being, and those from Poland the lowest. Life evaluation worsened along the life span, whereas the affect tended to improve: positive affect increased and negative affect decreased in Finland and Spain. In Poland negative affect increased with age.

Worse social networks are associated with higher age, while higher level of education is associated with better social networks. Furthermore, better levels of social networks are related with living in rural places, for the three countries. Reported good or very good health is associated with a better persons-environment interaction; people younger than 50 perceived their neighbourhood environment as more usable. Country-specific differences were found: in general, Polish respondents reported worse person-environment interactions, and Spanish better interactions. In the objective evaluation of built environment was found that environment was assessed as more facilitative in Spain than in Finland.

In conclusion, the newly developed and validated COURAGE Protocol for Ageing Studies has proven to be a valid tool for collecting comparable data in ageing populations. The COURAGE Project created valid and reliable scientific evidence for disability and ageing research and policy development that showed cross-country comparability. It is therefore recommended that future studies exploring determinants of health and disability in ageing use COURAGE-derived methodology.

S4

A life course approach to physical capability: findings from the HALCyon research programme

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Healthy Ageing across the Life Course (HALCyon) (<http://www.halcyon.ac.uk>), funded by the UK New Dynamics of Ageing cross council research programme, brought together investigators on nine cohort studies covering 30,000 participants born between 1921 and 1958, to investigate how healthy ageing is affected by factors operating across the whole of life. Our focus is on three domains of healthy ageing: (1) physical and cognitive capability (2) psychological and social wellbeing, and (3) biological ageing at the cellular and physiological system levels.

This presentation focused on the lifetime determinants and consequences of physical capability, and the capacity to undertake the physical tasks of daily living. First we showed that objective measures of physical capability, such as grip strength, timed standing balance and chair rises, and walking speed were reliable indicators of ageing by carrying out two systematic reviews that revealed that reduced performance was consistently associated with subsequent mortality and morbidity, as well as reduced wellbeing. With harmonised HALCyon datasets we showed that capability declines with age, and that gender differences in grip strength diminish with increasing age. One question commonly asked is whether 'it all goes together when it goes'. While strong cross sectional studies show that physical and cognitive capability are strongly correlated, we identified only seven that had investigated change in fluid cognition with change in physical capability; findings were not sufficiently strong or consistent to support a common cause mechanism.

HALCyon research has shown that early life factors, such as birth weight, physical and cognitive development and childhood socioeconomic circumstances are associated with later life capability, either through maximising peak level of function at maturity or its rate of decline. In addition greater adult adiposity was associated with worse capability; the detrimental impact was greatest in the highest two fifths of BMI, and stronger in women than men. Finally there was little evidence that capability was affected by genetic factors or change in telomere length, but there were associations with cortisol levels, measured prospectively and cross-sectionally, which suggest that the ability to mount a good stress-induced response may be a marker of a more reactive and healthier HPA axis with implications for functional ageing.

The main implication of these findings is that health surveillance earlier in life may be able to identify those most at risk of accelerated ageing so that interventions to maintain physical capability and prevent future disability and frailty can be instigated.

S5

Major drivers of health inequalities in later life and future research needs

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Europe is the oldest region in the world and its life expectancy is currently increasing at around about 12 months every 5 years. When added to population re-structuring as a result of demographic change, this means that by 2060 30% of the European population will be aged 65 years and over and with those aged 80 and over being the fastest growing age group. The European Union is placing a high priority on healthy ageing and its key indicator is Healthy Life Years (HLY). It is already obvious from the variation in HLY that not all European populations are ageing healthily. For example in France, life expectancy at age 50 for women is 22.9 years, with 9.9 years of healthy life. In comparison women's life expectancy at age 50 in Latvia is 17.2 years, with only 4.3 years of healthy life.

In 2009 the European Commission funded the FUTURAGE project, whose aim was to develop a definitive road map for ageing research for Europe for the next 10-15 years. Seven major research priority themes were identified by FUTURAGE according to a standard format covering: the significance of the theme; the fundamental insights necessary for future research; an overview of current research knowledge; and the main priority topics within the general theme (full report available at <http://futurage.group.shef.ac.uk/road-map-launch-conference.html>). Here we focus on one of these seven themes, that of 'Unequal Ageing'.

Six challenges related to future European ageing research were identified in the area of unequal ageing: Monitoring inequalities; Health in work and retirement; Inequalities and discrimination on health; Ageing and migration; Focus on the very old; and Inequalities and discrimination in the labour market. These challenges, as well as examples of specific research questions, can be described in the context of a life course perspective and the World Health Organisation model of health transitions.

FUTURAGE represented the most extensive consultation ever conducted in this research area, and it included all major stakeholders and active users of ageing research. 'Unequal Ageing' was identified as one of the main research priorities for the road map and within this the challenge to monitor inequalities across Europe. To be able to address this challenge demands not only a concerted collection of truly harmonised measures across Europe, but also that they are appropriate at a country or regional level.

S6

Health trends and health indicators

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Among the myriad of indicators available for measuring health, which ones are most appropriate for following health trends over time in the elderly population? Health in older people is often characterised by the simultaneous presence of multiple conditions, with or without disease, which cannot be cured. Morbid conditions interact with the environment and with the ageing process in ways we do not yet understand. The biomedical model of health is not enough to describe and analyse health in old people. We must complement the model with models of health as multi-dimensional and contextual, that is, consider the impact of the social and physical environment.

When we attempt to measure changes in health over time, it can be difficult to discern what is change in health and what is contextual change. For example, living conditions, access to care, definitions and awareness of disease, and expectations change over time and affect prevalence rates of health indicators.

There are two main reasons to study trends: to monitor and estimate needs for care, and to understand the forces and factors driving population health. To estimate needs for, e.g., home help or institutionalisation, indicators that

encompass context may be most useful. For example, walking ability is contingent on access to walking aides. As aides have become better and more accessible, the needs for help with shopping may decrease, regardless of ability to walk without aides. To estimate needs for, e.g., orthopaedic care, indicators of range of motion, ability to kneel, and pain may be more useful. If we want to understand what is driving population health we also need a variety of health indicators, perhaps especially indicators that are less sensitive to contextual change. In the example above, the ability to kneel or a test of range of motion would be less dependent on contextual change compared to ability to walk a given distance.

In conclusion, studies of health trends require a variety of health indicators that reflect multiple dimensions of health. Indicators should have varying degrees of objectivity and dependence on contextual change. The greatest challenge in trend studies is often to maintain consistency in successive waves in regards to health indicators and fieldwork in order to maintain comparability over time.

S7

Development of a standardised instrument to assess ageing-related health outcomes in a comparable fashion in European ageing populations, the CHANCES Health Module

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The FP7 Consortium on Health and Ageing: Network of Cohorts in Europe and the United States (CHANCES) is a collaboration project of 14 large cohort studies in Europe and North America. The main aim is to investigate the rates, determinants and implications of cardiovascular diseases, diabetes, cancer, disability, fractures, cognitive functions and mortality in older persons. An important part of the project is the development of a health module to measure the most important age-related health outcomes.

The rationale for developing a short health module is that there is currently a wide range of instruments to measure health in older people. Health surveys have used different measures with varying degrees of validation, resulting in data that are often not comparable between studies, across populations and over time. The aim of the CHANCES module was to review the existing instruments measuring health and health-related variables and to develop a single consolidated battery of measures. This new health module should be self-standing and reasonably short, so that it can be added to existing studies not originally focusing on ageing.

The selection of health domains was based on systematic reviews and analyses of empirical data. The module includes a mixture of subjective and objective measurements of the following domains: general health status, cognitive functions, physical functions, disability, depressive symptoms, physical activity, anthropometry, weight loss, eyesight, hearing, oral health, sleep, quality of life and a blood sample. The objective measurements include cognitive functions (word recall, verbal abilities, executive function) and physical function tests (grip strength, chair rise, walk speed). The time requirement for the full module is under one hour; however, it has a core and an extended component for additional flexibility in terms of scope and timing. The module is currently piloted in 3 geographically diverse populations (Northern Ireland, Greece and Poland). The pilot data will be analysed to assess the timing, data missing and feasibility and examine the agreement between the new and existing instruments in different dimensions of health outcomes. The pilot data analyses may lead to modifications of the final version of the instrument.

The new instrument will provide standardised and comparable information on prevalence of health in elderly populations in Europe. Existing and new studies, not primarily focused on ageing, can use the module to extend the scope to the study of older persons. If the module is successful and is adopted by the research community, the CHANCES project will make an important contribution to comparable assessment of ageing-related health outcomes between populations and over time.

S8

The English Longitudinal Study of Ageing (ELSA): Depressive symptoms and physical performance

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The English Longitudinal Study of Ageing (ELSA) is a panel study of community-dwelling people aged 50 years or older in England. ELSA started in 2002-03 (baseline) with a sample of 12,099 people, who were recruited from households that have earlier participated in the Health Survey for England. The ELSA sample is designed to be nationally representative and thus far it consists of four cohorts that have been introduced to the study at different time points.

ELSA is a multidisciplinary study that aims to explore the dynamic relationships between health and disability, social participation, socioeconomic position, and quality of life at older ages. After the baseline, follow-up interviews take place every two years and health examinations every four years (the first health examination took place in 2004-05). Data on self-reported chronic diseases; limitations in activities of daily living and other disability; symptoms; geriatric syndromes; gait; cognition; pensions and income; wealth; housing; demographics; social participation and other psychosocial factors; well-being and quality of life; and health behaviours are collected during a personal (face-to-face) interview. Blood samples and measurements of lung function, strength and balance, and blood pressure are collected by a nurse during a health examination. Both interviews and health examinations take place at respondents' home. More information about the study can be found at: <http://www.ifs.org.uk/ELSA>.

The study below is an example of the complex longitudinal analysis that could be performed using the ELSA data. We studied the association between depressive symptoms (measured using the eight-item Centre for Epidemiological Studies-Depression scale) and gait speed (m/s). Our aim was to explore whether this association is bidirectional at older ages. We used four repeated measurements of both depressive symptoms and gait speed over six years of follow-up (from 2002-03 to 2008-09). We estimated conditional models using Generalized Estimating Equations. These models were initially unadjusted and then gradually adjusted for an earlier measurement of the outcome measure, time, and covariates including socio-demographic, clinical, behavioural, psychosocial, and cognitive factors. We found that the association between depressive symptoms and gait speed was bidirectional. Slower gait speed was a predictor of concurrent and future elevated depressive symptoms and sub-threshold and elevated depressive symptoms were predictors of concurrent and future slower gait speed. These associations remained significant in the final model except for the lagged association between slower gait speed and future elevated depressive symptoms. Depressive symptoms and physical decline appear to be comorbid and mutually related at older ages.

S9

Epidemiological approaches to frailty - contributions from the ESTHER study

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Frailty is an emerging concept in gerontology. Two popular approaches to quantify frailty include the deficit accumulation approach which quantifies frailty by the proportion of deficits from a list of symptoms, signs, diseases and functional limitations present (the so-called "frailty index" [FI]), and a rules-based approach which defines frailty by the presence of at least 3 of 5 criteria (exhaustion, unintentional weight loss, low grip strength, low gait speed, low physical activity) (Fried frailty criteria). We employed both concepts in the context of ESTHER, a cohort study of older adults in Saarland, Germany. Baseline data from ESTHER (N: 9,886; age: 50-75) were used to create a FI through a deficit accumulation approach. Baseline FI was evaluated by

age and sex and related to 10-year survival. Below 60 years of age, men had a higher FI than women. However, mean FI showed a stronger increase with age among women (3.1% per year) than among men (1.7% per year) and was higher among women at older age. Relative mortality (95% confidence interval) was 1.08 (0.84-1.39), 1.32 (1.05-1.66), 1.77 (1.41-2.22), and 2.60 (2.11-3.20) for the 2nd, 3rd, 4th and 5th compared to the 1st quintile of the FI. There was a strong dose-response relationship between the FI and mortality among both men and women and both younger (<65 years) and older subjects.

Frailty was operationalized using modified Fried frailty criteria among 3,112 participants aged 58 years or older who underwent extensive geriatric assessment during 8-year follow-up of the study. Frailty criteria were categorised either according to quintiles or using population-independent cut-points, which were derived from the literature. Although frailty prevalence was higher with the latter (8.9%) than with the former (6.5%) approach, agreement and correlation of frailty classification by both approaches was high (Kappa = 0.75, $r_{\text{Spearman}} = 0.84$). Sex differences in frailty prevalence were more pronounced using the population-independent approach. Similarly strong associations with socio-demographic, lifestyle and medical factors such as older age, female sex, smoking, and obesity were seen for both approaches.

Both the deficit accumulation approach and the rules-based approach are feasible and highly informative in epidemiological ageing research. The former is applicable and highly predictive of mortality even below 65 years of age. Modification of the Fried index by using population independent cut-points of frailty criteria may enhance comparability across studies.

S10

Multi-morbidity and disability, findings from the KORA-Age study

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KORA-Age is a multidisciplinary research consortium funded by the German Federal Ministry of Education and Research (FKZ 01ET1003). The objective of KORA-Age is to examine the prevalence and determinants of mortality, multi-morbidity, functioning and successful ageing in persons aged 65 years or older in a large cohort of randomly selected inhabitants of the region of Augsburg, Germany.

The KORA-Age project is carried out within the framework of KORA (Cooperative Health Research in the Region of Augsburg; <http://www.helmholtz-muenchen.de/en/kora-en/index.html>). The cohort includes all participants of the four cross-sectional MONICA/KORA Surveys S1-S4 conducted between 1984 and 2001 who were born in or before 1943, in total 9,197 persons. Within KORA-Age, a mortality follow-up was conducted in 2008 and 2011. In 2008/2009, a mailed questionnaire was answered by 4,565 individuals and a telephone interview with 4,127 individuals conducted. A physical examination was performed in a gender and age-stratified random sample of the cohort in 2009 in 1,079 persons. They were followed up three years later and a re-examination took place in 822 persons. Information was obtained from interviews, a self-assessment form and health examinations including morbidity, a comprehensive assessment on mental health, health services utilisation, medication and a complete characterisation of ageing-related biological parameters like cardiovascular and pulmonary function, tests of balance and stability, bone density, body composition and measures of multi-morbidity, frailty, disability and participation. In 2013 a group of older citizens will take part in qualitative

focus groups on the lived experience of neighbourhood and environment to evaluate participation in-depth in the region of Augsburg. The sampling area was geocoded.

Major advantages of the study include the longitudinal design of the study with a wealth of data from previous surveys, and the comprehensive approach to functioning based on the model and framework of WHO's International Classification of Functioning, Disability and Health (ICF). We propose this approach for integrating functioning into a comprehensive view of the prevalence and determinants of multi-morbidity, disability and successful ageing in interaction with personal and environmental factors.

S11

Health in older age: The German Ageing Survey (DEAS)

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How healthy are people as they age, what are possible causes and consequences, and what can be derived from this with a view towards health promotion in older people? The German Ageing Survey, funded by the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (DEAS; <http://www.german-ageing-survey.de>) provides data to answer these questions. DEAS is an on-going population-based, representative survey of community-dwelling people living in Germany. The survey started in 1996, and the fifth wave will be conducted in 2014. It comprises cohort sequential data, i.e., both repeated cross-sectional surveys and panel data for people aged 40 and over.

To date, DEAS has considered people born between 1911 and 1968, and over 14,700 participants have been interviewed face-to-face and been given written tests and questionnaires. The survey aims at knowing more about the living conditions and the quality of life of people in middle-age and later life, and at knowing more about changes over time, both on the individual and the societal level. Thus DEAS covers a large range of subject areas, including family and social networks, work and retirement, participation, economic situation, well-being, psychosocial resources, as well as health and health behaviour. The data allow both the analysis of individual health trajectories and health changes on the societal level: How healthy will older people be in the next years or decades? For this purpose, different birth cohorts can be compared that have reached the same age at different points in time.

The present findings suggest that birth cohorts born later report less illnesses, lower ailments and higher physical activity, which points to better health and health behaviour of subsequent cohorts. Overall, these findings are in line with those from other surveys in Germany, though the comparison of different studies is limited. One reason for this is the use of different health indicators, which is perhaps most evident in the measurement of chronic illnesses and multi-morbidity. Additionally, other factors such as the in- or exclusion of very old or institutionalised people and the use of cross-sectional surveys versus panel data might contribute to heterogeneous findings on health trends.

For the study of health trends in ageing societies, multiple health indicators are needed to allow for the fact that differences between various health components become more pronounced in later life. Aiming at harmonising concepts and instruments to assess healthy ageing, as initiated by the Robert Koch Institute, is therefore highly appreciated.

S12

Addressing health and ageing in the German national health monitoring system

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Public health systems all over the world need to get adapted to the relatively new and unprecedented fact of longevity. Data from periodically repeated national health surveys can provide useful information to health researchers, health politicians, and the public by monitoring age-related morbidity, functional decline, and disability in relation to behavioural risk factors and context factors, including socioeconomic, political, and cultural factors.

In Germany, annually repeated national health interview surveys (German Health Update, GEDA) have been used to study patterns of multi- and comorbidity in the German adult population. In the recently completed German Health Interview and Examination Survey for Adults (DEGS1, 2008-2011), self-reported as well as objectively measured health data related to chronic diseases, physical and cognitive functional capacities, and disability were collected. DEGS1 was designed to be nationally representative for German residents 18-79 years. Comparable data on several, but not all constructs and indicators are available from a previous national health survey for adults in Germany (German National Health Interview and Examination Survey 1998, GNHIES98).

For example, comparable information from both surveys was available for self-reported medical history of 15 chronic health conditions, subjective health and health-related quality of life as assessed by the 36-Item Short Form Health Survey (SF-36), health-related behaviour, socioeconomic determinants, health care services utilisation, various anthropometric and biochemical measures, and verified information on current medication use. First analyses show that survey-weighted, age-standardised prevalence estimates of multi-morbidity (≥ 3 concurrent chronic conditions), obesity (body mass index ≥ 30 kg/m²), and poly-pharmacy (use of ≥ 4 prescription medications within 7 days prior to the survey) significantly increased in the population 65-79 years of age between 1998 and 2008-11; this was more pronounced among men than among women. Norm-based age standardised means of physical functioning (SF-36) improved over the same time, particularly among women.

These results underline that it is important to distinguish between the concepts of morbidity and disability when evaluating age-related changes in population health over time, as has been pointed out previously. Functional capacity represents a third multidimensional health concept as represented in the International Classification of Functioning, Disability and Health (ICF). Measures of physical and cognitive capabilities in the population 65-79 years have first been collected in DEGS1. Following DEGS1 study participants over time and adding on to the panel in future DEGS waves, opens the perspective to study health trajectories and to test hypothesized causal relationships.

Cite abstracts in this supplement using the relevant abstract number, e.g.: Scheidt-Nave *et al.*: Addressing health and ageing in the German national health monitoring system. BMC Proceedings 2013, 7(Suppl 4):S12