

# The 26<sup>th</sup> REVES

## Conference

“Healthy longevity –  
Where you live or how you  
live?”

Edinburgh 28-30 May 2014





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**“Healthy longevity—Where you live or  
how you live?”**

Edinburgh 28-30 May 2014

Programme,  
Abstracts  
&  
List of Participants

We are very grateful to the AXA Research Fund for  
providing funding for 4 PhD students to attend





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## Welcome to the 26<sup>th</sup> REVES meeting

In 1999, I hosted the REVES conference in London and, although it was highly enjoyed by all, I vowed I would not host another. But I never learn – and here I am welcoming you to the 26<sup>th</sup> REVES conference in Edinburgh, Scotland.

The theme of this year's meeting is "Healthy longevity – is it where you live or how you live?" and with that it is particularly appropriate to hold REVES in Scotland. Areas, such as Glasgow, have the lowest life expectancies at birth in the United Kingdom – six years lower than the UK average – and 72% of Scottish areas are in the lowest fifth for life expectancy at birth and none are in the top fifth. We hope that the new research presented at this meeting will aid our understanding of how socio-economic position, diet and lifestyle contribute so that we can ensure that healthy longevity is available to everyone.



This year's **George Myers Lecture** will be given by Professor Tom Kirkwood CBE. Professor Kirkwood is Dean for Ageing at Newcastle University and Director of the Newcastle Initiative for Changing Age, having previously been Director of the Institute for Ageing and Health from 2004-2011. Educated in biology and mathematics at Cambridge and Oxford, his research is focused on the basic science of ageing and on understanding how genes as well as non-genetic factors, such as nutrition, influence longevity and health in old age. He is a Fellow of the Academy of Medical Sciences, Fellow of the Royal College of Physicians of Edinburgh and Honorary Fellow of the Faculty and Institute of Actuaries. Professor Kirkwood has held numerous scientific leadership positions and has advised government on ageing issues. He has published more than 300 scientific papers and won several international prizes for his research. His books include the award-winning *'Time of Our Lives: The Science of Human Ageing'*, *'Chance, Development and Ageing'* (with Caleb Finch) and *'The End of Age'* based on his BBC Reith Lectures in 2001. In 2009 he was awarded a CBE by the Queen for his services to medical science.

We hope you will enjoy this year's programme. REVES is known for its friendliness and collegiality and we have given time to allow for informal conversations around the formal presentations. Our desire this year was to encourage more 'new blood' into REVES and we are very grateful to the AXA Research Fund which has helped to enable this by providing four PhD students with funding towards attendance.

*Carol Jagger*

Carol Jagger  
AXA Professor of Epidemiology of Ageing  
Institute for Ageing and Health  
Newcastle University





## Preconference Workshop:

### Methods and Software for Calculating Health Expectancy

27 May 2014, 14.00-17.00

**Location: St Trinneans rooms in St Leonards Hall, Pollock Hall Campus**

The workshop aims to introduce and encourage researchers to use longitudinal data to estimate health expectancies. We will cover the basics of longitudinal data requirements for analyses and various software packages, with their advantages and disadvantages, although the focus will be on the IMaCH package. The workshop will finish with a question and answer session. A short report will be available that assists the users with practical support for IMaCH.

There are no prerequisites to attend the workshop, but some basic understanding of longitudinal data structures and health expectancy would be an advantage.

<b>13.15</b>	<b>Workshop and conference registration &amp; coffee</b>
<b>14:00</b>	Welcome
	Introduction to longitudinal health expectancies
	Software packages, data structure and examples tested
<b>15:00</b>	Tea break with discussion
<b>15:30</b>	Worked examples results and cautionary tales
	Pros and cons of software packages
<b>16:30</b>	Questions & answers, discussion
<b>17:00</b>	Close

# Conference programme

## Day 1 Wednesday

REVES Day 1 Wednesday 28.5.2014		
7.45	Registration Foyer of the John McIntyre Conference Centre and coffee	
9.00-9.30	Welcome Carol Jagger	
09.30-11.00	<b>Subnational variation in health expectancies</b>	<b>Session Chair: Herman van Oyen</b>
	Pia Wohland, Carol Jagger, Tony Fouweather, Fiona Matthews, Vikki O'Neill	Where we live or how we live-Explaining regional health expectancy variations in England
	He Chen, Xiaoying Zheng	The decomposition of health expectancy change during 1987-2006 among Chinese elderly population
	Daniel Kreft	Spatial patterns in long-term care in Germany and how they are linked to socioeconomic factors. A study based on the concept of disability-free life expectancy.
	Michel Poulain, Anne Herm	Where you were born and where you live, does it influence your mortality risk ? Evidence found with Belgian data.
11.00-11.30	Coffee	
11.30-13.00	<b>The Joint Action Healthy Life Years</b>	<b>Session Chair: Carol Jagger</b>
	Susanne Wurm, Julia Wolff, Benjamin Schütz	On the meaning of health and Primary Care supply for a positive view on aging
	Wilma Nusselder, Dagmar Wapperom, Caspar Looman, Hendriek Boshuizen	The impact of smoking control on Healthy Life Years
	Aïda Solé-Auró, Emmanuelle Cambois	Educational differentials in activity limitations across the European Union: methodological issues and first results.
	Herman Van Oyen, Nicolas Berger	The development of a blueprint for a Summary Measure of Population Health
13.00-14.00	Lunch JMCC Restaurant	
14.00-15.30	<b>Longevity and health</b>	<b>Session Chair: Marc Luy</b>
	Rossella Miglio, Alessandra Samoggia, Giulia Roli, Rosella Rettaroli	A spatio-temporal analysis of longevity in an Italian region
	Jennifer Ailshire, Eileen Crimmins, Hiram Beltran-Sanchez	Pathways to longevity among exceptional survivors in the Health and Retirement Study
	Rom Perenboom	Clustering people based on functioning and health
	Arnold Mitnitski, Kenneth Rockwood	Assessing biological aging: the origin of deficit accumulation arising from age associated increase in recovery time.
15.30-16.30	Coffee	<b>Poster Session</b>
16.30-17.30	<b>George Myers lecture</b>	<b>Session Chair: Jean Marie Robine</b>
	Tom Kirkwood	"Why and how are we living longer?"
19.00-23.00	Reception and Dinner at Dynamic Earth	

## Day 2 Thursday

<b>REVES Day 2 Thursday 29.5.2014</b>		
<b>8.15</b>	<b>Registration</b>	<b>Foyer of the John McIntyre Conference Centre and coffee</b>
<b>09.00-10.30</b>	<b>Trends in health expectancies</b>	<b>Session Chair: Dorly Deeg</b>
	A.H.P. Luijben, H. Galenkamp, D.J.H. Deeg	Trends in healthy life expectancy at age 85 in European countries are disappointing
	Zachary Zimmer, Mira Hidajat, Yasuhiko Saito	Recent changes in Life and Disability-Free Life Expectancy in China: Do they vary by rural/urban residence and education?
	Bernard Jeune, Henrik Brønnum-Hansen, Mohammed Duraidi, Khaled Qalalwa	Increasing disability-free life expectancy among older adults in Palestine from 2006 to 2010
	Lidia Loukine, Chris Waters, Colin Steensma, Bernard Choi	Health Adjusted Life Expectancy trends in Canada: preliminary results
<b>10.30-11.50</b>	<b>Coffee</b>	<b>Poster Session</b>
<b>11.50-13.00</b>	<b>Work, retirement and health</b>	<b>Session Chair: Phil Rees</b>
	Sandra Reynolds	Cohort differences in work disability among US adults
	Dorly Deeg, Philip Fontijn	The rise in statutory retirement age: consequences for work disability and post-retirement healthy life years in the Netherlands
	Carol Jagger, Pia Wohland, Tony Fouweather, Tom Kirkwood	Raising the retirement age: implications for UK and Europe
<b>13.00-14.00</b>	<b>Lunch</b>	<b>JMCC Restaurant</b>
<b>14.00-15.30</b>	<b>Health expectancies from longitudinal data</b>	<b>Session Chair: Fiona Matthews</b>
	Angelique Chan, Chi-Tsun Chiu, Victoria Haldane, David Matchar, Yasuhiko Saito	Active Life Expectancy and functional limitations among older Singaporeans: gender, educational and ethnic differences
	Cecilia Albala, Lydia Lera, Hugo Sánchez, Alejandra Fuentes, Barbara Leyton	Socioeconomic and gender differentials in survival and healthy life expectancy in Chilean older people
	Fiona Matthews, Vikki O'Neill, Carol Jagger, Pia Wohland	Comparison of methods and programs for calculating health life expectancies
<b>15.30-16.00</b>	<b>Coffee</b>	
<b>16.00-17.10</b>	<b>The influence of past and current circumstances</b>	<b>Session Chair: Bernard Jeune</b>
	Scott Lynch, J. Scott Brown	Region of socialization vs. region of current residence and mid-to-late adulthood health outcomes in the US
	Patrick Coate	Children's education and parental health: Evidence from the PSID
	Jenjira Yahirun, Connor Sheehan, Mark Hayward	Children's Education and Parents' Health in Mexico: Evidence for "Upward" Transfers of Intergenerational Resources

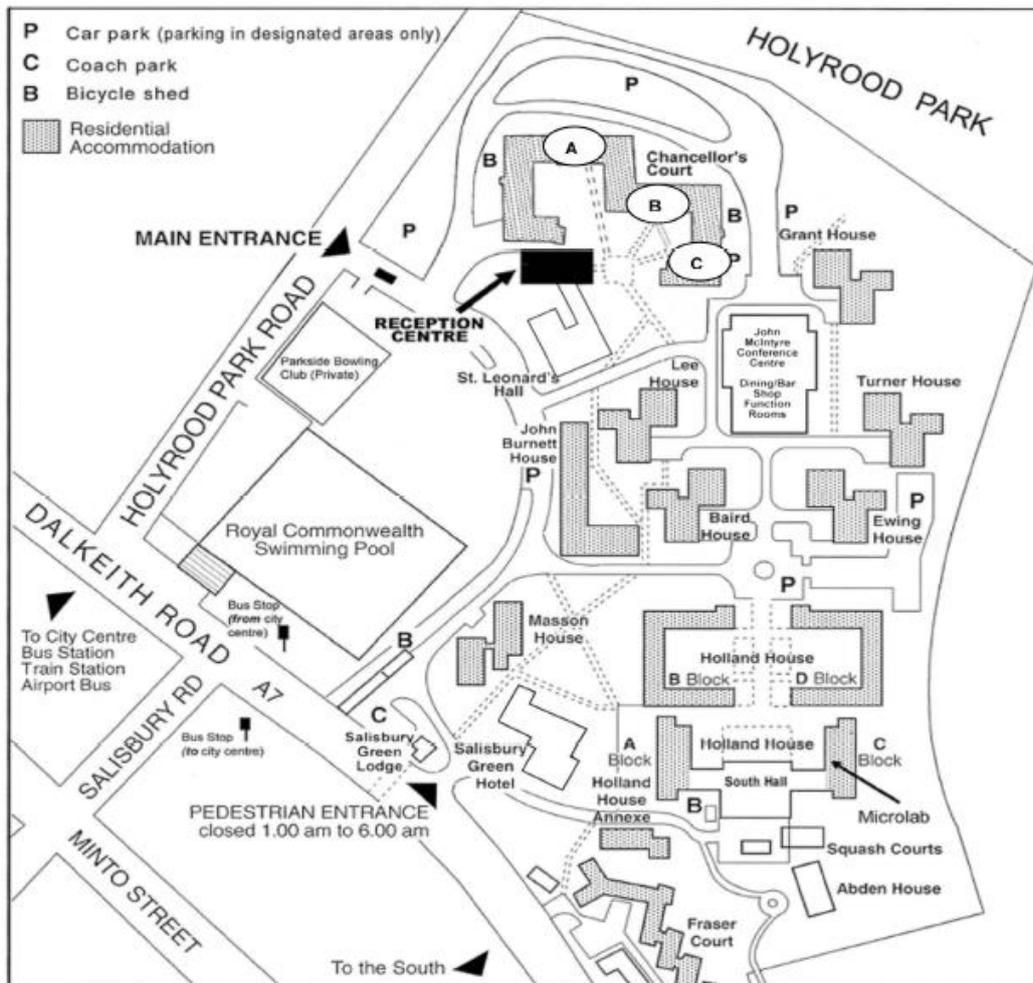
## Day 3 Friday

<b>REVES Day 3 Friday 30.5.2014</b>		
<b>8.45</b>	<b>Coffee</b>	
<b>09.00-10.45</b>	<b>Models for healthy longevity</b>	<b>Session Chair: Mark Hayward</b>
	Michael Wolfson, Presenter: Reed Beall	On the determinants of health inequalities – Explorations using the Theoretical Health Inequality Model (THIM)
	Philip Rees	A model for forecasting the health of the population, illustrated for local areas in Northern England
	Hui Zheng	Aging in the context of cohort evolution and mortality selection
	Patrick Deboosere, Françoise Renard	Life expectancy: between the elasticity of human longevity and the imperatives of societal systems
	Roberto Ham-Chande	Projections and operational scenarios on ageing and health
<b>10.45-11.15</b>	<b>Coffee</b>	
<b>11.15-13.00</b>	<b>How education influences healthy longevity</b>	<b>Session Chair: Wilma Nusselder</b>
	Chi-Tsun Chiu, Mark Hayward, Angeliq ue Chan	Educational gaps on compression of disability onset in the United States
	Henrik Brønnum-Hansen	Social differentials in the contributions of mortality and health to the impact of smoking on expected lifetime in good health
	Marc Luy, Christian Wegner-Siegmundt, Paola Di Giulio	Causal mechanisms behind the association of education and mortality in men: insights from a natural experiment
	Govert Bijwaard, Bertie Lumey, Frans van Poppel	Gain in life expectancy associated with higher education
	Mark Hayward, Robert A. Hummer, Isaac Sasson	Trends and group differences in the association between educational attainment and adult mortality: Implications for understanding education's causal influence
<b>13.00-14.00</b>	<b>Lunch</b>	<b>JMCC Restaurant</b>
<b>14.00-15.10</b>	<b>Trends in life and health expectancies</b>	<b>Session Chair: Sandy Reynolds</b>
	Peter Congdon	Modelling changes in small area Disability Free Life Expectancy: Trends in London wards between 2001 and 2011
	Isabelle Mairey, Peter Bjerregaard, Henrik Brønnum-Hansen	Gender difference in health expectancy trends in Greenland
	Yuka Minagawa, Yasuhiko Saito	Healthy Life Expectancy by prefecture in Japan: Changes in inequality between 2000 and 2010
<b>15.10-15.40</b>	<b>Closing Remarks and the announcement of next year's REVES meeting</b>	

**Useful information**  
**Pollock Hall campus map**

**Pollock Halls of Residence**  
**The University of Edinburgh**

Edinburgh First  
[www.edinburghfirst.co.uk](http://www.edinburghfirst.co.uk)  
 Telephone: 0131 651 2189

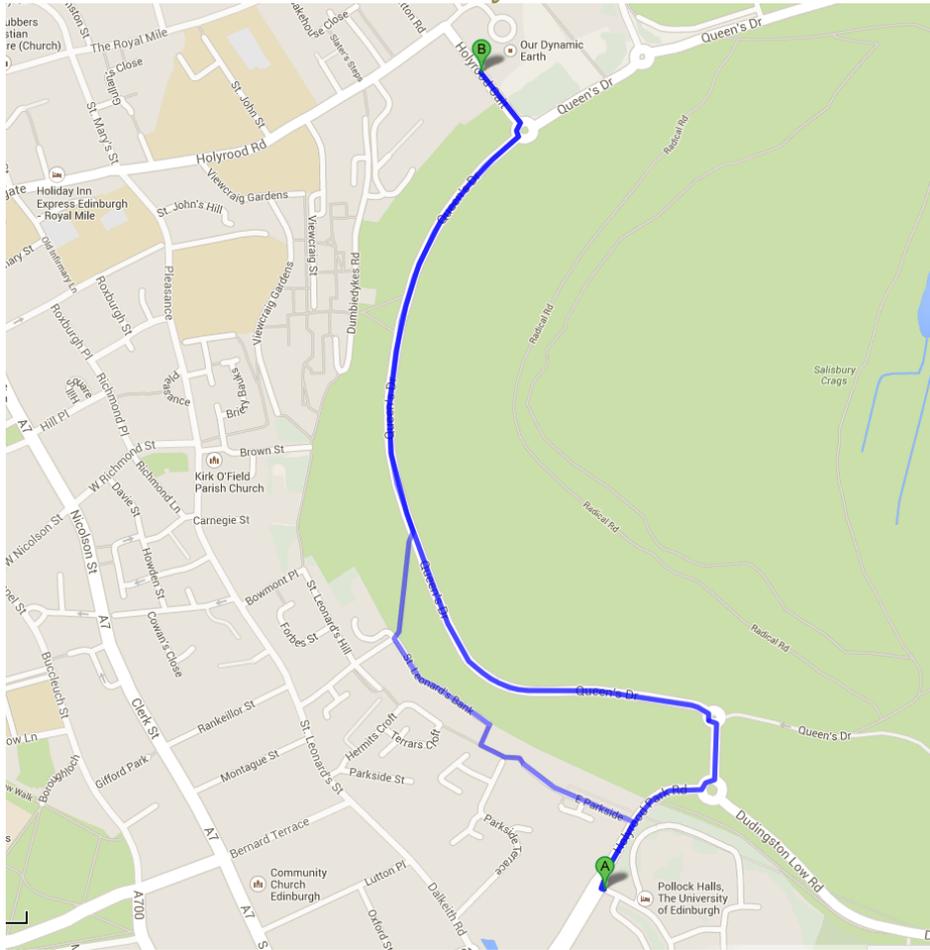


**Useful phone numbers**

Visit Scotland: 0131 332 2433  
 Central Taxis: 0131 229 4466  
 Lothian Buses info: 0131 555 6363  
 First Edinburgh bus info: 08708 72 72 71  
 Rail enquiries: 08457 48 49 50

Edinburgh Airport: 0131 333 1000  
 British Airways (reservations): 08708 50 98 50  
 British Airways (flight info): 0870 55 111 55  
 British Midland Airways: 0870 60 70 555  
 KLM UK: 08705 074 074

## Conference dinner location - Dynamic Earth



The walking distance between Pollock Hall Campus and Dynamic Earth is about 1 mile. And should take about 20 minutes to walk there.



### Pollock Halls of Residence

18 Holyrood Park Rd, Edinburgh EH16 5AY, United Kingdom

1. Head northwest toward Holyrood Park Rd
 

	go 13 ft
	total 13 ft
- ➡ 2. Turn right onto Holyrood Park Rd
 

About 1 min	go 325 ft
	total 338 ft
- ↶ 3. Turn left onto E Parkside
 

About 4 mins	go 0.2 mi
	total 0.2 mi
4. Continue onto Hermits Croft
 

About 47 secs	go 207 ft
	total 0.3 mi
- ➡ 5. Turn right toward St. Leonard's Hill
 

	go 131 ft
	total 0.3 mi
- ↷ 6. Slight right onto St. Leonard's Hill
 

About 5 mins	go 0.3 mi
	total 0.6 mi
- ↷ 7. Slight right onto Dumbiedykes Rd
 

About 5 mins	go 0.2 mi
	total 0.9 mi
- ➡ 8. Turn right onto Holyrood Rd
 

About 2 mins	go 0.1 mi
	total 1.0 mi
- ➡ 9. Turn right
 

	go 112 ft
	total 1.0 mi
- ➡ 10. Turn right
 

	go 157 ft
	total 1.0 mi



Unknown road

## Abstracts

### Session 1 Subnational variation in health expectancies

#### 1 Where we live or how we live-Explaining regional health expectancy variations in England

**Pia Wohland, Carol Jagger, Tony Fouweather, Fiona Matthews, Vikki O'Neill**

Wide-ranging health inequality in England is a long observed phenomenon. Even though life expectancy and healthy life expectancy keep increasing, the gender gap narrowing, there are no signs of inequalities between geographical areas or population subgroups declining. Poor health has been linked to socio-economic factors, as well as to health behaviors factors. This study explores the variations in disability free life expectancy (DFLE) for men and women across English regions in 2001 and the importance of various socio-economic and life style factors in explaining these variations. In 1991 LE at birth for men across English regions varied by 3.2 years, from 71.7 years (North East of England) to 74.9 years (South West of England). The DFLE gap for men in 1991 was much greater at 7 years, from 56.1 years (North East of England) to 63.2 years (South East of England). By 2001 LE and DFLE at birth for men had both increased, LE between 2.4 and 2.7 years, DFLE by 1 to 1.5 years, but the disparities in DFLE had widened to 7.6 years. Women had overall somewhat smaller variations across regions compared to men and whereas the DFLE gap also widened over the decade the gap in LE did not. This presentation will answer the following questions: Which socio-economic area factors (Social-class composition, deprivation, unemployment rate and more) explain the variation in DFLE at birth in 2001? Which health behaviours (smoking, alcohol consumption, obesity) explain the variations in 2001 and are they more, or less important than socio-economic factors? The answers to these questions are important for policy makers to plan where to target scarce resources to reduce inequality and ensure the extra years of life are healthy ones.

#### 2 The decomposition of health expectancy change during 1987-2006 among Chinese elderly population

**He Chen, Xiaoying Zheng**

Health expectancy (HE), one of the most widely used summary measures of population health, combines the mortality and morbidity data into a single composite indicator. Thus, the decomposition of HE changes over time has a significant advantage over usual health indicators (e.g. mortality decomposition). Using the HE decomposition method developed by Nusselder & Looman (2004), we decomposed the HE change during 1987~2006 among Chinese older persons into the contribution of various diseases. Results show that, during the twenty years, the negative influence of diseases related to public health, work and living environment and nutrition intakes on the health of elderly population went down, such as infectious diseases, respiratory system diseases, and ear and mastoid diseases; however, the negative impact of diseases related to dietary structure, physical exercise and stress went up, such as neoplasm, circulatory system diseases, endocrine and blood diseases, and mental disorders. Moreover, an urban-rural dual structure in diseases' contribution to HE change was found in China. Rural older persons gained more HE increase from reduced infectious diseases and respiratory system diseases, and urban older persons gained more HE increase from reduced eye diseases. Although the negative impact of circulatory system diseases and neoplasm rose in both urban and rural areas, the rural older people suffered more

from it during this period. To our best knowledge, this is the first study to decompose HE changes over time into contribution of diseases, which is also one of the best footnotes to the health transition undergoing in China.

### **3 Spatial patterns in long-term care in Germany and how they are linked to socioeconomic factors. A study based on the concept of disability-free life expectancy.**

**Daniel Kreft**

The ongoing rise in life expectancy means that the number of people who will be at increased risk of experiencing a severe loss of physical functioning and mobility at advanced ages will also rise, which could in turn lead to increased demand for long-term assistance and care services. This study explores spatial disparities in long-term care in Germany using the following indicators: disability-free life expectancy (DFLE), life expectancy with disability, and the health ratio, the proportion of DFLE to life expectancy. These indicators are combined measures of mortality and morbidity. Disability is defined as receiving benefits from the statutory long-term care (SLTC) insurance system. Data from the official census of all beneficiaries, the German SLTC census 2009, are combined with county-level life table estimates. In addition, socioeconomic indicators from the regional database of the German NSO are analyzed as determinants of disability disparities. Based on the health ratios observed, it is clear that there are pronounced spatial clusters which extend beyond the borders of federal states and are linked to the socioeconomic conditions in the respective counties. The cross-sectional relationship of regional health measured by DFLE suggests that there is a distinct absolute compression of morbidity in the West German counties and a moderate absolute compression in the East German counties. Results from meta-regression suggest there is a significant relationship between a county's health ratio and the county's socioeconomic performance, socioeconomic composition, level of urbanization, and health structure. A high household income per capita, a low long-term unemployment rate, a high population density, and a low level of premature mortality in a county are significantly linked to a high health ratio. This is the first study that shows the existence of spatial differentials in care need and the linkages of these differentials to the socioeconomic structure and performance of the county.

### **4 Where you were born and where you live, does it influence your mortality risk ? Evidence found with Belgian data.**

**Michel Poulain, Anne Herm**

The life table are traditionally constructed by considering the deaths occurring in a given population and the at risk population, both concerning the same place where those people live. The mortality risk could be associated with life style and environment (including availability and quality of health services) at the time of death in that given place. It is also worth to construct a life table by place of birth characterising the survival of all those born in a given place. The variation of the mortality risk by place of birth may reflect some socio-economic differences or past circumstances that had influenced early life conditions of these people. By following the Belgian population born before 1941 between the 1st January 1991 and the 1st January 2010 we consider 3,2 millions persons. Among these 1,7 millions died during the observation period. Every person is characterised by the place of birth and the place of residence at 1st January 1991 considering the 43 Belgian administrative 'arrondissement'. We distinguish two groups,

those who live in the same place as where they were born (1,9 millions non-movers) and those living in a different place (1,3 millions movers). We apply the survival analysis (Cox method) to identify the impact of (i) place of birth and (ii) place where the persons live later in life. We use only the 'movers' and we control by age, sex and level of education. The spatial patterns shown by the HR obtained for each place differ largely if we compare the effect of the place of birth and the one of the place of residence in 1991. The discussion will investigate how some characteristics of the different places at the time of birth (before 1940) or recently (between 1991 and 2010) could be associated with these spatial patterns.

## **Session 2 The Joint Action Healthy Life Years**

### **1 On the meaning of health and Primary Care supply for a positive view on aging**

**Susanne Wurm, Julia Wolff, Benjamin Schüz**

Health and self-perceptions of aging are closely linked with each other and are often considered important indicators of successful aging. Previous research has mainly examined the role of individual factors (including health) on self-perceptions of aging, but health is partly dependent on contextual factors such as primary care supply. This study therefore examines if the impact of diseases on self-perceptions of aging is buffered by primary care supply in the district, as it ensures sustained health care continuity. Nationally representative survey data (German Ageing Survey, DEAS) on health and self-perceptions of aging (n=4,442, 40-85 years) were linked to primary care supply (GP density in regional districts). Multilevel modeling shows that the impact of disease burden (multiple illnesses) was buffered by primary care supply: Disease burden was less strongly associated with negative self-perceptions of aging in districts with good primary health care supply. This underlines the importance of health care resources for successful aging. Germany is currently experiencing an increase in regional disparities; this pertains to both the enlargement of regional disparities in physician density and in social inequalities in general. Policy interventions may be more effective if they not only consider individual characteristics but also contextual factors such as healthcare access plus other environmental resources and opportunity structures. Together, these factors might contribute to healthy aging and, although more subtle, to more positive self-perceptions of aging.

### **2 The impact of smoking control on Healthy Life Years**

**Wilma Nusselder, Dagmar Wapperom, Caspar Looman, Hendriek Boshuizen**

Tobacco is leading cause of mortality and there is increasing evidence that smoking is also associated with disability. Increasing disability-free life expectancy (DFLE) is among the main priorities of national and European public health policy. The European Union is targeting a two-year increase in Healthy life Years by 2020. The aim of this presentation is to assess the loss in HLY in France due to smoking, and the gains that could be achieved under different smoking control scenarios: 1) all current smokers would quit smoking, 2) no never/former smoker would start smoking, 3) combination 1 and 2, 4) all current smokers with intention to stop do successfully quit smoking, and 5) no smoking initiation before age 18 years. *Data:* The Barometer Santé 2010 survey provides information on current smoking status (never, current, former smoker), the age persons started and/or stopped smoking, and intention to quit smoking, if applicable. The survey also includes information on the GALI indicator, the disability measure underlying

the HLY indicator. *Methods:* We used an extension of the DYNAMO-HIA tool to project the impact of different smoking scenarios on the HLYs. This extension includes DFLE as outcome and allows to directly linking smoking exposure to disability and mortality. The prevalence of smoking, GALI, the Odds Ratios linking smoking to GALI, and smoking initiation and quit rates were derived from the Barometer Santé 2010. Relative risks linking smoking to mortality were derived from the DYNAMO-HIA database. We will present the loss in HLY due to smoking and the gains in HLY that could be achieved under different scenarios of smoking control.

### **3 Educational differentials in activity limitations across the European Union: methodological issues and first results.**

**Aïda Solé-Auró, Emmanuelle Cambois**

Comparing the magnitude of the socioeconomic (SES) differentials in health across countries is challenging due to issues in data comparability and due to country specific association between health and SES. Social, health and educational systems have been developing differently across European countries and generations, inducing country-specific and generation-specific associations between health and SES categories. In this paper, we use EU-SILC 2009 dataset to discuss results on educational differentials in the global indicator of activity limitation (GALI) across Europe. We describe the variation in the differentials and use a logistic regression to highlight (1) the overall effect of level of education; (2) country differences in health and social context; (3) the interaction between the country and the levels of education and whether health differences are due to country specific effect towards high and/or low educational groups. The model is run for three age groups/generations to show the variation in the parameters. We found a large variation in the magnitude of the educational differentials. The distribution of the EU populations between educational groups impacts the observed level of health. The logistic multilevel model demonstrates a combination of effects; on the top of the overall effect of education, a country specific effect can be observed. For instance, higher educated have a relatively smaller health advantage in Denmark and Bulgaria; lower educated group have a relatively reduced disadvantage in Finland; southern European countries tend to have a relatively greater disadvantage for the lower educated groups. But these first results indicate that the interaction of education in with country-specific contexts should be accounted for when interpreting educational differentials and to understand the mechanisms behind social determinants of health within the EU.

### **4 The development of a blueprint for a Summary Measure of Population Health**

**Herman Van Oyen, Nicolas Berger**

*Background* The Joint Action EHLEIS is a European collaboration between the European Commission and almost all European Member States to develop a European Health and Life Expectancy Information System (EHLEIS). One of the objectives of the Joint Action is to strengthen international harmonization of Summary Measures of Population Health (SMPHs) - in particular, Health Expectancies. This presentation describes the process and the state of the art of the blueprint development of an internationally comparable SMPH at OECD level.

*Methods* At the end of 2011, a working group composed of experts from the European Union (EU), the United States (US) and Japan was set up to initiate conceptual discussion on a blueprint for SMPH.

Discussion was guided by literature review, expert surveys and three annual seminars. The third and last seminar was held in Paris on 10 and 11 April 2014.

*Results* The working group agreed on the purpose and need of internationally comparable Health Expectancies. The harmonization of a global measure of disability was set as the priority. In particular, international efforts should focus on the development of a global measure of participation restriction. A global measure of functional limitation was described as a useful complementary. Eight conceptual characteristics of a measure of participation restriction were specified, in addition to five technical criteria that the derived instrument should fulfil. The working group recommended testing and validation strategies and the use of translation guidelines.

*Conclusion* The working group reached consensus on fundamental conceptual characteristics of an internationally comparable SMPH. The blueprint resulting from the discussion is conceived as a guide for the design and testing of a survey instrument. Further development of the instrument should be co-led by the EU, the US and Japan and should involve additional OECD partners.

## **Session 3 Longevity and health**

### **1 A spatio-temporal analysis of longevity in an Italian region**

**Rossella Miglio, Alessandra Samoggia, Giulia Roli, Rosella Rettaroli**

We investigate the pattern of longevity in an Italian region at a municipality level in different periods considering a modified version of the centenarian rate (CR). Spatio-temporal modeling is used to tackle at both periods the random variations in the occurrence of long-lived individuals, due to the rareness of such events in small areas. This method allows us to exploit the spatial proximity, to smooth the observed data, as well as to control for the effects of a set of covariates. As a result, clusters of areas characterized by extreme indexes of longevity are well identified and the temporal evolution of the phenomenon can be depicted. A joint analysis of male and female longevity by cohort in the different periods is conducted specifying a set of hierarchical Bayesian models. We evaluated the effects of the structure of mortality on the cohort of long-lived subjects in the considered periods. The major causes of death were considered in order to deepen the analysis of the observed geographical differences.

### **2 Pathways to longevity among exceptional survivors in the Health and Retirement Study**

**Jennifer Ailshire, Eileen Crimmins, Hiram Beltran-Sanchez**

Reaching advanced old age is becoming an increasingly common experience in the U.S, yet there are very few studies of health and functioning of exceptionally long-lived individuals, and relatively little is known about the health trajectories of those who survive to exceptional old age. The current study uses data from the 1993-2010 Health and Retirement Study to examine variation in health and functioning trajectories over 17 years among those who lived to be 90 or older. Prior research suggests that the experience of the oldest-old can be characterized in terms of escaping, delaying the onset of, or surviving with disease and disability. We used latent class trajectory analysis to identify distinct groups of survivors among those who survived to at least age 90 in terms of their ADL limitations and chronic conditions and diseases. We found distinct groups of exceptional survivors whose health trajectories are remarkably consistent with previous theoretical and empirical work: 1) those who escape old-age with no disease

and disability; 2) those who delay the onset of disease and disability until their 80's and 90's; and those who survive through old age with disease and disability. These findings suggest there is variation in the aging experience, with some experiencing a compression of morbidity and disability and others living a long life with relatively worse health. We also examine individual and community-level determinants of health trajectories, thereby highlighting the importance of social, demographic, and economic factors for healthy living. This study contributes to the growing body of research on extreme longevity in the U.S. and globally by highlighting the considerable variability in paths to longevity.

### 3 Clustering people based on functioning and health

#### Rom Perenboom

To tackle the challenge of the greying of the population with its accompanying strains on care and finance, healthcare policy makers need information of the health and functional status of the population. Health interview surveys (HIS) provide a lot of this information. However, to make this information accessible, clustering of the information is necessary. We have developed a method to cluster the elderly population into 4 clusters of physical functioning, based on 12 indicators, mostly included in HIS. The indicators include perceived health and items of self-care and mobility problems. From latent class analyses (LCA) four clusters result: 'No problems', 'Mainly mobility problems', 'Mobility and Self-care problems' and 'Severe physical problems'. For care-planning purposes we have added a fifth cluster: 'severe dementia', as indicators for this cluster are not found in HIS. From the LCA, based on individual scores on the indicators, each individual elderly is then provided with a chance to belong to one or more of these clusters, and the prevalence of the clusters or profiles as they are also called can be calculated. And thus can be used to provide quantitative information on the composition of the elderly population. In this presentation we will also show a health expectancy calculation based on these profiles.

### 4 Assessing biological aging: the origin of deficit accumulation arising from age associated increase in recovery time.

#### Arnold Mitnitski, Kenneth Rockwood

Biological aging is studied predominantly at the micro level (tissue, cell, epigenetics, etc.). How to integrate such micro level damages and clinical manifestations at a macro level of organisms is not clear. We have suggested an approach based on deficit accumulation. Deficits are broadly defined and span from biological markers to laboratory abnormalities, clinical signs and symptoms. We present a model which links the process of deficit accumulation with the intensity of environmental challenges causing stresses, and the ability of the organism to sustain and repair the damage caused by such stresses. These processes are complex and intrinsically stochastic. We demonstrate that in a mean-field approximation, the number of accumulated deficits (N) equals the product of the intensity of environmental stresses (L) by the time of recovery (R). This relationship,  $N=LxR$ , holds independent of the specific mechanisms of how damage and recovery occur (e.g., the number stages involved in these processes). The age-associated increase in recovery time results in the accumulation of deficits. This can also be regarded as a manifestation of vitality decrease, as was postulated by Strehler and Mildvan in their classical paper in 1960. The kinetic of changes in recovery time is estimated from age-specific trajectories of the deficits number, available in multiple epidemiological and clinical datasets. The number of deficits individuals accumulate can be modified either by medical interventions, changes in the lifestyle, diet and exercise –

all of these factors are associated with life span extension because the number of deficits diminishes in the individual who make such changes, and because they reduce the time of recovery. This framework not only explains why the number of deficits can be used to estimate individual differences in aging rate, but also suggests that targeting the recovery rate (e.g., by preventive or therapeutic interventions) will decrease the number of deficits that individuals accumulate and thereby benefit life expectancy.

## **Session 4 Trends in health expectancies**

### **1 Trends in healthy life expectancy at age 85 in European countries are disappointing**

**A.H.P. Luijben, H. Galenkamp, Dorly Deeg**

We analysed trends for all EU countries for life expectancy (LE), LE without activity limitations (HLE), LE with moderate activity limitations, LE with severe activity limitations, and prevalence of morbidity, moderate activity limitations and severe activity limitations, in 2004-2011, at age 50, 65 and 85, for men and women separately. In this analysis we focus on the age group of 85 and older.

We used data from the European Statistics of Income and Living Condition survey (EU-SILC, previously ECHP). People living in institutions (older people, disabled people) are excluded from the survey. Trends by age group are reported if a correlation exists with time in years (non parametric test: Spearman's rho; p-value<0.01, two-sided).

Across all EU27 countries, LE at age 85 has significantly increased between 2007 and 2010. This improvement was not accompanied by an improvement in healthy life years. Most countries showed no trend in HLE at age 85. Only in Greece and Slovakia HLE at age 85 changed significantly for women (decreased) and only in Belgium for men (increased).

This analysis was performed within the MOPACT Work Package 'Health and Well-being', that aims to foster socially productive and satisfying lives for older people, specifically for those in poor health, and thus to improve ways in which older people can contribute to society. Innovative scenarios of policies and practices that foster social engagement of older people will be designed and associated gains in healthy life expectancy will be projected. The main goal of the current report was to provide input for these scenarios.

### **2 Recent changes in Life and Disability-Free Life Expectancy in China: Do they vary by rural/urban residence and education?**

**Zachary Zimmer, Mira Hidajat, Yasuhiko Saito**

China's population is aging rapidly, experiencing extensive gains in life expectancy, and undergoing socio-demographic transformation toward being more urban and more educated. Recent availability of longitudinal survey data has allowed for examination of whether the life expectancy gains among the growing older population are progressing with improvements in disability. These studies have, for the most part, investigated trends in disability. Largely absent from discussions has been how trends translate into years of disability-free life expectancy, and whether there is variation in disability-free life expectancy changes across the characteristics that describe China's socio-demographic transformation. To fill the gap in literature, this paper asks first whether there is variation in changes in life and disability-free life expectancy among men and women in China living in rural versus urban areas and with versus

without education; and second, whether variations in changes in life and disability-free life expectancy among men and women in China are a function of residence by education interactions. The latter question clarifies whether where older Chinese live is a determining factor in whether they are likely to benefit from improvements in education. Data come from several waves of the China Longitudinal Healthy Longevity Survey (1998 to 2011). This national sample, that includes a concentration on China's oldest-old (80+), allows study of upper age ranges where disability is most prevalent. Data is organized into pairs of waves with a baseline and a follow-up (e.g., 1998-2000; 2002-2005; 2008-2011). The investigation examines changes in life expectancy across time, and, using the Sullivan Method, constructs disability-free life expectancy tables across categories of sex, residence and education. Findings not only speak to the variation in life and disability-free life expectancy but ultimately to whether past and future compression or expansion of morbidity in China is a function of changing socio-demographic circumstances.

### **3 Increasing disability-free life expectancy among older adults in Palestine from 2006 to 2010**

**Bernard Jeune, Henrik Brønnum-Hansen, Mohammed Duraidi, Khaled Qalalwa**

*Background:* The population of Palestine comprises almost 200,000 Palestinians aged 60 or older. The purpose of the study was to estimate disability-free life expectancy for Palestinians living in the West Bank and Gaza Strip and to evaluate changes from 2006 to 2010. *Methods:* The study combined mortality data and prevalence of activity limitation derived from the Palestinian Family Health Surveys carried out in 2006 and 2010. Based on questions about the ability to perform five basic daily activities, disability-free life expectancy was estimated. Changes between 2006 and 2010 were decomposed into contributions from changes in mortality and disability. *Results:* Life expectancy at age 60 increased from 17.1 years in 2006 to 17.3 years in 2010 for men and from 18.7 years to 19.0 years for women. Disability-free life expectancy increased significantly, by 1.3 years for 60-year-old men (from 12.8 years to 14.1 years) and 1.8 years for 60-year-old women (from 12.6 years to 14.4 years). This increase was seen in the Gaza Strip as well as the West Bank. While the modest contribution of the mortality effect did not differ between gender and regions, the strong contributions from the disability effects varied, being greatest for women in the Gaza Strip. *Conclusion:* The significant increase in disability-free life expectancy for both genders is remarkable, and to our knowledge not seen in other low-income countries. This change may be due to decreasing incidence of disability and greater recovery from disability as a result of better prevention, care and rehabilitation of chronic diseases.

### **4 Health Adjusted Life Expectancy trends in Canada: preliminary results**

**Lidia Loukine, Chris Waters, Colin Steensma, Bernard Choi**

The study looks at trends in Health Adjusted Life Expectancy (HALE) and related statistics in Canada for the period of 2000-2008. The objective is to demonstrate the gradient in HALE, in terms of number of years (LE-HALE) as well as proportion of life ((LE-HALE)/LE) spent in poor health across provinces and territories and by gender. The data were obtained from the Canadian Chronic Disease Surveillance System and the Canadian Community Health Survey (CCHS). The abridged period life tables were constructed following the Chiang method except for the open ended age-interval where the Hsieh method was used. The Health Utilities Index mark 3 (available in CCHS) was used as a measure of health

related quality of life necessary for calculation of HALE. HALE was computed using the Sullivan method and it was calculated for 4 consecutive periods: 2000-2002, 2002-2004, 2004-2006 and 2006-2008. HALE increased by 1.6 years for the Canadian population over the period of study, with a statistically significant annual increase of 0.33% for women and 0.36% for men. Seven provinces and territories also demonstrated a statistically significant annual increase in HALE ranging from 0.2% in New Brunswick (increase of 0.5 years for the study period) to 0.5% in British Columbia (2.3 year increase for the study period). Statistically significant annual decreases in (LE-HALE)/LE were observed for British Columbia (1.6%, both genders combined) and for females in all of Canada (0.7%), while proportion of life spent in poor health increased significantly by 1.8% for Newfoundland (both genders combined) and by 2.7% for women in the Territories. Similar pattern was observed for LE-HALE. The study is a significant step in examining important differences in HALE and related statistics by Canadian jurisdiction, as well as by gender. It is expected to provide relevant information essential for public health policy makers.

## **Session 5 Work, retirement and health**

### **1 Cohort differences in work disability among US adults**

**Sandra Reynolds**

The objective of this study is to examine cohort differences in self-reported work disability. Using the US National Health Interview Surveys 1998 through 2012, we examine cohort patterns in work disability for adults born between 1928 and 1981, at ages ranging from 24 to 70 years. To examine these patterns, we constructed 18 3-year centered around the years 1929 to 1980. Work disability in the National Health Interview Surveys consists of answers to the question: “what was your main reason for not working last week. Work status was defined as disabled if the respondent answered either “temporarily unable to work for health reasons” or “disabled.” Results indicate that, compared to the 1929 cohort, cohorts born between 1932 and 1944 experienced a greater likelihood of being work disabled. Cohorts born between 1947 and 1974 (largely the Baby Boomers) were increasingly less likely to report work disability, but cohorts born after 1974 experience increasing likelihood. Racial and ethnic differences also need to be examined to clarify for whom these differences are the most striking.

### **2 The rise in statutory retirement age: consequences for work disability and post-retirement healthy life years in the Netherlands**

**Dorly Deeg, Philip Fontijn**

Many European governments attempt to compensate for the expected rise in the old-age dependency ratio by linking the statutory state pension age (SSPA) to life expectancy (LE). Elegant as this solution seems, the health of older workers and retirees is ignored. From 2013, the Netherlands government raises the SSPA from 65 to 67 years in 2023, after which SSPA is planned to follow the projected LE. This study examines the effects of a higher SSPA on the prevalence of work-limiting health problems (WLHP) and on post-retirement healthy life expectancy (HLE) up to 2050. Health data from the Longitudinal Aging Study Amsterdam (LASA) are used. During 1992-2009, the prevalence of WLHP (>=2 diseases and/or needing help with >=1 ADL activities and/or clinical levels of depressive symptoms) at age 65 remained constant at 38.4% for men, but rose from 39.3 to 54.6% in women. With rising SSPA, WLHP in men is expected to show a small increase to 49.8% in 2050, whereas in women a greater increase to 96.8% is projected. During 1992-2013, LE-65 increased from 14.3 to 18.5 years for men, and from 18.9 to 21.4

years for women. Based on LASA-data for 1992-2009, HLE-65 remained constant at 5.6 years for men and 4.9 years for women. Using Statistics Netherlands' projection of LE, SSPA will rise up to 71 years in 2050. Until 2023, LE at SSPA will decrease, after which it will remain constant at 18.0 years for men and 19.9 years for women. HLE will decrease to 3.4 years (from 30 to 22% of LE) for men and to 2.8 years (from 19 to 14% of LE) for women. In conclusion, a rise in SSPA does not seem fully feasible because of substantial increases in WLHP. Moreover, it does not seem fair because of substantial decreases in post-retirement HLE.

### **3 Raising the retirement age: implications for UK and Europe**

**Carol Jagger, Pia Wohland, Tony Fouweather, Tom Kirkwood**

Rising life expectancy is causing many European countries to increase their statutory retirement age (SRA) in order to fund state pensions. However the relationship between work and health in later life is complex; whilst continued work has been shown to be beneficial to health, the prevalence of chronic disease rises with age and therefore ill-health is more likely at older ages. Through three examples we look at the potential for raising the SRA in different countries and the implications for older workers employment policies. Firstly we revisit estimates of Healthy Life Years (HLY) at age 50 in 2005 to see the potential of different European countries to increase their SRA and then see the extent to which these patterns have changed by 2010. Secondly we repeat this analysis for local areas in England and Wales in 2001 and see that there is a strong geographical variation in the gap between average age of disability onset after age 50 and the SRA. Finally we connect the generations and, using data from the Newcastle 85+ Study, suggest that growth in the numbers aged 85 and over with their greater care needs, may pose a problem for UK women in their 60s as their SRA is rising rapidly to align it with men's.

## **Session 6 Health expectancies from longitudinal data**

### **1 Active Life Expectancy and functional limitations among older Singaporeans: gender, educational and ethnic differences**

**Angelique Chan, Chi-Tsun Chiu, Victoria Haldane, David Matchar, Yasuhiko Saito**

As the world's population ages it is also urbanizing - the intersection of these factors creates challenges in planning and policies to meet the needs of the increasing numbers of urban elderly. The WHO has proposed an Age-Friendly City approach to planning urban spaces and communities, so as to address the challenges of urban aging and best capitalize on the resources available in urban centers to promote active aging. The purpose of this paper was two-fold. The first aim was to provide information base for "Age-Friendly City" in Singapore through better understanding age-specific transition probabilities of functional limitations by sex, education or ethnicity. The second aim of this study was to examine health gaps for older Singaporean by sex, education and ethnicity using the incidence-based multistate life tables. The significant health gaps in functional limitation incidence and health expectancy have been shown in this study. This study highlights the importance of devising policies, programs and services that recognize the nuances and differing effects of sex, ethnicity and education on functional limitations in an "Age-Friendly City", especially a complete urban city nation like Singapore with sex, education and ethnicity diversity.

## 2 Socioeconomic and gender differentials in survival and healthy life expectancy in Chilean older people

**Cecilia Albala, Lydia Lera, Hugo Sánchez, Alejandra Fuentes, Barbara Leyton**

*Background:* The great success in improving the survival of Chileans does not necessarily mean that the extra years are healthy years. As decreases mortality and increases life expectancy, arise the question about the quality of the years gained. The deep socioeconomic and gender inequities observed in older adults (AM), suggest an increase in functional limitations and disability in this group, as such conditions arise not only as a result of pathological processes, but also as a result of behavior or socioeconomic factors. Objective: to explore the trajectories of functional limitations (FL) in Chilean older individuals from different Socio-economic backgrounds *Methods:* Longitudinal study of 2 cohorts of community dwelling people  $\geq 60$ y from Santiago: the SABE cohort including 1173 people of low and medium-low SEL and the ISAPRES cohort of 266 individuals of high SEL randomly selected from private health insurance system registries (ISAPRES). Self-reported FL of basic (ADL), instrumental (IADL) and Mobility were registered. FL was defined as limitation in 1 ADL and/or 1 IADL and/or 2 mobility limitations. Multistate methods (IMACH) were used to study trajectories of disability *Results:* At baseline significant social and gender differentials were observed. After age and gender adjustment, the OR for limitations in ISAPRES with respect to SABE were ADL (OR=0.17; 95%CI:0.079-0.343), IADL (OR = 0.27; 95%CI:0.159-0.452), and Mobility (OR = 0.42; 95%CI: 0.298-0.599). A large gap between Total life expectancy (TLE) and healthy life expectancy (HLE), with deep socioeconomic differentials was observed. At 70 years TLE of men from ISAPRE was 12.7y (64% HLE) compared with TLE 10,6y (HLE 55,9%) in SABE. The corresponding figures for women were ISAPRE: TLE 14.1y(58.9%HLE) SABE: TLE 13.5y(37.5%HLE) *Conclusions:* This study demonstrates profound socio-economic and gender inequalities in Chilean older people, thus showing that the years of healthy life gained are not the same for the whole society.

## 3 Comparison of methods and programs for calculating health life expectancies

**Fiona Matthews, Vikki O'Neill, Carol Jagger, Pia Wohland,**

There are many methods and programs that can be used for estimating life expectancies in different health states from longitudinal data. The aim of the inHALE project is to investigate these different methods and evaluate their strengths and weaknesses and provide guidance on the use of the programmes for other researchers. Using data from the MRC Cognitive Function and Ageing study where 13,004 individuals at baseline have been followed for up to ten years, we calculate disability-free life expectancies using a variety of software packages. The presentation will discuss the similarities and differences of the results and give some guidance for future research.

## **Session 7 The influence of past and current circumstances**

### **1 Region of socialization vs. region of current residence and mid-to-late adulthood health outcomes in the US**

**Scott Lynch, J. Scott Brown**

Region of residence is usually included in demographic models of health outcomes only as a control variable. However, region represents a rich combination of structural and cultural factors that may influence health. The Health and Retirement Study (HRS) asks respondents not only where they live at the time of interview, but also where they were born and where they lived during adolescence. The HRS also measures numerous health outcomes. This breadth of measurement on both region and health provides considerable leverage with which to disentangle the effects of early childhood socialization and current structural constraints and opportunities on different dimensions of adult health. In this paper, we use data across 8 waves of the HRS to investigate the relative effects of early life region and current region on a number of health outcomes, including self-rated health, cardiovascular disease, cancer, obesity, diabetes, depressive symptoms, mortality, and healthy life expectancy measures based on these outcomes. Next, we incorporate time-specific, region level measures in an effort to explain the region effects. We present results of analyses based on the complete sample and based on the subset of approximately 30% who move between adolescence and later adulthood.

### **2 Children's education and parental health: Evidence from the PSID**

**Patrick Coate**

A growing literature shows that even in the presence of other controls, individual health and mortality outcomes are associated with education levels of family members. In this paper, I use PSID data to show a strong correlation between educational achievement of adult children and health status of parents over the time period 1999-2011, especially when the adult children are college graduates. This correlation holds after accounting for the education of the parent (and parent's spouse) and income of both parent and adult child. In preliminary analysis, I break down these results by gender and by relative location. I find that across education levels, sons and daughters have broadly similar effects on parental health, although in certain cases daughters appear to have a larger effect. However, I also find that the relationship between highly educated children of either gender and parental health tends to be stronger for fathers' health than for mothers'. I also find that the correlation is equally strong or stronger for children who live in different US states than their parents than for those who live in the same state, suggesting that the mechanism for this relationship is not primarily through direct caregiving.

### **3 Children's Education and Parents' Health in Mexico: Evidence for "Upward" Transfers of Intergenerational Resources**

**Jenjira Yahirun, Connor Sheehan, Mark Hayward**

This paper asks how adult children's socioeconomic resources, reflected in their educational attainment, influence older parents' physical health in Mexico, a context where older adults often lack access to institutional resources and rely on kin, primarily children, as a main source of support. Typically, the association between education and health is portrayed in highly individualistic terms, with an individual's

own education presumed to influence their own health. However, recent research illustrates the limitations of this perspective, pointing to the additional importance of household or familial resources as crucial elements in the full array of socioeconomic resources that influence an individual's health problems. Therefore, this paper asks how adult children's resources – broadly defined by their educational attainment – affect parents' health, above and beyond parents' own socioeconomic resources. Understanding whether adult children's education is important for parental health, in addition to parents' own education, could help identify the elderly who are most at risk for poor health and health declines, better comprehend the intergenerational benefits of education, and shed light on the health advantages and disadvantages across socioeconomic groups. Using data from the Mexican Health and Aging Study, preliminary analyses document that elderly parents' own education is negatively associated with the presence of functional problems and ADLs as well as lower counts of both. In addition, the results identify that the average level of children's education is negatively associated with the presence of any functional limitations or ADLs among parents and lower counts of both, net of parents' education. Both the parents' and adult children's associations are highly robust and withstands controls for respondent-, municipal-, and household-level traits as well as children's other characteristics. It is evident that adult children's resources add significantly to parents' own resources to affect parents' health outcomes, and can thereby amplify or mitigate the health consequences of parent's own resources. Based on the parameter estimates from the statistical models, we are currently estimating multistate life tables that will allow us to document the substantive implications of the associations for healthy life expectancy. Of key importance, these life tables will allow us to show how healthy life expectancy varies for combinations of parents' and offspring's education, clarifying the magnitude of the intergenerational health benefits parents reap from greater levels of education in their offspring in a context where few institutional resources are available.

## **Session 8 Models for healthy longevity**

### **1 On the determinants of health inequalities – Explorations using the Theoretical Health Inequality Model (THIM)**

**Michael Wolfson**

There has been considerable debate in the social epidemiology literature as to whether there is an empirical association between income inequality and health (e.g. mortality rates) for population groups at various aggregated scales of observation (e.g. from counties to countries). There is far less debate about the association at the individual level between socio-economic status (SES) and health; the individual-level SES gradient is widely accepted not only as an empirical association but also as a causal relationship. Still, while there has been some conjecture, empirical evidence regarding the relationship, if any, between income inequality (at a population level) and the steepness of the SES gradient (at the individual level) is generally lacking. In this analysis, we use an abstract agent-based model (ABM) to explore the circumstances under which higher income inequality in a population would be associated with a steeper individual-level SES gradient, and whether some mix of neighbourhood segregation and parent-child transmission of social (dis)advantage can account for the observed patterns where higher income inequality is associated with poorer health. The THIM ABM incorporates plausible empirically-based but stylized relationships among health status, education, income, mortality rates and neighbourhood sorting / segregation. THIM generates, among its many outputs, both life expectancies and health-adjusted life expectancies. The two hypotheses are explored via a series of *in silico*

experiments with the model. Preliminary results support the hypotheses, though neighbourhood segregation alone appears insufficient to reproduce observed patterns at the ecological level.

## **2 A model for forecasting the health of the population, illustrated for local areas in Northern England**

**Philip Rees**

There are many studies of healthy life expectancy across the countries of the world, using a variety of methods which inform policy makers about the likely course of population. The underpinning healthy life table is based the assumptions that the population size and sex-age structure remain stationary and the rates of health/ill-health remain constant into the future. However, policy makers need to know about the numbers of people in various health/ill-health conditions, so that decisions can be taken about spending priorities within the health services and between health and other public services. This requires using a cohort-component population projection model which forecasts how population sizes and sex-age structures might change in future. It also requires that we understand trends in health/ill-health prevalence by sex and age. If we can implement such a model successfully, it will be possible to measure the impact of population ageing on the numbers in ill-health/disability and the additional impact of possible changes in health/ill-health prevalence. Also we can use the forecasts of sex-age specific mortality rates (carried forward for a century) to produce cohort healthy life expectancies. This paper presents some experimental health projections for the United Kingdom, Northern England and northern local authorities, which show that the programme of work is feasible. The results also expose considerable variation between local authorities, depending of the socio-economic composition of their populations. We discuss the forces driving down and driving up health prevalence by sex and age and the likely cost implications of the projections.

## **3 Aging in the context of cohort evolution and mortality selection**

**Hui Zheng**

This study examines historical patterns of aging through the perspectives of cohort evolution and mortality selection, where the former emphasizes the correlation across cohorts in the age dependence of mortality rates, and the latter emphasizes cohort change in the acceleration of mortality over the life course. In the analysis of historical cohort mortality data, I find support for both perspectives. The rate of demographic aging, or the rate at which mortality accelerates past age 70, is not fixed across cohorts; rather, it is affected by the extent of mortality selection at young and late ages. This causes later cohorts to have higher rates of demographic aging than earlier cohorts. The rate of biological aging, approximating the rate of the senescence process, significantly declined between the mid- and late-19th century birth cohorts and stabilized afterwards. Unlike the rate of demographic aging, the rate of biological aging is not affected by mortality selection earlier in the life course, but by cross-cohort changes in young-age mortality, which cause lower rates of biological aging in old age among later cohorts. These findings enrich theories of cohort evolution and have implications for the study of limits on the human lifespan and evolution of aging.

## 4 Life expectancy: between the elasticity of human longevity and the imperatives of societal systems

**Patrick Deboosere, Françoise Renard**

The aim of this study is to quantify the potential pace of progress in life expectancy in the next decades in Belgium. Life expectancy increase is in the first place a social process, an outcome of how mortality risks and survival are evolving for all members of society. Hence, (healthy) life expectancy is only partially influenced by the potential maximum longevity of humans. LE is the outcome of progress in “manufactured life” (Olshansky & Carnes, 2001) and the implementation thereof in a society. Consequently, the question of health inequality is intrinsically linked to progress in LE. The discussion on ageing societies has been dominated by the speculations on maximum longevity of humans, but this discussion is of marginal importance for the potential progress in life expectancy in the coming decades. Progress is at least possible in all societies that did not reach LE of the vanguard states and of the vanguard populations inside these states. For nations with a huge social deficit (most developing countries), the potential in progress is still tremendous and can be very fast. For most industrial modern states, progress will be incremental and depend on equal access to resources and on tempo of adjustment in behaviour. Based on the past evolution in mortality and on international comparisons realistic gains in LE and potential pace of progress can be estimated. In this study we will analyse age-adjusted mortality rates (ASMR) and potential years of life lost (PYLL) by specific cause of death in Belgium to estimate the potential growth in LE for the coming decades. These estimations can be used to assess the impact of an ageing population on the sustainability of an economic and social system by comparing the tempo of change in LE with the tempo of progress in productivity and economic growth.

## 5 Projections and operational scenarios on ageing and health

**Roberto Ham-Chande**

Population projections, life expectancies and healthy life expectancies have a goal. It is to glimpse into the future in order to create policies and programmes to better manage population ageing. To actually achieve this purpose it is essential to build scenarios under projection assumptions that could offer alternative planning practices by identifying, assessing and quantifying future effects of potential programs and interventions. We propose this system for the population 60 and over in Mexico. At the same time extensions to other Latin America countries are being implemented, initially Argentine, Chile and Costa Rica. Mexican-origin population in the United States is also a target. Comparisons will evaluate longevity related to where and how you live and also to how and where have you lived. Mortality models, epidemiological patterns and the estimation of demographic and health parameters consider socio-economic diversity in middle-income nations. Along with statistical, demographic and actuarial approaches, this project has the key the collaboration of the National Institute of Geriatrics (INGER) for health and epidemiological inputs. Population projections by cohorts (x,t) are correlated to life-cycle and historical environment. Mortality takes the central assumptions, although migration is also considered. Using records, statistics and longitudinal surveys on health and ageing, mortality and health are analyzed by causes and SES. Causes of future health and mortality are discussed with INGER using an intuitive approach on life and health expectancies, to be translated into projected rates of incidence, prevalence and mortality by cohorts. A software is being developed for this specific study and future applications. Microsimulation is contemplated to project mortality, health conditions and disability right before death.

Times at onset of disease and disability and their duration in relation to severity and dependence are estimated. This can be used for actuarial valuations, budgeting, financing, and prevention plans.

## **Session 9 How education influences healthy longevity**

### **1 Educational gaps on compression of disability onset in the United States**

**Chi-Tsun Chiu, Mark Hayward, Angelique Chan**

Studies regarding education as a “fundamental cause” of health disparities have shown that more-educated people enjoy longer life expectancy, compression of mortality, later disability onset and compression of disability compared with their less-educated counterparts, and this is especially true in the United States. However, it is still unclear whether educational differences in disability and mortality within a population are accompanied by compression of disability onset, that is, a smaller variation in ages of disability onset. This study proposes a hypothetical scenario of compression of disability onset, based on previous literature from the United States, showing that educational differences in disability and mortality within a population are very likely accompanied by compression of disability onset. In order to investigate whether education has significant association with the compression of disability onset, the Health and Retirement Study will be used and microsimulation and bootstrap techniques will be performed. The compression of disability onset has very important policy implications (long-term care and social security in particular). The variation of modal age of disability onset is also the key component that substantially influences how social welfare is arranged. The compression of disability onset measured by variation of modal age of disability onset therefore has crucial policy implications.

### **2 Social differentials in the contributions of mortality and health to the impact of smoking on expected lifetime in good health**

**Henrik Brønnum-Hansen**

*Objective* – The purpose of the study was to estimate social differentials in the contributions of mortality and health to differences in expected lifetime in self-rated good health between never smokers and smokers. *Methods* – Life tables for never smokers, ex-smokers, moderate, and heavy smokers with a high, medium and low educational level were constructed on the basis of Statistics Denmark registers combined with data from the Danish Health Interview Survey 2000. For each educational level differences in expected lifetime in good and less than good health between smokers and never smokers were decomposed into contributions from mortality and health status. *Results* – Difference in expected lifetime in self-rated good health of 30-year-old male ex-smokers, moderate and heavy smokers compared with never smokers increased with educational level. For instance the differences between heavy smokers and never smokers among men with a low, medium and high educational level were 10.3, 11.4 and 14.3 years, respectively, while the loss of life expectancy decreased with 8.9, 8.5 and 7.5 years. Among women the difference in expected lifetime in self-rated good health of ex-smokers, moderate and heavy smokers compared with never smokers decreased with educational level. Thus, the differences between female heavy smokers and never smokers with a low, medium and high educational level were 12.9, 8.9 and 4.1 years, respectively. The differences in life expectancy were 8.7, 8.3 and 8.1 years. Decomposition showed that the mortality effect increased markedly by exposure of smoking, but did not vary much between educational levels. For men the effect of health status did not change much, whereas among women the contribution of the health component decreased with educational level. *Conclusions* –

While the effect of the mortality component did not vary much between educational groups when smokers were compared with never smokers, a marked social gradient originated from the health component was detected for women indicating that smoking has an important effect on health among women with a low education.

### **3 Causal mechanisms behind the association of education and mortality in men: insights from a natural experiment**

**Marc Luy, Christian Wegner-Siegmundt, Paola Di Giulio**

Education is the central element of a complex network that links many factors related to socioeconomic status (SES) with health and mortality. As a consequence of these complicated interactions it is still unclear whether and to what extent education per se has a direct effect on longevity and what causal mechanisms could be responsible for this relationship. Our study aims at getting better insights into these issues by analysing the association between education and mortality in 3,060 Catholic monks from western Germany who were born between 1840 and 1959. This natural experiment allows us to isolate the effect of education from most other characteristics of SES. To better assess the obtained results on education-specific mortality we compare the monks with a sample of 3,221 men of the German general population. Analyses are based on Kaplan-Meier product limit estimation and Cox proportional hazard regression modelling. We find that among male order members education does not have a significant impact on mortality and that the survival of low as well as high educated monks is almost identical to that of worldly men with high education. These findings provide evidence against the existence of a direct effect of education on mortality. Health behaviours—which appear to be not inevitably linked with educational attainment—and occupation-related risk factors are discussed as most likely causes for the differences in education-specific mortality between the monastic and the general population. Finally, our results reveal that the well-known education gradient in life expectancy is rather due to the high mortality of low educated individuals than to the low mortality of persons with high education.

### **4 Gain in life expectancy associated with higher education**

**Govert Bijwaard, Bertie Lumey, Frans van Poppel**

Many studies show large differences in mortality across measures of education. However, recent results deriving from natural experiments in education suggest that the causal effect of education on health is small or even absent. This implies an important role for confounding factors, such as cognitive ability. Gains in life-expectancy associated with increasing education levels, should therefore be estimated taking differences in measured intelligence and socio-economic background into account. We disentangle the gains of education, cognitive ability and socio-economic background on mortality for men in the Netherlands followed from age 18 until age 63. We obtain the ‘treatment’ effect of education and the selection effect due to latent cognitive ability and due to observed socio-economic background. The analyses are based on a structural model with attained education level and IQ at age 18, mortality between 18-63 years by education level all depending on a latent cognitive ability. The model allows for selective education choice, based on observed factors and on an unobserved factor capturing ability, with an IQ-test offering a proxy measurement of the latent cognitive ability. In the model the mortality rates differ by education level and depend on observed factors and the latent ability. The data used are selected data from military recruits born in 1944-1947 in The Netherlands (n=39,798). *Results:* Higher

education levels were associated with higher life-expectancy. Although the lower mortality is partly explained by selection into higher education levels of individuals. Substantial (up to 3 years) differences in life-expectancy remain between the education levels after taking the selection into account. The results are consistent with both a strong selection into education based on socio-economic background and on cognitive ability and with the idea that there is a causal link between education and mortality. Thus, increases in education will lead to extended longevity.

## **5 Trends and group differences in the association between educational attainment and adult mortality: Implications for understanding education's causal influence**

**Mark Hayward, Robert A. Hummer, Isaac Sasson**

Has the shape of the association between educational attainment and U.S. adult mortality changed in recent decades? If so, is the association changing consistently across demographic groups? Does the change in the association reflect the growing importance of high levels of education for gaining access to a valued set of flexible resources that improve health and lower mortality risk over the adult life course? This paper reviews evidence on the changing functional form of the association between education and adult mortality, drawing from studies based in the United States. Particular attention is given to how widespread such changes are across race and gender subgroups of the population. We also provide an updated analysis of these functional form patterns and trends, contrasting data from the early 21st Century with data from the late 20th Century. This new evidence suggests that the association between educational attainment and U.S. adult mortality appears to be reflecting lower and lower adult mortality for very highly educated Americans compared to their low-educated counterparts in the 21st Century. We draw on this review and updated evidence to reflect on the question whether education's influence on mortality has become increasingly causal in recent decades, why, and the potential global implications of these changes.

## **Session 10 Trends in life and health expectancies**

### **1 Modelling changes in small area Disability Free Life Expectancy: Trends in London wards between 2001 and 2011**

**Peter Congdon**

Existing analyses of trends in disability free expectancy are mainly at aggregate level (national or broad regional), but major differences in health exist between different neighbourhoods within regions, supporting a small area perspective on changing inequalities in disability free life expectancy. This raises issues regarding the stability of conventional life table estimation methods at small area scales. This paper advocates a Bayesian borrowing strength technique to model trends in mortality and disability differences across 625 small areas in London, and two periods centred on the 2001 and 2011 population Censuses. This spatio-temporal perspective allows assessment of whether significant compression or expansion of morbidity has occurred in each small area. In fact the evidence supports morbidity expansion as the predominant trend, especially for females. Appropriate models involve random effects that recognise correlation and interaction effects over relevant dimensions of the observed deaths and illness data (areas, ages, genders), as well as major spatial trends (e.g. gradients in health and mortality according to deprivation). While borrowing strength is a primary consideration (and demonstrated by

raised precision for estimated life expectancies), so also is model parsimony. Therefore pure borrowing strength models are compared with models allowing selection of random age-area interaction effects using a spike-slab prior.

## 2 Gender difference in health expectancy trends in Greenland

**Isabelle Mairey, Peter Bjerregaard, Henrik Brønnum-Hansen**

*Background:* The population of Greenland comprises almost 31,000 Inuit Greenlanders aged 20-65. The purpose of the study was to estimate trends in expected life years between age 20 and 65 in good and poor health and to compare changes between men and women since the mid 1990s. *Methods:* Partial life expectancy was calculated and combined with prevalence data on self-rated health, longstanding illness and musculoskeletal diseases (the most prevalent chronic diseases) derived from health surveys carried out in 1993-94, 1999-01 and 2005-10. Trends for men and women were compared and changes were decomposed into contributions from changes in mortality and disability. *Results:* Partial life expectancy between age 20 and 65 increased by 2.2 years for men and 0.8 years for women during the period from 1993-94 to 2005-10. However, expected lifetime in self-rated good health decreased statistically significantly ( $p<0.01$ ) by 3.3 years for men (from 30.8 to 27.5 years) and by 4.6 years for women (from 30.0 to 25.4 years). For men life expectancy without longstanding illness increased statistically significantly ( $p<0.001$ ) by 4.7 years (from 22.0 to 26.7 years). The increase for women by 1.4 years (from 25.6 to 27.0 years) was non-significant ( $p=0.29$ ). Expected lifetime without musculoskeletal diseases increased significantly by 4.5 years for men and by 1.7 years for women. *Conclusions:* The development of expected lifetime without longstanding illness supports the theory of compression of morbidity, but as the direction of trends differs according to which measure for health is used a definite conclusion cannot be drawn. The different rate of development of (partial) life expectancy and expected lifetime in good health between men and women is remarkable, and has reduced the gender gap much. The results call for special concern about the women's health in Greenland. *Keywords:* disability-free life expectancy, health expectancy, life expectancy, Greenland, Inuit

## 3 Healthy Life Expectancy by prefecture in Japan: Changes in inequality between 2000 and 2010

**Yuka Minagawa, Yasuhiko Saito**

The concept of health expectancy has gained popularity in Japanese society. In 2012, the Japanese government revised the National Health Promotion Movement in the 21st Century, known as the Second Healthy Japan 21. The two main goals of this policy are to: 1) improve healthy life expectancy (HLE), denoting the number of years spent without limitations in activities of daily life, and 2) eliminate disparities in HLE across 47 prefectures in Japan for the next ten years. Using data from "Kokumin Seikatsu Kiso Chosa" (Comprehensive Survey of Living Conditions of the People on Health and Welfare), the present study traces HLE back to 2000 and investigates how the health-related quality of life of Japanese people have changed between 2000 and 2010 at the prefecture level. This work improves upon previous studies on this topic by conducting a subnational study of health expectancy measures in Japan and can contribute to current policy debates over improvements of the overall population health status.



## Posters

### 1 Multi-States Health Expectancies of the Thai Elderly

**Benjawan Apinonkul, Kusol Soonthorndhada, Patama Vapattanawong**

*Background:* Calculations of health expectancies have been limited on disability-free life expectancy, rather than the earlier stage in the chain of events leading to disabilities. *Objectives:* To calculate morbidity-free life expectancies (based on measures of chronic physical, psychological, and cognitive impairments), disability-free life expectancy (based on measures of activities of daily living (ADL) and instrumental activities of daily living (IADL)) in Thai elderly aged 60 years and older. *Methods:* Sullivan's method was used to calculate health expectancies. Prevalence of health states was obtained from the fourth National Health Examination Survey in 2009. Mortality data was employed from the vital registration system of the Ministry of Interior. *Results:* At age 60, males and females could expect to live on average for 19.1 and 22.6 years further, respectively. Males could expect on average to spend years free of chronic physical impairments, IADL disability, cognitive impairments, depression, and ADL disability for 9.1 (95%CI: 8.8-9.4), 11.1 (95%CI: 10.9-11.4), 17.1 (95%CI: 16.9-17.3), 18.6 (95%CI: 18.5-18.7), and 18.6 (95%CI: 18.5-18.7) years, respectively. Females could expect on average to spend years free of IADL disability, chronic physical impairments, cognitive impairments, depression, and ADL disability for 7.2 (95%CI: 7.0-7.5), 9.8 (95%CI: 9.4-10.1), 18.1 (95%CI: 17.8-18.4), 21.2 (95%CI: 21.0-21.3), and 21.7 (95%CI: 21.6-21.9) years, respectively. Total life expectancy and life expectancy free of all health states in both genders decreased with increasing age. *Conclusion:* This study provided the levels of health expectancies that more fully cover states in the disablement process. It could also inform average sequence of health events experienced by Thai elderly. The findings of health expectancies in different health states are relevant to different policy audiences. For example, years lived free of chronic diseases are significant for public health prevention. While, years lived with ADL disability are useful for social policy regarding dependency and long-term care.

### 2 An International Study of Self-Rated Health among Older Adults

**Emmanuelle Belanger, Maria Victoria Zunzunegui, Susan Phillips**

*Background:* Self-rated health is a relevant indicator of health among older adults, and a good predictor of mortality. This study aims at examining the differences in self-rated health that are related to demographic characteristics, socioeconomic status, and social support among a sample of older adults from five different international sites. *Methods:* A sample of 2,000 older adults between the ages of 65 and 74 was analyzed (n= 400 per site). The research sites included two Canadian sites (Kingston and Saint-Hyacinthe), two Latin American sites (Manizales, Columbia, and Natal, Brazil), and a site in Tirana, Albania. Self-rated health was measured with a five-point Likert scale. Descriptive statistics for the variables of interest were first explored. Given the wide differences in the distribution of self-rated health across sites, a dichotomous variable was created (very poor, poor, and fair health vs. good and very good health) to estimate the impact of demographic, socio-economic, and social support variables on self-rated health across research sites using a logistic regression model. *Results:* Descriptive statistics confirm major differences in self-reported health across contexts, with a majority of Canadian older adults reporting good health, and older adults at other sites reporting fair or poor health. Gender is significantly associated with self-rated health in Manizales, Natal, and Tirana, with women reporting poorer health than men. The odds of reporting good health are increased for younger respondents, for males when living outside of Canada, for those having post-secondary education, for middle and high income groups,

as well as for those who reported having a sufficient and very sufficient income. Many social support variables are also significantly related to self-rated health. Discussion: The impact of demographic, socioeconomic, and social support variables on older adults' self-rated health appears to be moderated by the cultural context, especially as far as gender is concerned.

### **3 An increasing trend in hospitalization is related to the changing health of Dutch older adults**

**Henrike Galenkamp, Dorly Deeg, Jan W.P.F. Kardaun, Martijn Huisman**

*Background:* Improved health care over the past decades has resulted in an increased life expectancy. It has been suggested that the increasing rate of hospital admissions is reflective of this development. However, trends in hospital admissions have not been examined in relation to trends in health status, which leaves open the possibility that an increase in hospital admissions is a consequence of declining health trends. Another development is the decreasing trend in hospital length of stay (HLOS), presumably unrelated to patients' health status. The current study examines associations between the health status, hospitalization and HLOS of older adults between 1995 and 2009. *Methods:* Data from the nationally representative Longitudinal Aging Study Amsterdam were linked to data from the Dutch Hospital Discharge Register. A total of 5681 observations of 2520 respondents (ages 65-88 years) across four waves (14 years) were studied. Psychosocial, lifestyle and health status factors were included in multivariate GEE models to assess their contribution to time trends in hospitalization and HLOS. *Results:* Between 1995 and 2009 most health factors, including the number of chronic conditions, functional limitations, medication use, depressive symptoms and self-rated health, showed a worsening trend. Also, higher proportions reported having had contact with a medical specialist. These trends were partly responsible for increases in overnight and acute admissions. In addition, a more than doubled risk of day admissions over time was observed. This trend was not related to changes in health or psychosocial characteristics. As expected, HLOS per admission decreased, but no trends in health, psychosocial or lifestyle characteristics were observed that could explain this trend. *Conclusions:* The worsening health profile of older patients could partly explain an increase in hospital admissions over time. Studies are needed that assess the impact of decreasing HLOS on future hospitalized older patients who will be in poorer health.

### **4 A high level health outcome indicator for the new NHS health care commissioning bodies in England**

**Emma Nash, Asim Butt, Llio Owen, Chris White**

Clinical Commissioning Groups are responsible for planning health care delivery locally on the basis of need; Healthy Life Expectancy (HLE) and Disability Free Life Expectancy (DFLE) are high level summary measures of population health, which can be used to assess differences in health needs and the effectiveness of these bodies in achieving health improvement through their commissioning decisions. ONS has taken advantage of census data to compute cross-sectional estimates of HLE and DFLE at birth, at age 50 and at age 65 to set a robust benchmark in the period 2010-12, from which health improvement can be judged using other data sources. It also enables the future potential of different data sources to be judged through cross validation with census estimates. HLE and DFLE are important as they add a quality of life dimension to estimates of life expectancy, providing indicators of lifetime spent

in favourable and unfavourable health states. Such an indicator has use to inform government policy for funding decisions, to assess health and social care need and plan services to meet needs in the public, private and voluntary sectors, for health improvement monitoring, and for research to add to the evidence base on the expansion or compression of morbidity at local level. Figures are presented at birth and at age 65 (and at age 50 for DFLE) for males and females in England using the 2011 Census. The health indicators used from the 2011 Census are subjective as they ask the respondent for their self-assessed health and activity limitation (disability) status. The analysis will show the scale of geographical inequality in these measures and whether current funding allocations are plausible based on needs suggested by these results.

## 5 Health dynamics of older populations across four continents

**Daniela Weber**

Nowadays, life expectancy is increasing particularly in mid and high income countries, which goes along with increased shares of older populations. Therefore the health status of those populations aging and its determinants are a broadly discussed issue especially as good health enhances quality of life. Prior work has shown that health status does not only depend on biological factors such as age and sex, but also on behavioral risk factors and socio-demographic factors, e.g. marital status and education. The main purpose of this study is to show and analyze the trajectories of health from an international perspective. Here, the determinants of disabilities and bad self-rated health are investigated using comparable aging surveys (e.g. CRELES, ELSA, HRS, JSTAR, KLOSA, SHARE, SAGE, and TILDA). Moreover, we analyze determinants of objective health measures (e.g. walking speed, BMI, and spirometry) and affective functioning. Preliminary results show remarkable differences between and within countries across Africa, Asia, America, and Europe. For instance, investigating hand grip strength, which co-varies with measures of general health, German men appear to be the strongest with 46kg on average, while Indians reach only about 29kg on average. Looking at chronic diseases, in 2010 the United States turns out to have the unhealthiest population aged 50+ with about 74% reporting at least one chronic disease, whereat only 42% Swiss aged 50+ report at least one chronic disease. Interestingly, following elderlies in the United States between 1995 and 2010 an increase in upper and lower body limitations can be identified.

## 6 Gender differences in Healthy Life Expectancies in South Africa

**Witness Chirinda**

*Background:* Little is known about the health status of elderly people in developing countries, including South Africa. *Objectives:* To estimate healthy life expectancy using different measures health states for men and women in South Africa. *Methods:* The Sullivan Method was used to estimate Health Life Expectancy (HLE) for South Africa. The method utilizes mortality and morbidity data to derive a single summary measure of overall population health. The mortality data was obtained from the UN period Life Tables for 2005-2010. Prevalence estimates of morbidity, functional status and health-related quality of life were obtained from the Study on Global Ageing and Adult Health (SAGE) collected in South Africa in 2008. *Results:* The results show some coping and adjustments to disability. Old people rate their health as good, even though they have limitations in functional status. overall, proportion of life expectancy in good health are more stable when measured by in Self-rated health and health-related quality of life. The proportions fall rapidly when measured by limitations in Activities of Daily living (ADLs), and less rapidly when measured by limitations in Instrumental Activities of Daily living (IADLs). *Conclusions:* although

women live longer than men, they spent much of their life in with poor health and difficulties at the older ages.

## **7 Have the drivers in inequalities in Healthy Life Years at age 50 in the EU countries changed between 2005 and 2010**

**Tony Fouweather, Clare Gillies, Pia Wohland, Herman Van Oyen, Wilma, Nusselder, Jean-Marie Robine, Emmanuelle Cambois, Carol Jagger and the JA: EHLEIS team**

*Background* Healthy life years (HLY) is a Structural Indicator adopted by the EU in 2005 to monitor health trends and gaps. First estimates of HLY at age 50 (HLY50) showed substantial variation in healthy ageing across Europe. Work to harmonise the instrument for measuring HLY was undertaken with a major update in 2008. A previous study assessed potential drivers of inequalities in 2005 and we wanted to see if the situation had changed since harmonisation and the economic crisis. Additionally, we explored the impact of material deprivation. *Methods* Standard and more rigorous meta-regression techniques that simultaneously examine multiple predictors of the relationship between two variables, were used to investigate whether drivers identified in 2005 were still associated to ill-health in 2010. Models for EU25 and separately for EU15 and EU10 countries were fitted. *Results* Women live longer than men, but spend a larger proportion of remaining life with disability. For men in the EU25, standard meta-regression showed GDP, long-term unemployment, life-long learning and low education remained strongly associated to HLY50 in 2010, with addition of income inequality and employment rate of older workers. For women, GDP and weak association for low-education remained in 2010, along with long-term unemployment and life-long learning. Material deprivation was strongly associated for men and women in both years even with the more rigorous approach. In the EU10 low-education remained strongly associated for both men and women, and long-term unemployment rate was strongly associated for both in 2010. No associations found for EU15. *Conclusion* It has long been known that socio-economic factors influence healthy ageing. Our analysis suggests focussing interventions at improving levels of education and employment rates, while reducing material deprivation, poverty rates, unemployment and inequality in income could help reduce inequalities in the EU and this could have particular benefits for the newer EU10.

## **8 Educational differences in disability free life expectancy in the Swedish old population 2002-2011**

**Louise Sundberg, Neda Agahi, Stefan Fors, Jonas Wastesson**

*Background:* Educational disparities exist both in remaining life expectancy (LE) and health during old age. Disability-Free Life Expectancy (DFLE) is poorly examined among older adults in the Swedish population and differences between educational groups have not been addressed previously. Aim: The aim of this study is to explore the trend in DFLE by education among older adults in Sweden between year 2002 and 2011. *Method:* DFLE was calculated by the Sullivan method. LE by education was obtained from Statistic Sweden and prevalence of ADL-disability from the Swedish Panel Study of Living Conditions of the Oldest Old (SWEOLD). DFLE at age 77 was calculated for year 2002 and 2011 according to sex and level of education, absolute and relative DFLE was derived. Result: LE increased with 0.5 years for women with secondary (or higher) education and with 0.4 for those with primary (or lower) education. The corresponding number for men was 0.5 respectively 0.7 years. DFLE increased more than LE, however the

increase was larger among those with higher education and the gap in DFLE increased between educational groups. *Conclusion:* The results suggest that educational disparities exist in both mortality and disability during old age. The difference in DFLE by educational level increased between 2002 and 2011 where the less educated had a less favorable development than the highly educated. Both men and women, regardless of education, had a larger increase of DFLE than LE. Thus, a compression of disability appears to have occurred during the period.

## 9 Contribution of chronic diseases to the burden of disability in Belgium

**Renata Yokota, Nicolas Berger, Johan Van der Heyden, Stefaan Demarest, Herman Van Oyen**

*Background:* Age-associated disability may reduce quality of life in the older population and lead to wide-range implications for social and health policy. The identification of diseases that contribute to the burden of disability is crucial to develop intervention strategies to reduce disability. In this study, we assessed the contribution of chronic diseases to the prevalence of disability.

*Methods:* Data from 36,269 individuals aged 15 years or older who participated to the Belgian Health Interview Surveys in 1997, 2001, 2004, or 2008 were used. Disability was defined based on difficulties in doing one of the six activities of daily living (transfer in and out of bed, transfer in and out of chair, dressing, washing hands and face, feeding, and going to the toilet) and difficulties in mobility (ability to walk without stopping at least 200m). Multiple additive regression models for men and women were fitted to estimate the age-specific background risk – risk of being disabled in individuals who did not report any disease – and disease-specific risk (disabling impacts) – risk of being disabled in subjects who reported selected chronic diseases.

*Results and Conclusions:* The results and conclusions will be presented at the REVES Conference.

## 10 Towards a consensus definition of healthy ageing

**Evelyn Barron, John Mathers, Martin White, Jose Lara**

The absence of a consensus definition of healthy ageing, and measurement tools based on that definition, is an impediment to healthy ageing research. Previous reviews (Depp & Jeste, 2009 and Hung et al 2010) have found significant overlap between published definitions but also differences in the domains of healthy ageing covered by each definition. There is a great difference between how academics define healthy ageing and the older people they apply their definitions to. A consensus definition is required before the field can advance. A systematic literature review was conducted to examine how definitions of healthy ageing were operationalized. Two hundred and seventy-seven operationalizations were found and their domains analyzed via a card sorting task. The results of the card sorting task were used to form a Delphi survey in which academics and older people were asked to rate how important different components were to the definition of healthy ageing. During the second round of the Delphi survey participants ranked components of the definition in order of importance. The second round of the survey was expanded to a larger population with a more varied age range to look at how opinions about what is important for healthy ageing change across the life course. Results of the systematic review, Delphi survey and expanded survey will be presented and suggestions for a consensus definition made. The overall aim of the project is to arrive at a consensus definition of healthy ageing which will be used to help with prioritisation of measurements of the Healthy Ageing Phenotype (HAP) for use within the LiveWell Programme.

## 11 Simulating Policy Options for an Ageing Society

**Peter Davis, Roy Lay-Yee**

We have developed a simulation model for New Zealand using existing publicly accessible data to test policy options for health and social care under various ageing scenarios. Underpinning our model is the concept of the "balance of care" in which different health and social care options can be weighed against a mix of likely epidemiological, demographic, and system settings in an ageing society. We find that the range of feasible policy options is narrow, given plausible demographic settings. In particular, the opportunities for the substitution of different service configurations guided by a balance of care philosophy are limited.

## 12 Educational inequalities in life expectancy with and without complex health problems in Sweden 2002-2011

**Bettina Meinow, Louise Sundberg, Stefan Fors, Marti G Parker**

*Background:* Although educational disparities in life expectancy (LE) are well-documented, less is known about educational inequalities in health expectancies. Most studies rely on single health indicators. Few studies address the simultaneous presence of several medical conditions and functional impairments, despite the fact that this is a common predicament among older adults. *Aims and methods:* This study identified serious problems in three health domains (diseases / symptoms, mobility, cognition / communication) in two nationally representative samples of the Swedish population aged 77+ in 2002 and 2011 ( $n \approx 1500$ ). People with serious problems in two or three domains were considered as having complex health problems (CHP). Age, sex, education and period specific mortality rates were provided by Statistics Sweden. Changes between 2002 and 2011 in educational differences in LE with and without CHP at age 77 were analyzed using the Sullivan method. *Results:* As expected, women and people with higher education could expect to live longer. LE at age 77 in 2002 ranged from 8.6 years for men with low education to 12.0 years for women with high education. LE increased for all groups during the 9-year period. People with low education were expected to spend more time with CHP than those with high education, both in terms of absolute years and as a proportion of remaining LE. The educational gap in LE with CHP was greater among women than men in 2011. For men and women with low education the gain in LE between 2002 and 2011 consisted entirely of years with CHP. In contrast, for men and women with high education LE with CHP decreased. *Conclusion:* This study indicates that educational inequalities in LE as well as healthy LE persist into old age and have increased between 2002 and 2011. With the demographic challenges facing welfare states monitoring the changes in health LE with CHP provides crucial information for predicting the need for integrated health and social care services.

## 13 Tobacco Smoking in Latin America: Differences between Smokers' Survival Expectations and Observed Mortality

**Beatriz Novak, Alberto Palloni**

*Context:* Since 1980s increases in life expectancy at age 50 have slowed down in the US, primarily due to the contribution of lung cancer and COPD. Smoking is the most likely explanation for the observed deceleration of life expectancy increases. With nearly thirty years of delay, low income countries are going through the same stages as high income countries did before them. Future mortality trends will depend on whether smoking behavior is accompanied by appraisals about its impact on individual survival that are similar to those in place in high income. *Objectives:* To compute and compare estimates of potential survival losses after age 50 and to contrast objective losses in survival with those estimated from subjective survival expectation in the population of smokers and non-smokers. Estimates are compared with those obtained for the US. *Data:* 2005 Mexican Family Life Study (N=3036), 2004 Chilean Social Protection Survey (N=2695), and 2010 Costa Rican Longevity and Healthy Aging Study-Retirement Cohort (N=2800). For comparison purposes, the 2004 Health and Retirement Study (N=5498), *Subjects:* Individuals aged 50-60. *Method:* We use standard estimation procedures to assess potential life expectancy losses at ages above 50 and accelerated failure time models to parameterize subjective survival expectations. *Results:* Preliminary results for Chile show that in general, Chilean male smokers are as optimistic as US male smokers (2.5 and 2.8 more years respectively, subjective life expectancy at age 50 compared with observed life expectancy). However, considering only White US males, US male smokers are more optimistic (3.8 years) than the Chilean male smokers. White female smokers in the US are somehow optimistic (0.8 years), Black females are by far more optimistic (5.3 years). On the contrary, Chilean female smokers and American Black male smokers are a little bit pessimistic (-1.2 years) regarding their future survival.

## 14 Health and ways of living among the elderly

**Pilar Zueras, Anna Cabré, Antonio D. Cámara**

This work presents a summary of results from several research projects dealing with aging and health expectancies and focusing on the following areas: 1) Health outcomes measured in terms of disability and chronic conditions; 2) The impact of health on living arrangements of the elderly; 3) Active aging (performance of daily outside activities); and 4) Socio-demographic profile of the elderly living in institutions. Special attention has been paid to gender, cohort and socioeconomic status in order to explain differentials in the aging and health-decline process among current elderly. Several microdata sources were used to analyze diverse populations (Europe, Spain and Catalonia), namely, the Spanish National Health Survey (ENSE; 1987-2011), the Catalan Health Survey (ESCA 2006), the Catalan Health Survey of Institutionalized Population (ESPI 2006), the Survey of Health, Ageing and Retirement in Europe (SHARE 2004-2011) and the national censuses from seven countries (1981-2011). Among Spanish elderly no consistent trend in disability was found but a systematic increase in the prevalence of cardiovascular chronic conditions between successive cohorts. Overall, socioeconomic conditions are associated with health differences during the aging process. Not only lower classes exhibit poorer health outcomes, but also sex-related disadvantages in terms of disability as well as its association with chronic conditions are higher within these classes. Most people remain active at old ages. For instance, among non-institutionalized Spanish aged 80-84 years 70% of women and 85% of men go daily outside home for shopping, walking, visiting family, etc. However, high-SES elderly are more prone to activity and

independent living arrangements. Disability jeopardizes residential independence of old people, particularly in absence of a co-resident partner. In these cases, co-residence is much commoner in Southern European countries (this is particularly the case of Spain) whereas institutionalization is the alternative to solitary living in Northern European countries.

## **15 Geographic Differential in Functional Difficulties among Older persons in the Philippines**

**Jeofrey Abalos**

Previous studies on functional difficulties among older persons in the Philippines were all based on survey data and were limited only at the national level, failing to capture the wide diversity in the health status of Filipino older persons at the sub-national level. This paper aims to address this limitation by examining patterns in functional difficulties among older persons in the Philippines at the regional and provincial level using the 2010 Census of Population and Housing (CPH). The 2010 CPH is the very first census in the Philippines that included indicators on functional difficulty. These indicators include difficulty in walking or climbing steps; self-caring (bathing or dressing); seeing, even when wearing eyeglasses; hearing, even when using hearing aid; remembering or concentrating; and communicating using his/her usual language. Contextual factors that may explain inter-provincial differences (or lack thereof) in functional difficulties among older persons will also be explored. These factors include levels of poverty, availability of medical professionals, unemployment rate, levels of urbanization, and proportion of older persons with secondary education

## **16 Future Trends of Older Adults with Disability under the Demo-Socio-Economic Factors in China, 2006-2050**

**Lei Zhang, Xiaoying Zheng**

*Background:* Population ageing, combined with the fact that disability is most common among the elderly, has focused attention on the future changing of ageing population with disability. While populations throughout the world are ageing rapidly, China already has one of the largest ageing populations who met a big challenge on burden of disability. *Objectives:* This study predicted the changing tendency of ageing population with disability, and determines whether demographic, social, and economic factors could account for the tendency, and finally gives some evidences on prevention and reduction of disability risk. *Data & Methods:* A cross-sectional data of Second China Sample Survey on Disability (2006) is used in this study, it covered total 31 provinces, Municipalities and Autonomous Regions, with the sample size of 2526145 (161479 were disabled persons), and six types of disability were included. *Results:* Most of the socio-economic-demographic factors were significantly associated with disability among total population except nationality ( $p \leq 0.05$ ), and among ageing population except occupation. The future total number and growth rate of older adults with disabilities in China are very striking. Under assumption II, about 1.5 million of older adults increase annually from 2006 to 2040, and more than 2.5 million increase annually from 2040 to 2050. Total number in 2050 is 3.05 times of 2006. And population ageing, sex, place of residence, marital status, education, income, provincial GDP per capita are significantly affect the prevalence of disability among the older adults. *Discussion:* The huge size of the population with disability in China will bring social economic environment and health care system a tremendous pressure and burden. And China's population will experience a process of population with disability aging and aging

population disabling in the future. *Conclusion:* Social and economic factors affect the development process of future changes in size of population with disability, but the most far-reaching impact factor is population aging, so the health expectancy of the elderly population is most worthy of attention. Well education background and economic environment contribute to the reduction of disability risk, which can be used as the primary factor in disability prevention and control.

## **17 Associated factor analysis on demands satisfactory of services for older adults with visual disability**

**Lei Zhang, Xiaoying Zheng**

*Objective:* To investigate the status and associated factors of demands satisfactory (DS) of services for older adults with visual disability (OAVD). *Methods:* Based on the 2nd National Sample Survey on Disability in 2006, totally 24,017 cases of OAVD were included. The associated relationship among demographic, health, social, economic factors and DS of services, which were health demand (Type I), basic livelihood demand (Type II), and environmental support demand (Type III) were analyzed. *Results:* The proportion of DS of type I, II, III services for OAVD were 35.1%, 9.3% and 4.3%. 8 factors associated such as had pension insurance (OR=1.64), living in urban (OR=1.54), per capita household income at 5000 + yuan (OR=1.46) were favorable factors of OAVD's DS; 80+ age group (OR=0.90) and male (OR=0.93) were adverse factors of Type I. 4 factors associated such as male (OR=1.43), living in urban (OR=1.15), defined as grade II (OR=1.36) and grade I (OR=1.70) were favorable factors of OAVD's DS; and 5 factors associated such as 15-59 discovery age group (OR=0.57), 60+ age group (OR=0.45), per capita household income at 1000-1999 yuan (OR=0.77), 2000-4999 yuan (OR=0.58) and 5000+ yuan (OR=0.39) were adverse factors of Type II. Living in urban (OR=1.23), defined as grade II (OR=1.38) and grade I (OR=1.34), had pension insurance (OR=1.62) and per capita household income at 5000+ yuan (OR=1.42) were favorable factors of Type III. *Conclusion:* DS degree of older adults with visual disability is generally very low, per capita household income, social insurance participation, age, disability, age, age of disability discovery, residence, gender, disability grade, marriage, education level were significantly associated with service DS.

## **18 Social Capital and Health among Older Europeans: Evidences from the Survey on Health and Retirement in Europe (SHARE)**

**Maria Felice Arezzo, Cristina Giudici**

The relationship between social capital and health is capturing the attention of an increasing number of researchers and a growing body of literature is flourishing. Researchers agree that social capital is the synthesis of three different points of view: the first defines social capital as those characteristics of social communities, such as networks of individuals and families together with norms, that create externalities for the society as a whole; the second defines social capital as a variety of different entities which all consist of some aspect of social structure and which facilitate certain actions of actors within the structure; the third includes the social and political environment that shapes social structure and allows for the development of norms. Theoretical research distinguishes between bonding and bridging social capital. The first refers to the relations that an individual has within his/her "inner circle" whereas the second relates to ties with people outside the closest circle but belonging to the same socio-economic group. Following the approach of the World Health Organization, health should be considered as having a dynamic nature, and should be taken into consideration in the context of life, as the ability to fulfill

actions or to carry out a certain role in society. The aim of the paper is to investigate the effects of bridging and bonding social capital on health of people aged 60 or more in sixteen European countries, using multinomial and logit models. The data used are from the 4th wave of the Survey on Health and Retirement in Europe (SHARE), which for the first time collects detailed information at European level on individual's social network. Health conditions are measured through perceived health status, chronic morbidity, functional limitations, self care activity restrictions (ADLs) and instrumental activity restrictions (IADLs).

## 19 Comparison of self-rated health and the global activity limitation indicator as predictors of mortality

**Nicolas Berger, Johan Van der Heyden, Herman Van Oyen**

*Background* Self-rated health (SRH) is a widely used and validated health measure and an excellent predictor of mortality, morbidity, functional status and health consumption. The global activity limitation indicator (GALI), which identifies subjects with longstanding limitations due to a health problem, has been developed more recently and is increasingly used to calculate disability-free life expectancies. Both instruments are included in the European Union Statistics on Income and Living Conditions and the European Health Interview Survey. In this study, we investigate the predictive power of each instrument on mortality, using a representative sample of the Belgian population. *Methods* We used data from the participants to the Belgian Health Interview Survey 2001 aged 15 years and older (n =10,758). Individuals were followed-up for their vital status until the end of 2010. The impact of an activity limitation measured by the GALI (AL) and poor SRH on mortality was assessed by mortality rate ratios (MRR) from a Poisson regression adjusted for age, gender and education. *Results* Preliminary results suggest that mortality was strongly associated with AL (MRR 5.26; 95% CI 4.6-6.0); a poor SRH was also a strong predictor for mortality (MRR 4.85; 95% CI 4.2-5.5). In a model including both GALI and SRH an independent association was found between mortality and each measure separately (MMR respectively 1.58 ; 95% CI 1.3-1.8 and 1.63; 95% CI 1.4-1.9). Gender did not affect the association between mortality and each measure. *Conclusion* Both SRH and the GALI are good predictors for long-term mortality. This finding may contribute to a further valorisation of the GALI in the domain of public health indicators.

## 20 The Global Activity Limitation Indicator as a predictor of health expenditure

**Johan Van der Heyden, Nicolas Berger, Renata Yokota, Jean Tafforeau, Herman Van Oyen**

*Background* The Global Activity Limitation Indicator (GALI) is a disability measure which is increasingly used to monitor the health of the European population. In this study we assessed the predictive value of the GALI on health expenditure in relation to chronic morbidity. We also investigated the consistency of the association between the GALI and health expenditure over a period of three years. *Methods* Data were used from the participants of the Belgian Health Interview Survey 2008 (n = 11,254). Through an individual linkage with data from the compulsory Belgian health insurance, exhaustive information was obtained on the reimbursed and out-of-pocket health expenses of the respondents from 2008 to 2010. Differences in health expenditure between people with and without activity limitations (AL) were evaluated by calculating cost ratios, adjusted for age, gender, education, level of urbanisation, household type and nationality, taking also into account the presence of chronic morbidity. *Results* The mean health expenditure in the 12 months following the survey increased from 619.32 euro for people with no

chronic morbidity and no AL to 4594.79 euro for people with chronic morbidity and severe AL. After adjustment for socio-demographic variables and chronic morbidity, the mean annual health expenditure was 3.20 (95% CI 2.78-3.69) times higher for people with severe AL and 2.04 (95% CI 1.91-2.18) times higher for people with moderate AL than for those without AL. After adjustment for the same socio-demographic variables and AL, the cost ratio for the presence of a chronic disease was 1.63 (95% CI 1.59-1.67). The impact of AL was similar for health expenses in 2008, 2009 and 2010. *Conclusion* AL have a more important impact on health expenditure than chronic morbidity. The stable association between the GALI and health expenditure over a period of three years confirms its consistency as a public health indicator.

## 21 Estimating the future local area demand for health care amongst the elderly

**Stephen Clark, Mark Birkin, Alison Heppenstall**

This poster will illustrate a methodology to estimate future demand in English local authorities for health care associated with morbidities that affect an ageing population. The techniques used are a spatial microsimulation to estimate the base year demand in 2011 and a static microsimulation to evolve this demand to 2031. To achieve this, data is used from the 2011 Census; the English Longitudinal Study of Ageing; local authority population projections and English Office for National Statistics variant projections. The outcomes of this work are illustrated using population pyramids; trend charts; and difference bar charts; all for a range of local authorities. Mention will also be made of how to re-cast the static microsimulation into a dynamic form and the methodological challenges this presents.

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