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The relationship between active ageing and health using longitudinal data from Denmark, France, Italy and England

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Title:

The relationship between active ageing and health using longitudinal data from Denmark, France, Italy and England

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ABSTRACT

Background: ‘Active Ageing’ has been promoted as a strategy for extending quality of life and healthy life expectancy. However there is limited evidence from nationally representative longitudinal studies on whether engagement among older adults is associated with better outcomes and few studies have considered possible bias arising from differential study attrition.

Methods: We investigate associations between the engagement of people aged 50-69 in three types of activity with self rated health and depression two years later using nationally representative longitudinal data from four European countries (Denmark, France, Italy and England). Data were drawn from waves 1 and 2 of the Survey of Health, Ageing and Retirement in Europe and the English Longitudinal Study of Ageing. Multivariable analysis was used to analyse associations between baseline activity and outcomes at follow-up controlling for socio-economic, demographic and health-related variables at baseline. Multiple imputation techniques and sensitivity analyses were undertaken to investigate possible bias arising from sample attrition.

Results: Respondents in paid work at baseline were less likely to be depressed or to report poor or fair health at follow-up than those who were ‘inactive’, although not in Italy. Engagement in formal and informal activities was not significantly associated with health at follow-up. Sensitivity analyses showed that assuming that those in bad health were over-represented among study attritors weakened the association between work at baseline and health at follow-up.

Conclusions: Engagement in paid work may help maintain health in later life although mechanisms and contextual influences need further investigation.

1. INTRODUCTION

The concept of 'active ageing' has been adopted as a policy priority in the European Union, which designated 2012 as the European Year for Active Ageing (<http://europa.eu/ey2012/>). The WHO defines 'active ageing' as continuing participation in any of a number of domains which extend beyond participation in economically productive activities to also include participation in cultural, spiritual and civic affairs, that contribute to personal well-being and quality of life, as well as to the well being of other individuals and society at large [1].

Engagement in social and productive activities has long been considered important for older people's health and well-being [2-4]. Previous studies generally support the idea that health is better among older people who are more active. For example, using longitudinal data drawn from the US Health and Retirement Study, Calvo [5] found that older people in paid work had reduced morbidity and better perceived well-being when compared to those out of the labour market, even after controlling for baseline health. Similarly, in their systematic review of 16 USA longitudinal studies von Bonsdorff and Rantanen [6] found that volunteering in old age was associated with increased life satisfaction, slower declines in self-reported health, and better physical functioning, well-being and longevity. Bath and Deeg [7] reviewed US and Scandinavian cross-sectional and longitudinal research which examined the impact of social participation on physical health outcomes and reported that educational, political and community-oriented activities were positively associated with better perceived health and reduced mortality.

Comparative European work on engagement and health is still relatively sparse and generally considers few activities at a time, focusing mostly on paid work, caring for a sick person, or volunteering [8-11]. Moreover, much previous longitudinal research reports analyses of complete record datasets, without considering whether sample attrition might bias associations [12 13].

In keeping with the WHO's holistic conceptualisation of active ageing, in this paper we investigate longitudinal associations between three types of engagement (paid work, formal and informal activities) and two important indicators of health two years later in 4 European countries. Engagement of older people occurs within a socio-political context and may be influenced by the provision of services and generosity of benefits, pension schemes, and labour, retirement and early-retirement policies, as well as norms and values [14 15]. It is well recognised that these contextual factors vary within Europe and typologies have been developed which group together countries with similar policies [16]. Although the fine detail

of these vary, most distinguish Nordic countries with generous welfare provisions (social democratic); countries which follow broadly Bismarckian welfare structure (such as France, Germany and Austria); those with liberal and mixed structures (such as the UK and Ireland, and the USA), and in more recent typologies, a Mediterranean group in which welfare policies are premised on greater familial exchange [16]. The countries we selected for inclusion in the study were chosen to represent these four types of regime.

The outcomes investigated were depression, which is associated with increased risk of coronary artery disease, cardiovascular death, and worsened quality of life [17 18], and self-rated health (SRH) which is predictive of quality of life and mortality, even when physical health conditions are controlled for, and has the potential to capture positive dimensions of health rather than just presence of disease or disability [19]. All models included control for baseline health and multiple imputation techniques are used to examine effects of attrition in the samples used.

2. METHODS

2.1 Study Population

Data were drawn from two surveys, the English Longitudinal Study of Ageing (ELSA) and the multi-country Survey of Health, Ageing and Retirement in Europe (SHARE). Both are multidisciplinary longitudinal surveys of individuals aged 50 and over representative of the relevant national populations which were designed to enable comparative analyses. Specific details of sampling frames and methodology, weighting strategies and questionnaires have been reported elsewhere [20 21]. We used data from Denmark, France, Italy and England, countries selected to represent different welfare regimes [16] with good response and retention rates compared with the other available countries from the same regime type.

Data were drawn from the first two waves of the surveys: the first wave of ELSA took place in 2002/03, SHARE collected wave 1 data in 2004/05; later waves were conducted biennially. We consider cohort respondents aged 50-69 at baseline, as only very small proportions of those in age groups older than this were in paid employment, and the analysis presented is necessarily restricted to those present in waves 1 and 2. Respondents who were missing baseline information for one or more variables in the analysis (n=402, 3.3%) were excluded. The proportion excluded for this reason ranged from 2.3% in Denmark to 4% in France. Respondents who had died by wave 2 (n=135, 1.1%) were also excluded. Initial sample sizes for the age groups of interest and attrition by wave 2 are shown in Table 1. Attrition is

defined as loss to follow-up for reasons other than death. Study drop-out was high, especially in France and Italy where 34.9% and 28.9% respectively of respondents had dropped-out of the survey by the second wave, compared to 23.3% of Danish and 19.2% of English participants. As previous studies have shown [12 22], attrition is not random and tends to be higher among respondents of lower socio-economic status and those in poorer health. Possible bias arising from attrition is considered in the final part of the paper.

2.2 Measures

2.2.1 Outcomes

Depression and self rated health were measured using validated scales [23 24]. ELSA included an abbreviated eight-item version of the Center for Epidemiologic Studies Depression Scale (CES-D) [25] whereas SHARE used the EURO-D 12 item scale [24]. Both asked respondents whether they had experienced any depressive symptoms, such as restless sleep or being unhappy in the week (ELSA) or month (SHARE) prior to interview. Those who reported three or more symptoms on the CES-D or four or more on the EURO-D scales were classified as being ‘depressed’ [26 27]. Self-rated health in both SHARE and ELSA was measured in both waves using responses to a generic question (“Would you say your health is ...”) on a 5-point ordinal scale (excellent, very good, good, fair, or poor). SRH responses may be sensitive to positioning of the question [28]. In both studies, respondents were randomly allocated to rate their health status before or after a module of health questions. Since no systematic differences by socio-economic or demographic characteristics were found, answers were combined. The five SRH items were dichotomised into ‘fair or poor’ versus better health in order to simplify the analysis. Although by dichotomising SRH we may lose some information, previous studies have shown that measures of morbidity and mortality are more strongly associated with adverse than with good SRH [23]. Manderbacka, et al. [29] have also shown that results using the dichotomised measure agree well with those based on treating the variable as continuous.

2.2.2 Variables on Activity

Respondents were classified as in paid work if they described their current situation as “employed or self-employed” and if they were not “temporarily away from any work, including seasonal work”, to include only those with a current commitment to labour market activity. Participation in formal activities was defined as non-kin social activities linked to formalised associations, performed within an established structure with a regular schedule.

Formal social involvement thus included organised voluntary work; attendance at training courses, and participation in political organisations, religious organisations or sport, social or other kinds of clubs. Informal and family-related engagement included activities with family members and/or friends, such as care-provision for sick or disabled adults, provision of help to family, friends or neighbours and others from inside and outside the household; and looking after grandchildren without the presence of their parents. SHARE asked about participation in these activities almost every week or more often, as well less frequent engagement. We chose the indicator of weekly activities as this was most suitable to the research hypothesis. However, this was at some cost in terms of comparability as ELSA only collected data on engagement in the month prior to interview.

2.2.3 Other co-variates

On the basis of the existing literature we identified characteristics known to be associated with either or both health and activity and accordingly controlled for the following characteristics at baseline: age, gender, education, wealth, living alone, functional limitation. Educational qualifications were re-coded to three categories representing low, mid and high education using the ISCED classification [30]. Wealth was measured using quintile of the harmonised sum of the net value of properties, non-housing financial wealth and business assets created by the RAND Corporation (www.mmicrodata.rand.org/meta/). Living arrangements were measured using a dichotomised indicator of whether the respondent lived alone or with others. Functional health was measured using a dichotomised variable indicating whether or not respondents had any limitations Activities of Daily Living (ADL); Instrumental Activities of Daily Living (IADL) or physical performance activities using the Nagi item battery [31].

2.2.4 Statistical Analyses

Preliminary analyses were carried out separately for men and women in each country but given the similar patterns observed for men and women, results for both genders combined are presented here. Analyses were firstly undertaken for participants with complete data on all variables examined. In a second stage multiple imputation (MI) under the Missing At Random (MAR) assumption (i.e. missingness in a variable is independent of the missing values themselves after conditioning on the observed data) [32] was used to explore the effects of missing data. In this analysis, SRH and depression at follow-up were imputed separately by country and gender using chained equations. All baseline co-variates used in the

analysis models were included in the imputation of both outcomes (i.e. age, gender, whether the respondent lived alone or not, ADL, IADL, NAGI, SRH, depression, education, wealth, engagement in the various activities). Additionally, number of chronic diseases and marital status were included as auxiliary variables in the multiple imputation model as both are predictors of health outcomes in Western populations. As previously discussed, the very small proportions of respondents with missing information on baseline covariates were excluded. The chained equation process was continued for 20 cycles and 200 imputed datasets were created. The results of analyses on each individual data set were combined using Rubin's rules [32].

Pattern mixture models [33] were used to assess whether and how much various plausible 'arbitrary' assumptions about the missing data mechanism affected the results. The robustness of the results was tested by doing successive analyses assuming that among drop-outs the proportion of people who had depressive symptoms and who rated their health as poor or fair was increased by 20% and 33%. All analyses were performed using Stata, version 12 [34].

3. RESULTS

3.1 Descriptive statistics

Table 1 shows the level of engagement and health of older respondents by gender and country. There were large variations by country with the highest levels of activity in Denmark and the lowest in Italy. There were also differences by country and gender in the proportions with depressive symptoms or poor or fair self-rated health. Danish and English respondents had better health than Italian and French respondents both at baseline and at follow-up.

3.2 Associations between engagement at baseline and health indicators at follow-up

3.2.1 Depression

Table 2 shows results from logistic regression models which investigated associations between baseline engagement and depression at follow-up in each country considered, controlling for baseline socio-economic and demographic characteristics and health. In England engagement in paid work at baseline was significantly associated with lower odds of depression at follow-up; in Italy and Denmark those in paid work also had lower odds of depression, but the results were of marginal statistical significance ($p < 0.10$). Participation in formal or informal activities was not associated with depression in any of the countries investigated; only among English respondents was there any indication of an association (at a

10% level) between informal engagement at baseline and depression at follow-up and in this case the direction of the association was positive, rather than negative as hypothesised. Associations with other co-variables were generally as would be expected from previous studies. Women were significantly more likely to be depressed than men in France Italy, and England. Higher education was negatively associated with depression in France and in England, where those with mid levels of education were also less likely to be depressed than those in the reference category with the lowest education level. In Italy and England living alone was associated with higher odds of depression. Being in the lowest wealth quintile was associated with depression at follow-up in Denmark. In all countries baseline depression was strongly associated with depression at follow up; baseline functional limitation was also associated with depression at follow up, although this was not statistically significant in Denmark.

3.2.2 Self-rated health

Table 3 shows findings from equivalent analysis of variation in SRH at follow-up. In France and England respondents who were in paid work at baseline had significantly lower odds of reporting fair or poor SRH at follow-up; results for Denmark were similar although of marginal statistical significance. Neither formal nor informal/family-related engagements at baseline were associated with SRH at follow-up. Low wealth was positively associated with poorer SRH in Denmark and in Italy, France and England there was an inverse association between higher educational level and poor SRH. Living alone at baseline was significantly associated with lower SRH at follow-up only among Italian respondents. In all countries, respondents who reported functional limitation and who self-assessed their health as poor at baseline were more likely to report low SRH at follow-up.

3.2.3 Imputation and Sensitivity analysis

The results reported above come from complete-record analyses. Item response was a minor issue: as already noted, at baseline, 402 respondents (3.3%) were missing one or more of the variables used in the analyses, and of respondents successfully interviewed at follow-up fewer than 2% had either SRH (n=150) or depression score (n=174) missing. However, as sample attrition was quite considerable, we undertook further analysis to test possible effects of bias resulting from this. As shown in previous studies [12 22], attrition was higher among respondents of lower socio-economic status and those in poorer health. For instance, 23% of attritors were in the lowest quintile of the wealth distribution compared to 19% of respondents who remained in the study. Similarly, among those who dropped out 72% rated

their health as good compared with 77% of those who stayed in the study. Missing values at follow-up were imputed under the MAR assumption and regression analyses for each outcome repeated. Excluding deaths and respondents with at least one missing baseline characteristic, between 18.5% (England) and 38.4% (France) of follow-up depression scores and between 18.5% (England) and 36.9% (France) SRH measurements were imputed. Distributions of observed and imputed data were compared; no implausible differences were found. Table 4 shows the findings from the regression of SRH at follow-up controlling for SRH at baseline, assuming that the missingness was at random. The associations between the indicators of engagement and health at follow-up remained the same in all countries: paid work was associated with decreased likelihood of being in poor health in France and England with a similar but only marginally significant association in Denmark. However, under MAR, women are no longer more likely to report fair or poor health compared to men in Italy. Similarly, age is significant only at the 10% level in England and Italy. Finally, living alone was no longer associated with poor SRH at follow-up in Italy, the only country where respondents living alone were significantly more likely to drop out.

If we assume that missingness was not at random, associations between paid work and poor or fair SRH at follow-up weaken further. Table 5 shows a sample of the sensitivity analyses performed, under the assumption that the proportion of people with poor or fair SRH was 33% higher among non-respondents than respondents, regardless of baseline characteristics. Under this scenario, the association between paid work at baseline at SRH at follow-up weakened in France and England and ceased to be of even marginal significance in Denmark. We also undertook a further analysis assuming that among drop-outs the proportion of people who had depressive symptoms and who rated their health as poor or fair was increased by only 20%. This produced similar results.

4. DISCUSSION

The aim of this paper was to assess whether activity had a positive impact on SRH and depression among older people in four European countries. As previous research has shown variations in health by welfare regime type and social policies are known to interact with decisions on retirement, we examined this association in four countries drawn from different stylised welfare regimes. Our baseline results are consistent with previous research on differences associated with welfare state regimes and policy implementations [16] which have found that older people in social-democratic countries have better general health [35] and higher levels of engagement than older people in Southern welfare regimes, both in volunteering, informal care and labour participation [15]. Longitudinal associations, however, showed less country variation. Our longitudinal results showed some association between engagement in paid work and better health outcomes in England, France (only SRH) and Denmark (marginal significance). Weak associations were found for Italy only in the case of depression. The weak association between paid work and health in Italy may reflect the fact that associations between health and paid work are muted in countries where retirement is available and usual at relatively young ages [36]. Engagement in paid work may enhance health by providing individuals with power, prestige, status, and emotional gratification or by providing them with social support, all of which have a demonstrated effect on health. Another possible mechanism is the positive effect of the physical activity resulting from paid work, related to commuting and moving about while performing the job [37]. Paid work can also be a means of obtaining adequate economic resources, which are important for material well-being and health [38]. No associations were found between engagement in the other types of activity considered and either depression or self rated health.

The ELSA and SHARE surveys suffered from attrition rates of between 19% (England) and 35% (France). Multiple imputation techniques and sensitivity analyses confirmed that sample attrition cannot just be ignored without confounding some reported associations. This is particularly important when ‘active ageing’ is being investigated, given that the causal association between ‘engagement’ and ‘good health’ is likely to be bi-directional and is difficult to identify, even in longitudinal studies. Although it is plausible that being active sustains health, it is equally likely that better health provides an impetus for being more active and that this advantage is maintained over time. This source of bias is addressed to some extent by controlling for baseline health. However, this may not be an adequate and sufficient

way to acknowledge biases arising in such complete-case longitudinal analyses, particularly when pattern of missing data is informative.

4.1 Strengths and limitations

In this paper we investigated associations between engagement and health comparing data collected from SHARE and ELSA. Contributions of the study include examination of a wider range of activities than usually considered derived from a holistic conceptualisation of active ageing, and explicit attention to possible bias arising from missing data.

This analysis, however, has some limitations. The measurements considered in this study were sensitive to the time frame they referred to (i.e. month or week prior to and day of interview). Moreover, data rely on self-reports: measurements such as SRH or participation in certain activities may be sensitive to cultural differences of definitions, and cross-country comparisons should be made with caution [39]. Neither questionnaire provided enough information to capture the full complexity of the experiences and activities older people may engage in, the appraisal of the engagement experience, the meaning attached to it and the personal benefits or satisfaction gained from it. The effect of multiple-role occupancy was not studied: the current research used summary and rather crude indicators of the various forms of engagement, and did not investigate possible effects of concurrent participation in various combinations of activities. Finally, further work is needed to identify causal pathways underlying the association between paid work and health. However, if paid work is indeed an important pathway to health in late life, more attention should be paid to people's working lives, job security, quality of work and work conditions [40] as these are well-known factors which influence participation in, and withdrawal from, the labour market.

What is already known on this subject

- Participation in social and productive activities is associated with good health in early old age. Until recently, most of the evidence has come from US studies and focused on paid work and volunteering.
- Sample attrition may bias longitudinal associations, yet this issue is generally ignored and analyses tend to be limited to complete record datasets.

What this study adds

- This research study adopts a holistic approach to ‘active ageing’, using nationally representative comparable data on four European countries.
- Multiple imputations and sensitivity analyses showed how informative drop-outs can have an impact on findings, an issue which is generally not recognised.

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Contributors GDG conducted the analysis and wrote the manuscript while being supervised by EG who also critically reviewed and contributed to the manuscript. Both authors have read and approved the final version.

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References

1. WHO. *Active Ageing: A Policy Framework*. Geneva, Switzerland: WHO [World Health Organisation], 2002.
2. Havighurst R. Successful Aging. In: Williams RH, Tibbits C, Donahue W, eds. *Processes of Aging*, vol 1. Chicago: University of Chicago Press, 1963.
3. Butler RN, Gleason HP. *Productive aging: Enhancing vitality in later life*. New York: Springer, 1985.
4. Atchley RC. Retirement and Leisure Participation: Continuity or Crisis? *The Gerontologist* 1971;**11**(1 Part 1):13-17
5. Calvo E. Does Working Longer Make People Healthier and Happier? *Work Opportunities for Older Americans Brief, Series 2*. Boston College: Chestnut Hill, MA: Center for Retirement Research, 2006.
6. von Bonsdorff M, Rantanen T. Benefits of formal voluntary work among older people. A review. *Aging Clinical and Experimental Research* 2011;**23**(3):162-69
7. Bath PA, Deeg D. Social engagement and health outcomes among older people: introduction to a special section. *European Journal of Ageing* 2005;**Volume 2**(1):24-30
8. Siegrist J, Wahrendorf M. Participation in socially productive activities and quality of life in early old age: findings from SHARE. *Journal of European Social Policy* 2009;**19**(4):317-26
9. Wahrendorf M, von dem Knesebeck O, Siegrist J. Social productivity and well-being of older people: baseline results from the SHARE study *European Journal of Ageing* 2006;**3**(2):67-73
10. Hank K. How “Successful” Do Older Europeans Age? Findings From SHARE. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 2011;**66B**(2):230-36
11. Alavinia SM, Burdorf A. Unemployment and retirement and ill-health: a cross-sectional analysis across European countries *International Archives of Occupational and Environmental Health* 2008;**82**(1):39-45
12. Fitzgerald J, Gottschalk P, Moffit R. An Analysis of Sample Attrition in Panel Data. *The Journal of Human Resources. Special Issue: Attrition in Longitudinal Surveys* 1998;**33** (2):251-99
13. Twisk JWR. *Applied longitudinal data analysis for epidemiology. A practical guide*. Cambridge: Cambridge University Press, 2007.

14. Leonard R, Johansson S. Policy and practices relating to the active engagement of older people in the community: a comparison of Sweden and Australia. *International Journal of Social Welfare* 2008;**17**(1):37-45
15. Warburton J, Jeppsson Grassman E. Variations in older people's social and productive ageing activities across different social welfare regimes. *International Journal of Social Welfare* 2011;**20**(2):180-91
16. Arts W, Gelissen J. Three worlds of capitalism or more? A state-of-the-art report. *Journal of European Social Policy* 2002;**12**(2):137-58
17. Celano CM, Huffman J. Depression and Cardiac Disease: A Review. *Cardiology in Review* 2011;**19**(3):130-42
18. Angermeyer MC, Holzinger A, Matschinger H, Stengler-Wenzke K. Depression and Quality of Life: Results of a Follow-Up Study. *International Journal of Social Psychiatry* 2002;**48**(3):189-99
19. Strawbridge WJ, Wallhagen MI, Cohen RD. Successful Aging and Well-Being: Self-Rated Compared With Rowe and Kahn. *Gerontologist* 2002;**42**(6):727-33
20. Taylor R, Conway L, Calderwood L, et al. *Health, wealth and lifestyles of the older population in England: The 2002 English Longitudinal Study of Ageing. Technical Report*. London: National Institute for Social Research, 2007.
21. Börsch-Supan A, Jürges H. *The Survey of Health, Aging, and Retirement in Europe – Methodology*. Mannheim: Research Institute for the Economics of Aging, 2005.
22. Banks J, Muriel A, Smith JP. *Attrition and health in ageing studies: evidence from ELSA and HRS*, 2011.
23. Idler EL, Benyamini Y. Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies. *Journal of Health and Social Behavior* 1997;**38**(1):21-37
24. Prince M, Reischies F, Beekman A, et al. Development of the EURO-D scale--a European, Union initiative to compare symptoms of depression in 14 European centres. *The British Journal of Psychiatry* 1999;**174**(4):330-38 doi: 10.1192/bjp.174.4.330[published Online First: Epub Date].
25. Radloff LS. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement* 1977;**1**(3):385-401
26. Dewey M, Prince MJ. Mental Health. In: Börsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J, Weber, G., eds. *Health, Ageing and Retirement in Europe First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim: Research Institute for the Economics of Ageing, 2005:108-24.

27. Steffick DE. Documentation of Affective Functioning Measures in the Health and Retirement Study. In: Center SR, ed. Ann Arbor, MI: University of Michigan, 2000.
28. Bowling A, Windsor J. The effects of question order and response-choice on self-rated health status in the English Longitudinal Study of Ageing (ELSA). *Journal of Epidemiology and Community Health* 2008;**62**(1):81-85
29. Manderbacka K, Lahelma E, Martikainen P. Examining the continuity of self-rated health. *International Journal of Epidemiology* 1998;**27**(2):208-13
30. UNESCO - UIS. International standard classification of education - ISCED 1997. Secondary International standard classification of education - ISCED 1997 2006. http://www.uis.unesco.org/TEMPLATE/pdf/isced/ISCED_A.pdf.
31. Guralnik JM, Fried LP, Salive ME. Disability as a Public Health Outcome in the Aging Population. *Annual Review of Public Health* 1996;**17**(1):25-46 doi: doi:10.1146/annurev.pu.17.050196.000325[published Online First: Epub Date]].
32. Little RJA, Rubin DB. *Statistical Analysis With Missing Data*. New York: Wiley, 2002.
33. Daniels M. J., Hogan JW. *Missing data in longitudinal studies: Strategies for Bayesian modeling and sensitivity analysis*. Boca Raton: Chapman & Hall, 2008.
34. Stata Corp. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP, 2011.
35. Eikemo TA, Bambra C, Judge K, Ringdal K. Welfare state regimes and differences in self-perceived health in Europe: A multilevel analysis. *Social Science & Medicine* 2008;**66**(11):2281-95
36. Borsch-Supan A, Brugiavini A, Croda E. The role of institutions and health in European patterns of work and retirement. *Journal of European Social Policy* 2009;**19**(4):341-58
37. Luoh M-C, Herzog AR. Individual Consequences of Volunteer and Paid Work in Old Age: Health and Mortality. *Journal of Health and Social Behavior* 2002;**43**(4):490-509
38. Waddell G, Burton AK. *Is work good for your health and well-being?* London: The Stationery Office/TSO, 2006.
39. Jylhä M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E. Is self-rated health comparable across cultures and genders? *The Journals of Gerontology Series B : Social Sciences* 1998 **53**(3):S144-52

40. Siegrist J. Work, health and welfare: new challenges. *International Journal of Social Welfare* 2006;**15**:S5-S12

Table 1. Percent Distribution of sample members by activity, self rated health and depression (people aged 50-69) in Denmark, France, Italy and England

	Denmark		France		Italy		England	
	M	W	M	W	M	W	M	W
No Activities	16.9	17.7	24.7	25.7	37.2	35.1	32.4	32.9
Paid work	59.5	50.0	47.5	40.1	39.8	20.5	55.4	42.9
Formal Engagement	37.4	37.7	29.5	24.1	12.8	13.0	14.2	19.2
Informal Engagement	36.7	43.6	33.9	45.4	28.8	47.7	17.4	29.1
Health outcomes at baseline								
With depressive symptoms	13.9	20.5	21.7	40.8	21.7	38.0	19.0	24.5
Self-rated health as poor or fair	21.1	21.2	24.3	26.2	27.2	36.2	24.2	21.8
Baseline Respondents N	545	557	949	1,049	777	999	3,527	4,037
Health outcomes at follow-up								
With depressive symptoms	13.4	19.0	14.7	40.4	20.6	40.3	18.1	24.1
Self-rated health as poor or fair	22.1	25.5	25.9	31.0	33.2	48.0	26.7	24.9
Follow-up Respondents N	413	416	581	692	535	714	2,792	3,257
Initial Response Rate	63.2%		81.0%		54.5%		67.0%	
Drop out (excluding deaths)	23.3%		34.9%		28.9%		19.2%	
Dead between waves	1.5%		1.1%		1.0%		1.0%	

Source: Denmark, France and Italy data obtained from SHARE, 2004 and 2006 ; English data obtained from ELSA, 2002 and 2004. Note: data for England is based on the 8-point depression scale CES-D, data for SHARE countries is based on the 12-item EURO-D measurement. Measures of engagement relate to past week in Denmark, France and Italy and past month in England. Own calculations; weighted data.

Table 2. Association between engagement at baseline and depression at follow-up, controlling for baseline depression. Odds Ratios and 95% Confidence Intervals obtained from fully adjusted logistic regression, by country

	DENMARK		FRANCE		ITALY		ENGLAND	
	OR	95% CIs	OR	95% CIs	OR	95% CIs	OR	95% CIs
Female	1.32	(0.87 – 2.02)	2.76 ***	(1.97 – 3.87)	1.81***	(1.27 – 2.58)	1.15 *	(0.99 – 1.33)
Age	0.97	(0.93 – 1.02)	0.95 ***	(0.92 – 0.98)	0.99	(0.95 – 1.03)	0.97 ***	(0.95 – 0.98)
Education: MIDDLE^a	0.67	(0.40 – 1.13)	0.81	(0.58 – 1.11)	0.91	(0.60 – 1.40)	0.90	(0.76 – 1.07)
Education: HIGH^a	0.69	(0.40 – 1.21)	0.66 **	(0.44 – 0.99)	0.72	(0.36 – 1.47)	0.74 ***	(0.61 – 0.91)
In Poorest Quintile^b	2.48 ***	(1.54 – 3.98)	1.07	(0.77 – 1.48)	0.98	(0.65 – 1.44)	1.42 ***	(1.20 – 1.70)
Living Alone^c	0.77	(0.46 – 1.31)	1.01	(0.63 – 1.62)	1.88 **	(1.17 – 3.15)	1.42 ***	(1.20 – 1.70)
In Paid Work^d	0.68 *	(0.41 – 1.02)	0.79	(0.47 – 1.32)	0.66 *	(0.43 – 1.03)	0.74 ***	(0.63 – 0.88)
Formally Engaged^e	0.98	(0.64 – 1.52)	0.87	(0.63 – 1.19)	0.71	(0.44 – 1.15)	1.04	(0.85 – 1.27)
Informally Engaged^f	1.16	(0.76 – 1.76)	0.93	(0.66 – 1.29)	0.94	(0.62 – 1.42)	1.15 *	(0.98 – 1.36)
Depressed^g	4.25 ***	(2.71 – 6.65)	5.72 ***	(4.22 – 7.76)	4.91 ***	(3.46 – 6.96)	5.74 ***	(4.95 – 6.68)
Functional Limitations^h	1.26	(0.80 – 1.97)	1.72 ***	(1.28 – 2.31)	1.76 ***	(1.27 – 2.43)	1.77 ***	(1.53 – 2.06)
N Observations	818		1,189		1,226		5,983	

Sources: SHARE 2004 and 2006, ELSA 2002 and 2004; Weighted Data. *, **, ***: significant at the 0.10, 0.05 and 0.01 levels, respectively. Ref categories: a) Low Education; b) In other wealth quintiles at baseline; c) Not Alone at baseline; d) Not in paid work at baseline; e) Not formally engaged at baseline; f) Not informally engaged at baseline; g) without depressive symptoms at baseline; h) No functional limitations at baseline Measures of engagement relate to past week in Denmark, France and Italy and past month in England. Own calculations

Table 3. Association between engagement at baseline and poor SRH at follow-up, controlling for baseline SRH. Odds Ratios and 95% Confidence Intervals obtained from fully adjusted logistic regression, by country

	DENMARK		FRANCE		ITALY		ENGLAND	
	OR	95% CIs	OR	95% CIs	OR	95% CIs	OR	95% CIs
Female	1.02	(0.67 – 1.54)	1.05	(0.72 – 1.55)	1.39 **	(1.01 – 1.88)	0.78 ***	(0.67 – 0.91)
Age	1.01	(0.97 – 1.05)	0.98	(0.95 – 1.01)	1.05 ***	(1.01 – 1.08)	0.98 **	(0.96 – 0.99)
Education: MIDDLE^a	0.80	(0.46 – 1.38)	1.01	(0.74 – 1.37)	0.57 **	(0.36 – 0.90)	0.65 ***	(0.55 – 0.77)
Education: HIGH^a	0.60 *	(0.33 – 1.11)	0.68 **	(0.46 – 1.00)	0.56 **	(0.33 – 0.98)	0.55 ***	(0.45 – 0.68)
In Poorest Quintile^b	1.94 **	(1.19 – 3.15)	1.21	(0.84 – 1.74)	0.98	(0.69 – 1.39)	1.86 ***	(1.54 – 2.24)
Living Alone^c	0.86	(0.52 – 1.41)	1.17	(0.83 – 1.64)	1.98 **	(1.11 – 3.54)	0.98	(0.80 – 1.21)
In Paid Work^d	0.73 *	(0.35 – 1.09)	0.42 ***	(0.30 – 0.60)	0.89	(0.53 – 1.49)	0.61 ***	(0.51 – 0.73)
Formally Engaged^e	1.02	(0.67 – 1.54)	0.80	(0.60 – 1.08)	0.95	(0.62 – 1.47)	0.88	(0.72 – 1.07)
Informally Engaged^f	1.25	(0.83 – 1.87)	0.98	(0.68 – 1.40)	1.02	(0.69 – 1.50)	1.03	(0.86 – 1.22)
SRH \geq Good^g	0.10 ***	(0.06 – 0.17)	0.10 ***	(0.07 – 0.15)	0.13 ***	(0.09 – 0.18)	0.11 ***	(0.09 – 0.12)
Functional Limitations^h	2.51 ***	(1.61 – 3.88)	1.64 **	(1.11 – 2.42)	1.85 ***	(1.39 – 2.43)	2.45 ***	(2.09 – 2.88)
N Observations	826		1,217		1,235		5,982	

Sources: SHARE 2004 and 2006, ELSA 2002 and 2004; Weighted Data. *, **, ***: significant at the 0.10, 0.05 and 0.01 levels, respectively. Ref categories: a) Low Education; b) In other wealth quintiles at baseline; c) Not Alone at baseline; d) Not in paid work at baseline; e) Not formally engaged at baseline; f) Not informally engaged at baseline; g) SRH at baseline = fair or poor; h) No functional limitations at baseline. Measures of engagement relate to past week in Denmark, France and Italy and past month in England. Own calculations

Table 4. Association between engagement at baseline and poor SRH at follow-up, controlling for baseline SRH. Odds Ratios and 95% Confidence Intervals obtained from fully adjusted logistic regression with imputed datasets under MAR, by country

	DENMARK		FRANCE		ITALY		ENGLAND	
	OR	95% CIs	OR	95% CIs	OR	95% CIs	OR	95% CIs
Female	1.03	(0.68 – 1.55)	1.02	(0.75 – 1.39)	1.20	(0.86 – 1.65)	0.81 ***	(0.70 – 0.95)
Age	1.01	(0.96 – 1.05)	0.99	(0.96 – 1.02)	1.03 *	(0.99 – 1.06)	0.99 *	(0.97 – 1.00)
Education: MIDDLE^a	0.81	(0.48 – 1.36)	0.85	(0.61 – 1.18)	0.66 *	(0.43 – 1.01)	0.68 ***	(0.57 – 0.81)
Education: HIGH^a	0.63	(0.35 – 1.11)	0.65 **	(0.43 – 0.97)	0.58 *	(0.32 – 1.03)	0.58 ***	(0.47 – 0.71)
In Poorest Quintile^b	1.78 **	(1.10 – 2.88)	1.34 *	(0.97 – 1.84)	1.14	(0.79 – 1.65)	1.74 ***	(1.46 – 2.08)
Living Alone^c	0.87	(0.53 – 1.42)	1.11	(0.77 – 1.60)	1.57	(0.90 – 2.74)	1.00	(0.82 – 1.22)
In Paid Work^d	0.72 *	(0.42 – 1.05)	0.48 ***	(0.33 – 0.71)	0.88	(0.56 – 1.39)	0.63 ***	(0.53 – 0.75)
Formally Engaged^e	1.07	(0.70 – 1.63)	0.85	(0.61 – 1.19)	0.87	(0.56 – 1.36)	0.87	(0.71 – 1.07)
Informally Engaged^f	1.11	(0.74 – 1.66)	0.98	(0.71 – 1.35)	1.02	(0.73 – 1.44)	1.01	(0.85 – 1.20)
SRH ≥ Good^g	0.11 ***	(0.06 – 0.18)	0.10 ***	(0.07 – 0.15)	0.13 ***	(0.09 – 0.17)	0.10 ***	(0.09 – 0.12)
Functional Limitations^h	2.07 ***	(1.34 – 3.19)	1.57 ***	(1.12 – 2.18)	1.84 ***	(1.38 – 2.47)	2.16 ***	(1.84 – 2.53)
N Observations	1,077		1,918		1,721		7,324	
(% imputed)	23.7		36.9		28.5		18.5	

Sources: SHARE 2004 and 2006, ELSA 2002 and 2004; Weighted Data. *, **, ***: significant at the 0.10, 0.05 and 0.01 levels, respectively. Ref categories: a) Low Education; b) In other wealth quintiles at baseline; c) Not Alone at baseline; d) Not in paid work at baseline; e) Not formally engaged at baseline; f) Not informally engaged at baseline; g) SRH at baseline = fair or poor; h) No functional limitations at baseline. Measures of engagement relate to past week in Denmark, France and Italy and past month in England. Own calculations

Table 5 Association between engagement at baseline and poor SRH at follow-up, controlling for baseline SRH. Odds Ratios and 95% Confidence Intervals obtained from fully adjusted logistic regression with imputed datasets under MNAR (assuming SRH as fair or poor among non-respondents increased by 33%), by country

	DENMARK		FRANCE		ITALY		ENGLAND	
	OR	95% CIs	OR	95% CIs	OR	95% CIs	OR	95% CIs
In Paid Work^a	0.76	(0.46 – 1.26)	0.58 **	(0.33 – 0.99)	0.96	(0.61 – 1.46)	0.66 ***	(0.53 – 0.83)
Formally Engaged^b	0.95	(0.64 – 1.40)	0.82	(0.61 – 1.11)	0.83	(0.52 – 1.31)	0.83	(0.68 – 1.08)
Informally Engaged^c	1.09	(0.73 – 1.64)	0.92	(0.66 – 1.27)	0.97	(0.71 – 1.34)	1.02	(0.85 – 1.23)
Functional Limitations^d	2.16 ***	(1.39 – 3.37)	1.41	(0.85 – 2.35)	1.56 *	(0.99 – 2.45)	2.05 ***	(1.41 – 2.97)
N of Observations	1,077		1,918		1,721		7,324	
(% imputed)	23.7		36.9		28.5		18.5	

Sources: SHARE 2004 and 2006, ELSA 2002 and 2004; Weighted Data. Imputed Datasets. *, **, ***: significant at the 0.10, 0.05 and 0.01 levels, respectively. Reference categories: a) Not in paid work at baseline; b) Not formally engaged at baseline; c) Not informally engaged at baseline; d) No functional limitations at baseline. Controlling for age, gender, education, wealth, whether the respondent lived alone and SRH (all at baseline). Measures of engagement relate to past week in Denmark, France and Italy and past month in England. Own calculations