



HAL
open science

Social protection expenditure on health in later life in 20 European countries

Stefan Sieber, Dan Orsholits, Boris Cheval, Andreas Ihle, Michelle Kelly-Irving, Cyrille Delpierre, Claudine Burton-Jeangros, Stéphane Cullati

► **To cite this version:**

Stefan Sieber, Dan Orsholits, Boris Cheval, Andreas Ihle, Michelle Kelly-Irving, et al.. Social protection expenditure on health in later life in 20 European countries. *Social Science & Medicine*, 2022, 292, pp.114569. 10.1016/j.socscimed.2021.114569 . hal-04357652

HAL Id: hal-04357652

<https://ut3-toulouseinp.hal.science/hal-04357652v1>

Submitted on 21 Dec 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NoDerivatives 4.0 International License



Social protection expenditure on health in later life in 20 European countries: Spending more to reduce health inequalities

Stefan Sieber^{a,*}, Dan Orsholits^{b,c}, Boris Cheval^{d,e}, Andreas Ihle^{b,c,f}, Michelle Kelly-Irving^g, Cyrille Delpierre^h, Claudine Burton-Jeangros^{b,h}, Stéphane Cullati^{i,j}

^a LIVES Centre, Swiss Centre of Expertise in Life Course Research, University of Lausanne, Switzerland

^b LIVES Centre, Swiss Centre of Expertise in Life Course Research, University of Geneva, Switzerland

^c Center for the Interdisciplinary Study of Gerontology and Vulnerability, University of Geneva, Switzerland

^d Swiss Center for Affective Sciences, University of Geneva, Switzerland

^e Laboratory for the Study of Emotion Elicitation and Expression (E3Lab), Department of Psychology, University of Geneva, Switzerland

^f Department of Psychology, University of Geneva, Switzerland

^g CERPOP, UMR1295, Université de Toulouse, UPS, Inserm, Toulouse, France

^h Institute of Sociological Research, University of Geneva, Switzerland

ⁱ Population Health Laboratory (#PopHealthLab), University of Fribourg, Switzerland

^j Department of Readaptation and Geriatrics, University of Geneva, Switzerland

ARTICLE INFO

Keywords:

SHARE
Longitudinal
Ageing
Trajectory
Self-rated health
Grip strength
Social protection expenditure

ABSTRACT

Background: This study aims to examine whether higher social protection expenditure reduces the negative association of life-course socioeconomic disadvantages with subjective and objective health status and trajectories in later life.

Methods: We used SHARE data from participants living in 20 European countries aged 50 to 96. Seven waves allowed to examine the trajectories of health inequalities in later life. We used linear mixed-effects models stratified by sex to examine the association between life-course socioeconomic disadvantage and subjective (self-rated health, SRH, N = 55,443) and objective (grip strength, N = 54,718) health. Cross-level interactions between net social protection expenditure as percentage of gross domestic product and life-course socioeconomic disadvantage tested for the moderating effect of social expenditures on the association of disadvantage with SRH and grip strength in later life.

Findings: Higher social protection expenditure reduced socioeconomic health inequalities in both men and women for grip strength, and in women but not men for SRH. For SRH, the health-inequality-reducing effect of social protection expenditure became weaker with increasing age. This was not observed in grip strength. Some separate expenditure functions (disability, family and children) were found to have inequality-widening effects in men's and women's SRH, which were either offset or overcompensated by the other functions. No inequality-widening effects were observed in grip strength.

Interpretation: Higher social spending reduces life-course socioeconomic inequalities in women's subjective health and in men's and women's objective health. However, some specific social protection policies may have the unintentional effect of increasing inequalities in people's evaluation of their own health.

1. Research in context

1.1. Evidence before this study

An increasing body of literature has studied the impact of social protection policies on socioeconomic inequalities in late-life health and

across the aging process. Cross-sectional evidence so far suggests that absolute educational inequalities in self-rated health (SRH) in the general population are smaller in countries with higher social protection expenditure. Furthermore, available evidence suggests that these inequality-reducing effects of social expenditure are stronger in women compared to men.

* Corresponding author. University of Lausanne, Institute of Psychology, Géopolis, 1015 Lausanne, Switzerland.

E-mail address: stefan.sieber@unil.ch (S. Sieber).

<https://doi.org/10.1016/j.socscimed.2021.114569>

Received 9 June 2021; Received in revised form 25 October 2021; Accepted 14 November 2021

Available online 15 November 2021

0277-9536/© 2021 The Authors.

Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1.2. Added value of this study

This study extends existing knowledge by examining the role of social protection expenditure on life-course socioeconomic inequalities in indicators of subjective (SRH) and objective health (grip strength) simultaneously. In addition, we use a comprehensive measure for life-course socioeconomic disadvantage to capture the accumulation of disadvantage over the life course. Our findings suggest that higher social protection expenditure reduces the negative impact of life-course socioeconomic disadvantage on women's SRH, as well as on women's and men's grip strength at age 50. Furthermore, this study goes beyond cross-sectional data by examining how social protection expenditure affects the evolution of life-course socioeconomic inequalities across the ageing process. Results show that the positive effect of social protection expenditure decreased with ageing in SRH. Finally, the analysis of separate social protection functions indicated that some policies have an inequality-widening effect in subjective health, which is either offset or overcompensated when looking at total social protection expenditure.

1.3. Implications of all the available evidence

Generally, findings suggest that higher social spending reduces life-course socioeconomic inequalities. However, differences between men and women and the fact that some policies have inequality-widening effects in subjective health point to the need for careful analysis of social protection policies in relation to health inequalities.

2. Introduction

In the context of ageing European societies, it is crucial to understand people's health trajectories through later life and the factors that are associated with better or worse health during the ageing process. A large body of research has shown that socioeconomic disadvantage over the life course is associated with a wide range of adverse health outcomes in later life, including self-rated health and muscle strength (Sieber et al., 2019; Cheval et al., 2018; Hyde et al., 2006). Moreover, these health inequalities differ across countries and welfare regimes (Sieber et al., 2019; de Breij et al., 2020). These differences suggest that the impact of life-course socioeconomic circumstances on individuals' health can be influenced by macro-level factors (de Breij et al., 2020; Sieber et al., 2020). Since poor health in later life may have a significant economic and societal impact (Cristea et al., 2020), it is important to examine how macro-level factors are related to health inequalities and their pattern over the ageing process.

There have been three common approaches to study differences in health between countries: the regime approach, the institutional approach, and the expenditure approach (de Breij et al., 2020). The most commonly used one is the regime approach, which assumes that countries can be clustered according to their degree of decommodification (the degree to which individuals can maintain a socially accepted standard of living without depending on market participation) and policies related to family (Esping-Andersen, 1990). However, this clustering may prevent us from studying the mechanisms linking country-level characteristics with individual-level health due to the loss of between-country variance within the clusters (de Breij et al., 2020; Ferrarini et al., 2014; Lundberg et al., 2015). The institutional approach focuses on specific social policy program characteristics and is based on the premise that social citizenship is key to the examination of the welfare state (Dahl and van der Wel, 2013). Yet, as this approach requires us to make assumptions with regards to a 'standard worker' and a 'standard family' that typically represent only a small part of the examined population (Korpi and Palme, 2007), its utility in comparative studies is limited (Dahl and van der Wel, 2013). Finally, the expenditure approach uses information on the public spending on social protection and services at the national level to examine welfare state effort and generosity (de Breij et al., 2020; Dahl and van der Wel, 2013; Jolidon

et al., 2021). Spending areas include sickness and health care, disability, old age, survivors, family and children, unemployment, housing, and social exclusion. Since the expenditure approach focuses on a specific characteristic of the welfare state rather than welfare regimes as a whole, it enables analysing how domain-specific policies affect health inequalities (Lundberg, 2008; Hillier-Brown et al., 2019). Thus, this approach is particularly useful when examining the potential mechanisms involved in macro-policy effects on health inequalities. Yet, the expenditure approach has been criticized for not being able to differentiate well between welfare state effort and need. For instance, high expenditure in social protection policies may not only be an indicator for high welfare state effort but also for increased need among the citizens due to higher unemployment rates (de Breij et al., 2020). However, a study revealed that adjusting all social protection expenditure measures for need had little effect on results (Dahl and van der Wel, 2013).

As well as between-country factors, within-country factors also deserve consideration. Specifically, socioeconomic circumstances are thought to have an impact on health through both a material and a psychosocial pathway (Bartley, 2017). The material pathway is the mechanism through which absolute material living standards and resources (such as income and wealth) affect health. The psychosocial consequences evoked by socioeconomic disadvantage, such as stress, stigmatization, feeling of loss of control, can have a negative impact on health. These within-country factors can interact with between-country factors. For instance, welfare systems are designed to build a safety net and provide resources to people in need or people who are not able to generate enough income on the labour market to provide for themselves (material pathway) (Bartley et al., 1997). As a consequence, people finding themselves in vulnerable situations can benefit from the welfare system in order to alleviate their difficult circumstances. Therefore, more generous welfare states in terms of social protection expenditure are believed to be better able to mitigate the negative impact of disadvantaged socioeconomic circumstances on health. Furthermore, the mere knowledge of an existing welfare system that people can revert to in case of need, can alleviate the stress related to the insecurity of potentially vulnerable situations (psychosocial pathway) (Sieber et al., 2020). Generous welfare systems have been shown to create a more beneficial psychosocial environment, even for those not in direct need of benefits (Sieber et al., 2020; Bartley et al., 1997). Moreover, in line with cumulative dis/advantage theory, not only the exposure but also the accumulation of exposure to sources of stress throughout the life course generates growing differences in later life (Dannefer, 2003). We hypothesize that more generous welfare systems are better able to break this vicious circle and prevent increasing socioeconomic health inequalities in later life.

Previous research has shown that higher social protection expenditure has a reducing effect on health inequalities and are associated to better health in the general population (Dahl and van der Wel, 2013; Álvarez-Gálvez and Jaime-Castillo, 2018). However, to our knowledge, existing studies have only looked cross-sectionally at health inequalities at a particular point in time. This study aims to examine whether higher social protection expenditure lowers the impact of life-course socioeconomic disadvantage on health levels and evolution across ageing. Our particular focus lies on the health inequalities that arise from disadvantaged socioeconomic circumstances and their evolution over the ageing process and how social protection expenditure on the country level influences these health inequalities across ageing. To achieve our goal of better understanding this relationship, we make use of longitudinal data to look at the impact of social protection expenditure on the evolution of health inequalities over the ageing process. In this analysis we use self-rated health (SRH) and grip strength as indicators of individual health. These measures capture two different health domains, a subjective evaluation of one's general health for SRH, and an objective measure of participants' physical health for grip strength.

3. Methods

3.1. Data

This study used individual-level data from the cross-national and longitudinal Survey of Health, Ageing and Retirement in Europe (SHARE). The survey includes information on socioeconomic circumstances and health of individuals aged 50 and older in 27 European countries (Börsch-Supan et al., 2013). SHARE has collected seven waves of data between 2004 and 2017 (every two years). Waves 3 and 7 (for those who have not completed wave 3) include retrospective information on the life-course socioeconomic circumstances. To be included in our study, participants needed to be between 50 and 96 years old, have completed the retrospective SHARELIFE module either in wave 3 or 7, and have provided at least one outcome observation over the seven survey waves (Fig. S1, Supplementary Material). As a result, 20 countries were included in our analyses (Table S1, Supplementary Material). The included countries participated for varying durations in SHARE and collected data for different amounts of waves, which is detailed in Table S5 of the Supplementary Material.

Country-level data were obtained from Eurostat (the statistical office of the European Union) administered surveys and datasets. Data on social protection expenditure were derived from its ESSPROS framework (European System of Integrated Social Protection Statistics), which enables international comparison of national administrative data on social protection (European Union, 2019). The Real Gross Domestic Product (GDP) per capita data come from the National accounts database (Eurostat, 2020). The unemployment rate data were obtained from the EU Labour Force Survey (Eurostat, 2020).

3.2. Outcomes

3.2.1. Self-rated health

As a measure of subjective general health, respondents evaluated their own health on a five-point Likert scale ranging from 1 'poor' to 5 'excellent' by answering following question: "Would you say your health is ..." (Ware and Gandek, 1998). SRH is a predictor of morbidity and mortality covering different health dimensions including physical and mental health (DeSalvo et al., 2006). In the analyses, the scale was inverted such that higher scores indicated worse health. Since SRH was distributed approximately symmetrical with skewness at -0.16 , we conducted linear regression analyses to keep the results comparable with the grip strength outcome (Rhemtulla and Brosseau-Liard PÉsavalei, 2012). To account for the uneven spacing between response categories, we conducted a robustness analysis by recoding SRH as proposed by Perneger et al. (2013)

3.2.2. Grip strength

As a measure of objective physical health, grip strength is a strong predictor of morbidity and mortality (Leong et al., 2015). In SHARE, grip strength was measured in kilograms twice on each hand with a handheld dynamometer (Smedley, S Dynamometer, TTM, Tokyo, 100 kg), alternating between the hands. For this study, we used the mean of the maximum values of both hands (Leong et al., 2015). Values corresponding to 0 were excluded. In the analyses, the scale was inverted such that higher values indicated weaker grip strength.

3.3. Main exposure

Life-course socioeconomic disadvantage is a score combining childhood and adulthood (young adulthood, middle age, later life) socioeconomic circumstances by giving each life-course period a weight of 2. For childhood, based on Wahrendorf & Blane's measure (Wahrendorf and Blane, 2015), we aggregated information on four binary indicators of socioeconomic disadvantage at age 10; occupational position of main breadwinner (high vs low skill), number of books in the household (11+

vs 10 or less), overcrowding (one or fewer persons per room vs more than one), and housing quality (presence of either vs absence of fixed bath, cold running water supply, hot running water supply, inside toilet, and central heating). For each indicator, 0 corresponds to an advantaged and 0.5 to a disadvantaged situation, amounting to a total possible score of two for childhood. For young adulthood, educational attainment was classified according to the International Standard Classification of Education (ISCED) as "primary" (2), "secondary" (1), or "tertiary" (0). For middle age, occupational class of the respondent's main occupation during work life was determined according to the International Standard Classification of Occupations as "never worked" (2), low skill (1), high skill (0). For later life, financial strain was measured through the mode of the available values of the ability to make ends meet over the follow up period. Those who made ends meet "with difficulty" or "great difficulty" were given a score of 2, those who made it "fairly easily" a score of 1, and those who made it "easily" a score of 0. This results in a score ranging from 0 to 8, where higher values indicate greater exposure to socioeconomic disadvantage throughout the life course. Supplemental Material provide more detail on the construction of the score.

3.4. Net social protection expenditure

ESSPROS defines social benefits as transfers, in cash or in kind, by social protection schemes to households and individuals to relieve them of the burden of a defined set of risks or needs (European Union, 2019). These schemes are split into eight functions of social protection: sickness/health care, disability, old age, survivors, family/children, unemployment, housing, social exclusion not elsewhere classified. Net social protection expenditure is obtained by taking into account the average rates of taxes and social contributions paid by recipients of each cash benefit. These rates are then applied to the gross expenditure to obtain the net value as follows: Net social protection expenditure = Gross expenditure * (1 - Average tax rate - Average social contribution rate). In this study, we used net social protection expenditure as a percentage of GDP to measure welfare generosity. Since the net values were only available from 2007 on, we calculated the median of the percentages from 2007 to 2017 for each country as general approximation of the welfare generosity over this period. The analyses were performed for the total net social protection expenditure as well as for each function separately.

3.5. Covariates

At the individual level we included age, sex (woman, man), birth cohort (1919–1928, 1929–1938, 1939–1945, and post-1945), and employment status at baseline (retired, in the labour market, out of the labour market) in the models as known confounders of the association between life-course socioeconomic circumstances and health (Sieber et al., 2020). In addition, models were adjusted for observations (number of waves participated to account for selection effects), partnership status (living with partner, alone), unhealthy behaviors (index combining physical inactivity, unhealthy eating, smoking, and alcohol consumption, ranging from 0 to 1, where 1 indicates unhealthy behavior across participated waves). These covariates are known to potentially influence the tested association (Sieber et al., 2020). Refer to supplemental material for more details on variable construction of partnership status and unhealthy behaviors.

As country-level confounders, we adjusted for the logged GDP per capita to remove the effect of between-country differences in wealth and the general unemployment rate (centered at the mean), since countries with higher unemployment rates tend to have higher social protection expenditure. To be consistent with net social protection expenditure, both country-level confounders represent the median for the 2007–2017 period.

3.6. Statistical analysis

The data were analyzed with linear mixed-effects models with observations (Level 1) nested within individuals (Level 2) nested within countries (Level 3). Linear mixed-effects models avoid excluding participants with missing observations as they do not require an equal number of observations for all participants. We adopted an accelerated longitudinal design by using age as the time basis (Sieber et al., 2019, 2020; Cheval et al., 2018). Thus, each participant contributed to a part of the outcome trajectories across the ageing process. The models included a random intercept and slope for linear age at the individual level as well as a random intercept and slope for the main exposure at the country level to account for cross-country differences in the effect of life-course socioeconomic disadvantage on health in later life. Age was centered at the beginning of the health trajectory (i.e., 50 years), which allowed to examine health inequalities at the youngest age of the sample's age range. In addition, age was divided by 10 to reduce multicollinearity and so that the coefficient yielded effects over a 10-year period. The models were stratified by sex as previous research has shown differential effects for women and men (de Breij et al., 2020; Dahl and van der Wel, 2013). For each outcome, model 1a tested the association between life-course socioeconomic disadvantage (centered at the mean) and SRH/grip strength adjusted for all covariates except for partnership status and unhealthy behaviors. Cross-level interaction terms between life-course socioeconomic disadvantage and net social protection expenditure (centered at the mean) allowed to test for the moderating role of the macro-level variable on the health inequalities at age 50. A three-way interaction life-course disadvantage x net social protection expenditure x age examined the subsequent evolution of health inequalities. Model 1b was fully adjusted with partnership status and unhealthy behaviors. Our model can be written as (covariates not included in equation):

$$Y_{cti} = \beta_0 + \beta_1 Age_{cti} + \beta_2 SECdis_{ci} + \beta_3 SocProt_c + \beta_4 SECdis_{ci} * SocProt_c + \beta_5 Age_{cti} * SECdis_{ci} + \beta_6 Age_{cti} * SECdis_{ci} * SocProt_c + e_{cti}$$

where Y_{itc} is the continuous health outcome (SRH or grip strength) for individual i at age t within country c . $SECdis$ = life-course socioeconomic disadvantage, $SocProt$ = net social protection expenditure, e_{cti} = level-1 residuals, β_3 = direct effect of net social protection expenditure on health for when $SECdis$ and Age equal 0 (i.e. their centered values), β_4 = estimate of impact of net social protection expenditure by life-course socioeconomic disadvantage on health at age 50, β_5 = evolution of life-course socioeconomic health inequalities across ageing, β_6 = three-way interaction for moderating effect of net social protection expenditure on the evolution of health inequalities. In addition, for the random structure we have:

$$\beta_0 = \gamma_{000} + u_{0ci} + u_c$$

$$\beta_1 = \gamma_{100} + u_{1ci}$$

$$\beta_2 = \gamma_{200} + u_{2c}$$

where the intercept β_0 depends on a common intercept γ_{000} and two random terms u_{0ci} and u_c accounting for variation at the individual and country level, respectively. The slope for age β_1 depends on one random term accounting for variation at the individual level. The estimate for the main exposure β_2 varies by country.

To decompose the effect of total net social protection expenditure and to explore specific policy effects, the same models were run for the eight separate social protection functions. For this purpose, each model included the eight functions plus the interactions with the main function of interest.

3.7. Sensitivity/robustness analyses

To account for the uneven spacing between the response categories of the SRH item, we ran the models by recoding the variable as follows: excellent = 1, very good = 1.5, good = 2.3, fair = 4, poor = 5. This recoding was proposed by Perneger et al. in order to turn SRH into an interval variable through a coding that better reflects the underlying construct of health (Perneger et al., 2013). The results revealed that the interaction of life-course socioeconomic disadvantage with age for women and men was not significant anymore compared to the main models (data available upon request). Moreover, these results were confirmed by an additional robustness analysis using ordinal models. Therefore, we consider the findings related to the interaction between life-course socioeconomic disadvantage and age not robust enough to make conclusions from.

We ran the grip-strength models 1b by further adjusting them with the body mass index (BMI), as grip strength can depend on an individual's height and weight (data available upon request) (Leong et al., 2015). The main findings were not changed by this adjustment. Thus, to ensure maximum comparability between SRH and grip-strength analyses, we show the results without BMI adjustment.

In addition, we ran the analyses for total net social protection expenditure by excluding Luxembourg from the sample (data available upon request). Since a significant proportion of benefits in Luxembourg are paid to persons living outside the country, this might have an influence on the cross-level interactions (Dahl and van der Wel, 2013). Individual-level data from SHARE only considers people living in the country. Results from the sensitivity analyses revealed that the moderation of the association between life-course socioeconomic disadvantage and women's grip strength by social protection expenditure became statistically borderline insignificant ($p = 0.069$ in Model M1b), while the other findings were not changed.

Furthermore, we reran the analyses by including only individuals that provided three or more observations in order to account for the fact that some of the countries had follow-up durations below three waves. This has led to three countries being excluded: Croatia, Hungary, and Ireland. The results revealed no changes in comparison with the main findings, which further strengthens the findings put forward below (data available upon request).

4. Results

Tables S1-S4 show the baseline characteristics of the SRH ($N = 55,443$, 56.3% women) and grip strength ($N = 54,718$, 56.3% women) samples by country and sex. The highest SRH scores (3-4) were reported in Denmark and Ireland for women and men. The lowest scores (2-2) were reported in Estonia and Poland for women and men. The highest grip strength scores were reported in Germany (26.2 kg) for women and Denmark (44.0 kg) for men, the lowest in Spain for both women and men (20.7 kg and 34.9 kg, respectively). Tables S5 and S6 show descriptive statistics for the country-level variables. The median over the 2007-2017 period of the total net social protection expenditure as percentage of GDP varied from 15.03% in Estonia to 30.03% in France, while the overall mean was 22.63%. Random intercept only models indicated that level-3 clustering (countries) accounted for 11.7% (women) and 11.3% (men) of the total variance in the SRH and 4.7% and 5.0% in the grip strength models, respectively. The variance inflation factors remained below 3 in all the models, indicating that the models were not affected by multicollinearity issues (Forthofer et al., 2007).

4.1. Associations of life-course socioeconomic disadvantage with health at age 50 and moderation by social protection expenditure

For SRH (Model M1b, Table 1), the longer respondents experienced socioeconomic disadvantage over the life course, the worse was their

Table 1

Associations of life-course socioeconomic disadvantage with poor self-rated health and the moderating effect of net social protection expenditure, stratified by sex.

	Female				Male			
	M1a		M1b		M1a		M1b	
	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value
Age	0.23 (0.22–0.25)	<0.001	0.23 (0.22–0.25)	<0.001	0.31 (0.29–0.32)	<0.001	0.31 (0.30–0.32)	<0.001
Birth cohort (ref. after 1945)								
between 1919 and 1928	−0.06 (−0.11–0.01)	0.01	−0.10 (−0.15–0.06)	<0.001	−0.23 (−0.28–0.17)	<0.001	−0.22 (−0.28–0.17)	<0.001
between 1929 and 1938	−0.02 (−0.05–0.01)	0.14	−0.03 (−0.06–0.00)	0.06	−0.17 (−0.21–0.14)	<0.001	−0.15 (−0.19–0.12)	<0.001
between 1939 and 1945	−0.05 (−0.07–0.02)	<0.001	−0.04 (−0.06–0.01)	<0.01	−0.13 (−0.16–0.10)	<0.001	−0.12 (−0.15–0.09)	<0.001
Observations	−0.02 (−0.03–0.01)	<0.001	−0.01 (−0.01–0.00)	<0.01	−0.02 (−0.03–0.01)	<0.001	−0.01 (−0.02–0.00)	<0.01
Employment status (ref. Retired)								
In the labour force	−0.15 (−0.17–0.12)	<0.001	−0.15 (−0.17–0.12)	<0.001	−0.11 (−0.14–0.08)	<0.001	−0.11 (−0.14–0.09)	<0.001
Out of the labour force	0.05 (0.03–0.08)	<0.001	0.05 (0.02–0.07)	<0.001	0.71 (0.66–0.77)	<0.001	0.67 (0.62–0.72)	<0.001
Life-course socioeconomic disadvantages	0.15 (0.14–0.17)	<0.001	0.14 (0.13–0.16)	<0.001	0.15 (0.13–0.17)	<0.001	0.14 (0.12–0.16)	<0.001
Net social protection expenditure	−0.01 (−0.04–0.02)	0.40	−0.01 (−0.04–0.02)	0.41	−0.01 (−0.04–0.01)	0.38	−0.01 (−0.04–0.01)	0.38
GDP per capita (log)	−0.34 (−0.52–0.16)	<0.01	−0.32 (−0.51–0.14)	<0.01	−0.33 (−0.50–0.15)	<0.01	−0.31 (−0.49–0.14)	<0.01
Unemployment rate	−0.02 (−0.04–0.00)	0.04	−0.02 (−0.05–0.00)	0.04	−0.04 (−0.06–0.01)	<0.01	−0.03 (−0.05–0.01)	<0.01
Living alone (ref. living with a partner)			0.01 (−0.00–0.03)	0.15			0.04 (0.02–0.07)	<0.01
Unhealthy behaviors			0.64 (0.60–0.67)	<0.001			0.48 (0.45–0.52)	<0.001
Interactions								
LCSEC disadvantage x Social protection	−0.006 (−0.009–0.002)	0.01	−0.005 (−0.009–0.002)	<0.01	−0.004 (−0.009–0.000)	0.08	−0.004 (−0.008–0.001)	0.16
LCSEC disadvantage x Age	−0.006 (−0.010–0.002)	<0.01	−0.007 (−0.011–0.003)	<0.01	−0.006 (−0.011–0.001)	0.02	−0.005 (−0.010–0.000)	0.05
Social protection x Age	0.003 (0.001–0.005)	<0.01	0.004 (0.002–0.006)	<0.001	0.004 (0.001–0.006)	<0.01	0.004 (0.002–0.007)	<0.01
LCSEC disadvantage x Social protection x Age	0.003 (0.001–0.004)	<0.001	0.003 (0.002–0.004)	<0.001	0.002 (0.001–0.004)	<0.01	0.002 (0.001–0.004)	<0.01

Note: SRH scale was inverted such that higher scores indicate worse health. Coefficients and confidence intervals of interactions rounded to three decimal places for more precision. LCSEC disadvantages = Life-course socioeconomic disadvantages, Social protection = Net social protection expenditure. Age was centered at 50 years and divided by 10 so that the coefficients yielded the effects for a 10-year period.

reported health for both women and men (0.14, $p < 0.001$ for both). Results do not show a direct effect (at age 50 and the mean for life-course socioeconomic disadvantage) of net social protection expenditure on

SRH for women and men (all $p > 0.05$). The cross-level interaction between life-course socioeconomic disadvantage and social protection expenditure indicates that the detrimental health effects of life-course

Table 2

Associations of life-course socioeconomic disadvantage with weak grip strength and the moderating effect of net social protection expenditure, stratified by sex.

	Female				Male			
	M1a		M1b		M1a		M1b	
	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value
Age	2.86 (2.80–2.93)	<0.001	2.86 (2.80–2.93)	<0.001	5.19 (5.08–5.30)	<0.001	5.21 (5.10–5.32)	<0.001
Birth cohort (ref. after 1945)								
between 1919 and 1928	1.34 (1.05–1.64)	<0.001	1.17 (0.87–1.46)	<0.001	2.30 (1.79–2.80)	<0.001	2.26 (1.76–2.76)	<0.001
between 1929 and 1938	0.67 (0.48–0.86)	<0.001	0.63 (0.43–0.82)	<0.001	0.92 (0.60–1.24)	<0.001	1.04 (0.72–1.36)	<0.001
between 1939 and 1945	0.15 (−0.01–0.31)	0.07	0.18 (0.02–0.35)	0.03	0.10 (−0.17–0.36)	0.47	0.17 (−0.09–0.43)	0.21
Observations	−0.31 (−0.35–0.28)	<0.001	−0.26 (−0.30–0.22)	<0.001	−0.44 (−0.50–0.38)	<0.001	−0.37 (−0.43–0.31)	<0.001
Employment status (ref. Retired)								
In the labour force	−0.24 (−0.41–0.08)	<0.01	−0.25 (−0.41–0.08)	<0.01	−0.02 (−0.26–0.23)	0.90	−0.07 (−0.32–0.17)	0.56
Out of the labour force	0.34 (0.18–0.50)	<0.001	0.35 (0.19–0.51)	<0.001	3.76 (3.27–4.24)	<0.001	3.41 (2.93–3.89)	<0.001
Life-course socioeconomic disadvantage	0.38 (0.31–0.46)	<0.001	0.34 (0.27–0.42)	<0.001	0.49 (0.35–0.64)	<0.001	0.42 (0.28–0.56)	<0.001
Net social protection expenditure	0.00 (−0.12–0.13)	0.94	0.00 (−0.12–0.12)	0.98	−0.07 (−0.27–0.12)	0.46	−0.08 (−0.28–0.11)	0.41
GDP per capita (log)	0.62 (−0.17–1.40)	0.15	0.71 (−0.05–1.47)	0.09	1.23 (0.06–2.41)	0.06	1.43 (0.30–2.56)	0.03
Unemployment rate	0.16 (0.07–0.25)	<0.01	0.15 (0.07–0.24)	<0.01	0.31 (0.17–0.44)	<0.01	0.32 (0.19–0.44)	<0.001
Living alone (ref. living with a partner)			0.20 (0.08–0.32)	<0.01			1.16 (0.92–1.39)	<0.001
Unhealthy behaviors			2.19 (1.94–2.43)	<0.001			2.84 (2.48–3.21)	<0.001
Interactions								
LCSEC disadvantage x Social protection	−0.023 (−0.042–0.003)	0.03	−0.022 (−0.041–0.002)	0.04	−0.060 (−0.098–0.021)	<0.01	−0.057 (−0.095–0.018)	<0.01
LCSEC disadvantage x Age	0.008 (−0.018–0.035)	0.53	0.005 (−0.022–0.031)	0.73	0.007 (−0.037–0.052)	0.76	0.013 (−0.031–0.057)	0.56
Social protection x Age	−0.010 (−0.023–0.003)	0.12	−0.008 (−0.021–0.004)	0.20	−0.003 (−0.025–0.019)	0.76	−0.002 (−0.024–0.020)	0.83
LCSEC disadvantage x Social protection x Age	0.002 (−0.006–0.009)	0.68	0.002 (−0.005–0.009)	0.53	0.012 (−0.001–0.024)	0.07	0.012 (−0.001–0.024)	0.06

Note: Grip strength scale was inverted such that higher scores indicate weaker grip strength. Coefficients and confidence intervals of interactions rounded to three decimal places for more precision. LCSEC disadvantage = Life-course socioeconomic disadvantage, Social protection = Net social protection expenditure. Age was centered at 50 years and divided by 10 so that the coefficients yielded the effects for a 10-year period.

socioeconomic disadvantage were reduced by higher expenditure at country level in women but not in men at age 50 (-0.005 , $p < 0.01$ for women and -0.004 , $p = 0.16$ for men).

For grip strength (M1b, Table 2), the longer male and female respondents were exposed to socioeconomic disadvantage throughout the life course, the weaker was their grip strength at age 50 (0.34 , $p < 0.001$ for women and 0.42 , $p < 0.001$ for men). Results do not show a direct effect (at age 50 and the mean for life-course socioeconomic disadvantage) of net social protection expenditure on grip strength for both men and women (all $p > 0.05$). However, the cross-level interaction indicates that higher social protection expenditure reduced the negative effects of life-course socioeconomic disadvantage on grip strength for both women and men at age 50 (-0.022 , $p = 0.04$ and -0.057 , $p < 0.01$, respectively).

4.2. Associations of life-course socioeconomic disadvantage with evolution of later-life health and moderation by social protection expenditure

For SRH (M1b, Table 1), the interaction of life-course socioeconomic disadvantage with age indicates that the negative effects of life-course disadvantage on SRH found at age 50 decreased with ageing for women but not men (-0.007 , $p < 0.01$ for women and -0.005 , $p = 0.052$ for men). However, this result is not supported by the robustness analysis applying the recoding of Perneger et al. to the SRH item (see section Sensitivity/robustness analyses) (Perneger et al., 2013). The three-way interaction term (Fig. 1), life-course socioeconomic disadvantage x social protection expenditure x age, reveals that the reduction of the negative effects of life-course socioeconomic disadvantage on SRH by social protection expenditure became weaker with ageing (0.003 , $p < 0.001$ for women and 0.002 , $p < 0.01$ for men).

For grip strength (M1b, Table 2), the effect of life-course

socioeconomic disadvantage was not moderated by age in both women and men (0.005 , $p = 0.73$ and 0.013 , $p = 0.56$, respectively). Similarly, the three-way interaction term indicates no moderation of the reduction of the negative effects of life-course socioeconomic disadvantage on grip strength with increasing age (0.002 , $p = 0.53$ for women, 0.012 , $p = 0.06$ for men, Fig. 2).

4.3. Exploratory results for separate net social protection expenditure functions

The models examining the effects of the separate net social protection expenditure functions offer a fine-grained picture of the results shown above. For SRH (Table 3), no specific function had a direct effect on the outcome in both women and men. The cross-level interactions indicate that higher expenditure in old age and survivors reduced the negative effects of life-course socioeconomic disadvantage at the beginning of the modelled SRH trajectories in women (-0.015 , $p < 0.001$ and -0.042 , $p < 0.001$, respectively). However, spending on disability and family and children schemes had the opposite influence of increasing the negative effects of life-course disadvantage (0.029 , $p < 0.01$ and 0.042 , $p < 0.001$, respectively). In men, results show a reduction of negative effects of life-course socioeconomic disadvantage on SRH by higher spending on old age (-0.012 , $p = 0.01$), survivors (-0.031 , $p = 0.02$), and unemployment (-0.025 , $p = 0.03$), while spending on disability (0.029 , $p = 0.02$), family and children (0.037 , $p < 0.01$), and housing (0.071 , $p = 0.048$) showed an increase of negative effects of life-course socioeconomic disadvantage on SRH. The three-way interactions are consistent with the results for the total net social protection expenditure. With increasing age, the moderation effects of the expenditure functions on the association of life-course socioeconomic disadvantage with SRH became weaker. Table S7 in Supplemental Material provides the models M1a.

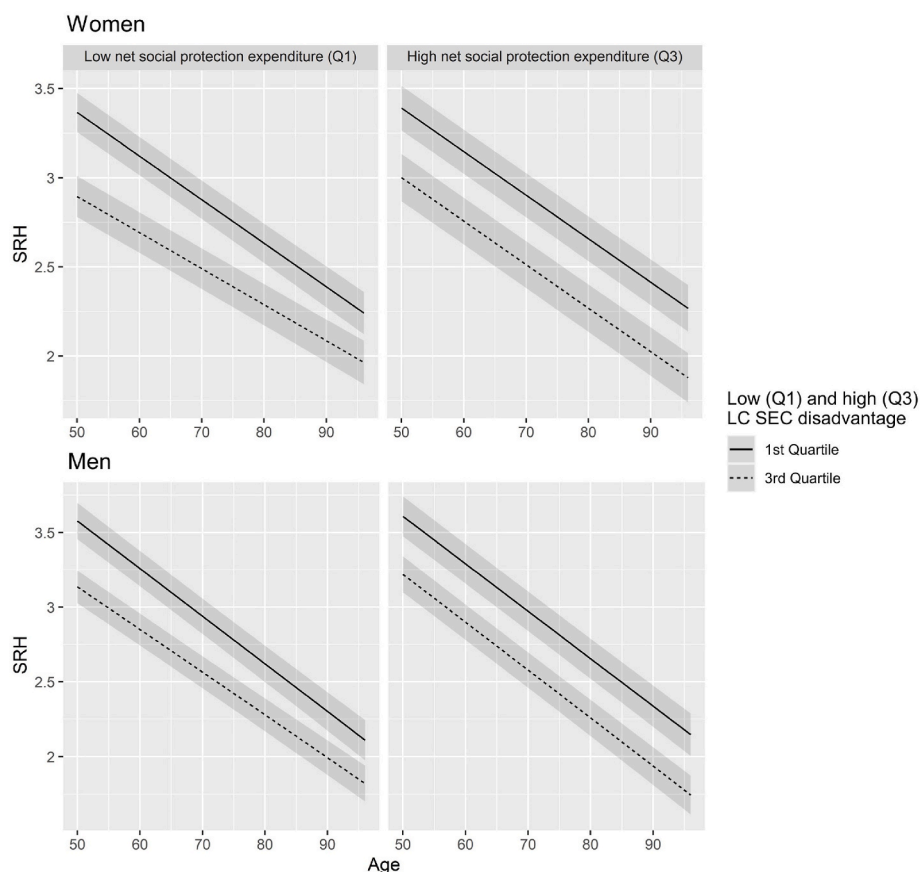


Fig. 1. Marginal effects plot for predicted self-rated health by women and men, model M1b. Notes: SRH = self-rated health [1; 5], for a more intuitive reading of the figure, higher values on the SRH scale represent better health. Net social protection expenditure was dissociated into low and high by applying quartiles on the whole self-rated health sample: Q1 = 20.72%, Q3 = 25.93%. LC SEC disadvantage = Life-course socioeconomic disadvantage [0; 8] was dissociated into low and high by applying quartiles on the sub-samples by women (Q1 = 2.50, Q3 = 5.50) and men (Q1 = 2.00, Q3 = 5.00).

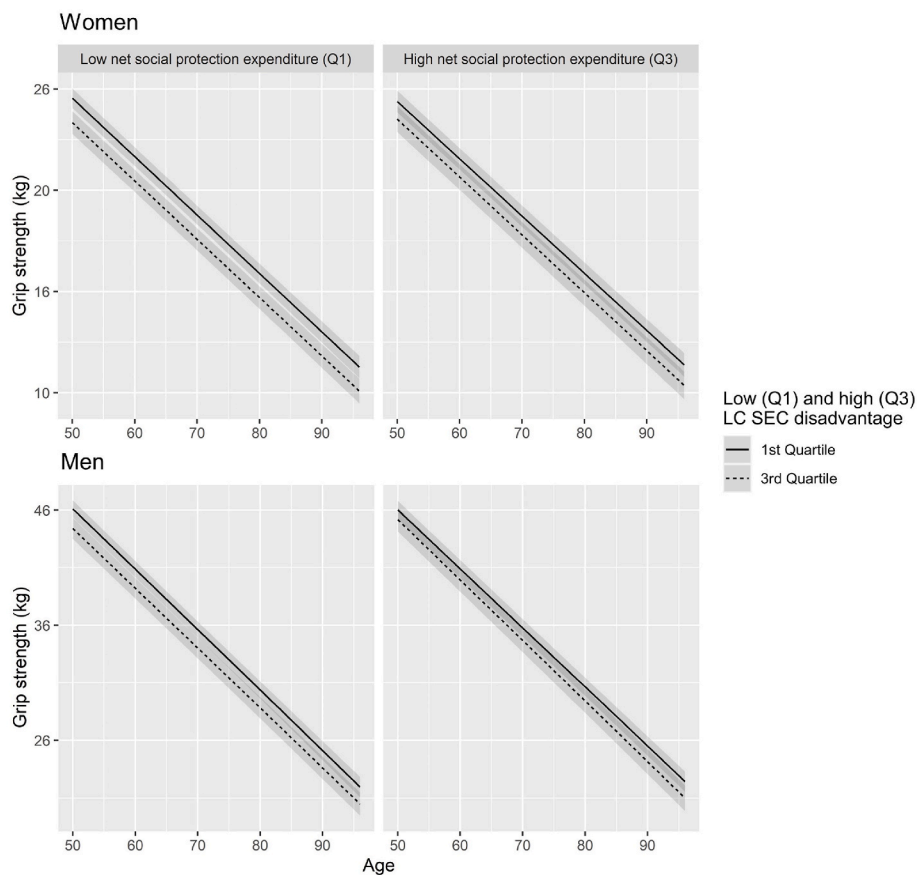


Fig. 2. Marginal effects plot for predicted grip strength by women and men, model M1b. Notes: For a more intuitive reading of the figure, higher values on the grip strength scale represent better health. Net social protection expenditure was dissociated into low and high by applying quartiles on the whole grip strength health sample: Q1 = 20.72%, Q3 = 24.51%. LC SEC disadvantage = Life-course socioeconomic disadvantage [0; 8] was dissociated into low and high by applying quartiles on the subsamples by women (Q1 = 2.49, Q3 = 5.49) and men (Q1 = 1.99, Q3 = 4.99).

For grip strength (Table 4), higher expenditure in sickness/health care policies had a direct (at age 50 and the mean for life-course socioeconomic disadvantage) and beneficial effect on the outcome in women and men (-0.54 , $p = 0.03$, -0.92 , $p < 0.01$, respectively). Additionally, in men, spending on survivor schemes had a negative impact on grip strength (1.60 , $p < 0.01$), while expenditure in family and children (-1.99 , $p < 0.01$) and social exclusion (-3.15 , $p < 0.01$) had a positive effect. The cross-level interactions show a reduction of the negative effects of life-course socioeconomic disadvantage on grip strength at age 50 in men by the sickness/health care (-0.201 , $p < 0.01$), disability (-0.363 , $p < 0.01$), family and children (-0.303 , $p < 0.01$), housing (-1.118 , $p < 0.01$), and social exclusion (-0.876 , $p < 0.001$) functions. The three-way interactions indicate that these reduction effects became weaker with increasing age. Refer to Table S8 in Supplemental Material for models M1a.

5. Discussion

Our findings from this large European-wide study show that longer exposure to socioeconomic disadvantage throughout the life course was associated with worse SRH and grip strength at 50 years for both women and men. The results suggest no direct association of social protection expenditure with these outcomes, which may be due to the sample not only including people in need of social protection benefits. This is reflected in two similar studies, where the one including a broad sample of people aged 25–80+ years did not find a direct association between social protection expenditure and health (Dahl and van der Wel, 2013), and the other with a sample including only retired individuals found a direct association (de Breij et al., 2020). As hypothesized, higher spending reduced the negative effects of socioeconomic disadvantage in women's subjective health (SRH) as well as in men and women's objective health (grip strength). A potential explanation for the sex

differences in subjective health could be that men's assessment of their own health may depend less on contextual factors than women's, since the latter are more connected to people in need through a bigger share of caregiving responsibilities (Mussida and Patimo, 2021; European Commission Direc, 2018). Generally, the found effects may seem small in size but small changes in ubiquitous causes (socioeconomic disadvantage) may result in more substantial differences in the health of populations than larger changes in rarer causes (Keyes and Galea, 2016).

Furthermore, with increasing age the inequality-reducing effect in SRH of higher spending in social protection became weaker (Fig. 1). For objective health, a similar moderation of the inequality-reducing effect of social protection by age was not observed (Fig. 2). The novelty of our study is to reveal this difference between subjective and objective health.

Looking at the separate functions of social expenditure reveals the differing influences of the various social protection policies on the association of socioeconomic disadvantage and later-life health. While spending in old age and survivors policies had a protective effect by reducing socioeconomic inequalities in women's SRH at 50 years, disability and family and children schemes had the opposite, deteriorating, effect. However, the findings for total net social protection expenditure suggest that the former inequality reducing effects are stronger than the latter. In men, adding to the effects found in women, unemployment schemes play a positive role, too, while housing policies add to the negative effects. The findings for total net social protection expenditure suggest that positive and negative effects offset each other. The results for family and children policies are consistent with de Breij et al.'s study, where in countries with higher expenditure on family, educational differences in men's SRH were larger (de Breij et al., 2020). Existing research suggests that individuals from lower socioeconomic strata more often rely on their parents for their children's care-taking duties instead of benefitting from childcare policies (de Breij et al.,

Table 3

Associations of life-course socioeconomic disadvantage with poor self-rated health and the moderating effect of separate functions of social protection expenditure, Models M1b.

	Social protection function		LCSEC dis x Social prot		LCSEC dis x Age		Social prot x Age		LCSEC dis x Social prot x Age	
	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value
Women										
Sickness/Health Care	-0.03 (-0.16-0.10)	0.65	-0.002 (-0.013-0.008)	0.67	-0.007 (-0.011-0.002)	<0.01	-0.002 (-0.008-0.004)	0.48	-0.000 (-0.004-0.003)	0.86
Disability	0.06 (-0.19-0.31)	0.67	0.029 (0.011-0.047)	<0.01	-0.009 (-0.013-0.005)	<0.001	-0.024 (-0.036-0.013)	<0.001	-0.008 (-0.014-0.002)	0.01
Old age	-0.05 (-0.12-0.02)	0.18	-0.015 (-0.022-0.008)	<0.001	-0.013 (-0.018-0.009)	<0.001	0.023 (0.019-0.028)	<0.001	0.006 (0.004-0.008)	<0.001
Survivors	0.07 (-0.16-0.30)	0.58	-0.042 (-0.061-0.022)	<0.001	-0.014 (-0.018-0.009)	<0.001	0.035 (0.024-0.046)	<0.001	0.019 (0.014-0.025)	<0.001
Family & Children	0.07 (-0.21-0.35)	0.64	0.042 (0.027-0.057)	<0.001	-0.011 (-0.015-0.006)	<0.001	-0.022 (-0.033-0.012)	<0.001	-0.013 (-0.018-0.007)	<0.001
Unemployment	0.03 (-0.18-0.24)	0.78	-0.012 (-0.029-0.005)	0.17	-0.007 (-0.011-0.003)	<0.01	-0.009 (-0.018-0.000)	0.06	0.004 (-0.001-0.009)	0.13
Housing	0.22 (-0.59-1.04)	0.60	0.057 (0.002-0.112)	0.05	-0.009 (-0.014-0.005)	<0.001	-0.068 (-0.100-0.037)	<0.001	-0.018 (-0.034-0.001)	0.03
Social exclusion	0.04 (-0.54-0.62)	0.89	0.024 (-0.015-0.064)	0.24	-0.011 (-0.015-0.007)	<0.001	-0.075 (-0.098-0.052)	<0.001	-0.020 (-0.032-0.008)	<0.01
Men										
Sickness/Health Care	0.03 (-0.09-0.14)	0.66	0.005 (-0.008-0.017)	0.47	-0.006 (-0.011-0.001)	0.02	-0.009 (-0.016-0.002)	0.02	0.001 (-0.003-0.005)	0.70
Disability	-0.02 (-0.25-0.22)	0.89	0.029 (0.007-0.052)	0.02	-0.006 (-0.012-0.001)	0.012	-0.020 (-0.034-0.005)	0.01	-0.010 (-0.017-0.002)	0.01
Old age	-0.07 (-0.13-0.00)	0.07	-0.012 (-0.021-0.003)	0.01	-0.011 (-0.016-0.006)	<0.001	0.032 (0.027-0.037)	<0.001	0.004 (0.001-0.007)	0.01
Survivors	0.12 (-0.10-0.34)	0.32	-0.031 (-0.056-0.006)	0.02	-0.010 (-0.016-0.005)	<0.001	0.032 (0.019-0.045)	<0.001	0.018 (0.010-0.025)	<0.001
Family & Children	0.10 (-0.15-0.35)	0.44	0.037 (0.017-0.057)	<0.01	-0.010 (-0.016-0.005)	<0.001	-0.034 (-0.046-0.021)	<0.001	-0.012 (-0.018-0.005)	<0.001
Unemployment	-0.02 (-0.22-0.17)	0.82	-0.025 (-0.045-0.004)	0.03	-0.006 (-0.011-0.001)	0.02	-0.023 (-0.033-0.012)	<0.001	0.007 (0.001-0.013)	0.02
Housing	0.05 (-0.69-0.79)	0.91	0.071 (0.004-0.139)	0.05	-0.007 (-0.012-0.001)	0.01	-0.051 (-0.090-0.012)	0.01	-0.022 (-0.042-0.002)	0.03
Social exclusion	-0.07 (-0.61-0.46)	0.79	0.044 (-0.006-0.093)	0.09	-0.008 (-0.013-0.003)	<0.01	-0.065 (-0.093-0.036)	<0.001	-0.022 (-0.037-0.008)	<0.01

Note: SRH scale was inverted such that higher scores indicate worse health. Coefficients and confidence intervals of interactions rounded to three decimal places for more precision. LCSEC disadvantage = Life-course socioeconomic disadvantage, Social protection = Social protection function. All models are adjusted for the seven other social protection functions. Age was centered at 50 years and divided by 10 so that the coefficients yielded the effects for a 10-year period. Refer to Supplemental material for the not fully adjusted models M1a.

2020; Wang and Marcotte, 2007). While individuals in our study’s age range mostly do not have child care duties to fulfill, they may take care of their grandchildren. Consequently, better-off grandparents may benefit more from child care benefits. Furthermore, the inequality-widening properties of the disability scheme may be due to unintentional stigmatization effects that such policies can have on people’s judgement of their own health (Buljevac et al., 2012). Consistently, these effects were not observed (in women) or had the opposing influence (in men) in the objectively measured grip strength outcome.

The separate functions showed no moderating effect on the life-course socioeconomic disadvantage and grip strength association in women at 50 years, whereas when taken together, higher total social protection expenditure reduced the negative impact of disadvantage on grip strength. In men, only old age, survivors, and unemployment showed no moderation on this association, while spending in the other policies reduced inequalities at age 50.

In comparison with previous literature, this study extends existing knowledge by not only looking at the protective or deteriorating role (moderation effects) of social protection expenditure on the association of life-course socioeconomic disadvantage and subjective and objective health in later life at age 50, but also by examining how the country-level policies influence this association over the ageing process. De Breij et al. found smaller absolute educational inequalities in SRH for both men and women in countries with higher total social protection expenditure, whereas our results suggest that this is only the case for

women (de Breij et al., 2020). However, in de Breij’s et al.’s study only post-retirement SHARE participants were included. Another cross-sectional study using the European Union Statistics on Income and Living Conditions (EU-SILC) database including a sample with a large age span of 25–80+ years found that higher social expenditures are associated with lower educational SRH inequalities among women and, to a lesser degree, among men (Dahl and van der Wel, 2013). These results were generally confirmed by a study using the repeated cross-sectional European Social Survey with a similar sample age range but that did not specifically look at sex differences (Álvarez-Gálvez and Jaime-Castillo, 2018).

This study comes with many strengths such as an approach considering subjective as well as objective health outcomes, a comprehensive measure of life-course socioeconomic disadvantage, and a large European sample including data allowing to look at health trajectories in later life. In addition, this study makes use of a precise indicator of welfare generosity (net social protection expenditure) to assess its interaction with an individual-level indicator of socioeconomic disadvantage on health in later life. However, there are some limitations worth mentioning. Information on childhood and middle age (main occupational position) is self-reported and obtained through a retrospective questionnaire, which may suffer from recall bias, common source bias, or social desirability. However, a previous study examining recall and contemporaneous measures of overcrowding has shown encouraging levels of consistency between the two (Brown, 2014).

Table 4

Associations of life-course socioeconomic disadvantage with weak grip strength and the moderating effect of separate functions of social protection expenditure, Models M1b.

	Social protection function		LCSEC dis x Social prot		LCSEC dis x Age		Social prot x Age		LCSEC dis x Social prot x Age	
	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value	Coef (95% CI)	P value
Women										
Sickness/Health Care	-0.54 (-0.95-0.14)	0.03	-0.057 (-0.114-0.000)	0.06	0.011 (-0.015-0.037)	0.40	0.025 (-0.012-0.063)	0.19	-0.000 (-0.021-0.020)	0.94
Disability	0.35 (-0.46-1.16)	0.42	0.018 (-0.094-0.131)	0.75	-0.007 (-0.034-0.020)	0.60	-0.118 (-0.190-0.045)	<0.01	-0.004 (-0.040-0.032)	0.84
Old age	0.09 (-0.13-0.32)	0.44	-0.036 (-0.077-0.004)	0.09	0.011 (-0.016-0.037)	0.42	-0.033 (-0.062-0.003)	0.03	0.008 (-0.007-0.022)	0.28
Survivors	0.30 (-0.46-1.06)	0.46	0.042 (-0.075-0.158)	0.49	0.006 (-0.022-0.033)	0.69	0.024 (-0.047-0.096)	0.50	-0.012 (-0.048-0.024)	0.53
Family & Children	-0.80 (-1.67-0.07)	0.11	-0.030 (-0.132-0.072)	0.57	0.005 (-0.023-0.033)	0.73	-0.022 (-0.089-0.044)	0.51	0.012 (-0.021-0.045)	0.47
Unemployment	0.63 (-0.05-1.31)	0.11	-0.050 (-0.149-0.048)	0.33	0.009 (-0.017-0.034)	0.50	0.014 (-0.043-0.072)	0.63	-0.008 (-0.038-0.023)	0.61
Housing	2.86 (0.30-5.43)	0.06	-0.189 (-0.510-0.132)	0.26	-0.003 (-0.030-0.023)	0.80	-0.256 (-0.457-0.056)	0.01	0.044 (-0.058-0.146)	0.40
Social exclusion	-0.98 (-2.80-0.83)	0.32	-0.134 (-0.357-0.089)	0.25	0.000 (-0.027-0.028)	0.97	-0.110 (-0.254-0.033)	0.13	-0.004 (-0.077-0.069)	0.91
Men										
Sickness/Health Care	-0.92 (-1.37-0.47)	<0.01	-0.201 (-0.310-0.092)	<0.01	0.039 (-0.005-0.083)	0.09	0.110 (0.047-0.173)	<0.01	0.048 (0.013-0.082)	<0.01
Disability	-0.60 (-1.51-0.30)	0.21	-0.363 (-0.575-0.151)	<0.01	0.044 (-0.002-0.089)	0.06	0.254 (0.130-0.378)	<0.001	0.139 (0.078-0.201)	<0.001
Old age	0.19 (-0.09-0.48)	0.20	0.005 (-0.080-0.090)	0.91	0.045 (0.001-0.089)	0.05	-0.116 (-0.162-0.070)	<0.001	-0.007 (-0.032-0.018)	0.58
Survivors	1.60 (0.71-2.48)	<0.01	0.212 (-0.024-0.449)	0.09	0.070 (0.024-0.116)	<0.01	-0.303 (-0.419-0.187)	<0.001	-0.092 (-0.154-0.030)	<0.01
Family & Children	-1.99 (-2.90-1.09)	<0.01	-0.303 (-0.504-0.102)	<0.01	0.076 (0.030-0.123)	<0.01	0.312 (0.203-0.420)	<0.001	0.144 (0.088-0.199)	<0.001
Unemployment	0.50 (-0.27-1.27)	0.23	-0.154 (-0.348-0.040)	0.13	0.021 (-0.022-0.065)	0.33	0.012 (-0.083-0.107)	0.80	0.006 (-0.045-0.057)	0.82
Housing	1.33 (-1.45-4.11)	0.37	-1.118 (-1.740-0.496)	<0.01	0.040 (-0.005-0.086)	0.08	0.556 (0.219-0.893)	<0.01	0.383 (0.205-0.560)	<0.001
Social exclusion	-3.15 (-5.04-1.25)	<0.01	-0.876 (-1.296-0.456)	<0.001	0.050 (0.004-0.096)	0.03	0.559 (0.317-0.802)	<0.001	0.263 (0.137-0.389)	<0.001

Note: Grip strength scale was inverted such that higher scores indicate weaker grip strength. Coefficients and confidence intervals of interactions rounded to three decimal places for more precision. LCSEC disadvantage = Life-course socioeconomic disadvantage, Social protection = Social protection function. All models are adjusted for the seven other social protection functions. Age was centered at 50 years and divided by 10 so that the coefficients yielded the effects for a 10-year period. Refer to Supplemental material for the not fully adjusted models M1a.

Furthermore, SRH as a subjective outcome may be sensitive to the respondent's sociocultural context, which may be also the reason for the higher variance accounted for by the level-3 clusters (countries) in the models (11.7% and 11.3% for women and men, respectively) as compared to grip strength (4.7% and 5.0% for women and men, respectively). Yet, existing research on the European context has shown that differences in reporting styles explained only some part of the cross-country variations (Hardy et al., 2014). In addition, it has been argued that the estimates of the country-level fixed effects may be biased when less than 25 countries are included in the analyses (Bryan and Jenkins, 2016). Therefore, caution is advisable when interpreting the β of the country-level effects. However, the Satterthwaite approximation used to calculate the F-tests in this study has been shown to produce acceptable Type 1 error rates in linear mixed-effects models even for smaller samples (Luke, 2017). Lastly, social protection expenditure was included as a time-invariant predictor using its median over the 2007–2017 period as a proxy of a country's welfare system generosity. This is due to missing information before 2007. However, as can be deduced from Table S6 (Supplementary material), except for Ireland, the percentage share of social protection expenditure of GDP did not vary considerably over this period.

This study makes a contribution to the literature examining how the generosity of country-level policies affect individual-level life-course socioeconomic experiences and subjective and objective health in later life. In light of the current Covid-19 pandemic, research on this topic is

crucial. As the virus is known to aggravate socioeconomic health inequalities by affecting vulnerable and socially disadvantaged people more frequently and severely, country-level spending on social protection might be key to address these issues (Settersten et al., 2020).

By including a subjective as well as an objective measure of health and looking at their evolution over the ageing process, the findings add insights to existing literature. This study shows that socioeconomic disadvantage experienced over the life course is robustly associated with worse health outcomes in later life. In countries where expenditure on social protection was higher, differences in later-life grip strength could be reduced in both sexes, but only in women's subjective health. A closer look at the separate functions of social protection expenditure revealed possibly unwanted inequality widening effects in subjective health which were not observed for objective health. This finding suggests policy makers may carefully examine social protection policies linked to disability as they may come with 'side effects' in terms of people's perceived health.

6. Data sharing

Data from the SHARE project is publicly available (<http://www.share-project.org/>), which is also how we got access to it. Access to the data requires a registration.

Credit author statement

Stefan Sieber: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – Original Draft, Visualization. **Dan Orsholits:** Writing – Review & Editing, Visualization. **Boris Cheval:** Writing – Review & Editing. **Andreas Ihle:** Writing – Review & Editing. **Michelle Kelly-Irving:** Writing – Review & Editing. **Cyrille Delpierre:** Writing – Review & Editing. **Claudine Burton-Jeangros:** Writing – Review & Editing, Supervision. **Stéphen Cullati:** Writing – Review & Editing, Project administration.

Funding

This work was supported by the Swiss National Centre of Competence in Research “LIVES – Overcoming vulnerability: Life course perspectives” financed by the Swiss National Science Foundation (grant no. 51NF40-160590). Boris Cheval is supported by an Ambizione grant (PZ00P1_180040) from the Swiss National Science Foundation.

Declaration of competing interest

We declare no competing interests.

Acknowledgements

This paper uses data from SHARE Waves 1, 2, 3, 4, 5, 6 and 7 (DOIs: 10.6103/SHARE.w1.710, 10.6103/SHARE.w2.710, 10.6103/SHARE.w3.710, 10.6103/SHARE.w4.710, 10.6103/SHARE.w5.710, 10.6103/SHARE.w6.710, 10.6103/SHARE.w7.710), see [Börsch-Supan et al. \(2013\)](#) for methodological details.

The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782) and by DG Employment, Social Affairs & Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2021.114569>.

References

- Álvarez-Gálvez, J., Jaime-Castillo, A.M., 2018. The impact of social expenditure on health inequalities in Europe. *Soc. Sci. Med.* 200, 9–18.
- Bartley, M., 2017. *Health Inequality: An Introduction to Concepts, Theories and Methods*, second ed. Polity Press, Cambridge.
- Bartley, M., Blane, D., Montgomery, S., 1997. Socioeconomic determinants of health: health and the life course: why safety nets matter. *BMJ* 314, 1194.
- Börsch-Supan, A., Brandt, M., Hunkler, C., et al., 2013. Data resource profile: the survey of health, ageing and retirement in Europe (SHARE). *Int. J. Epidemiol.* 42, 992–1001.
- Brown, M., 2014. Assessing recall of early life circumstances: evidence from the National Child Development Study. *Longitud. Life Course Stud.* 5 <https://doi.org/10.14301/llic.v5i1.232>.
- Bryan, M.L., Jenkins, S.P., 2016. Multilevel modelling of country effects: a cautionary tale. *Eur. Socio Rev.* 32, 3–22.
- Buljevac, M., Majdak, M., Leutar, Z., 2012. The stigma of disability: Croatian experiences. *Disabil. Rehabil.* 34, 725–732.

- Cheval, B., Boisgontier, M.P., Orsholits, D., et al., 2018. Association of early- and adult-life socioeconomic circumstances with muscle strength in older age. *Age Ageing* 47, 398–407.
- Cristea, M., Noja, G.G., Stefea, P., Sala, A.L., 2020. The impact of population aging and public health support on EU labor markets. *Int. J. Environ. Res. Publ. Health* 17, 1439.
- Dahl, E., van der Wel, K.A., 2013. Educational inequalities in health in European welfare states: a social expenditure approach. *Soc. Sci. Med.* 81, 60–69.
- Dannefer, D., 2003. Cumulative advantage/disadvantage and the life course: cross-fertilizing age and social science theory. *J. Gerontol. Ser. B* 58, S327–S337.
- de Brey, S., Huisman, M., Deeg, D.J.H., 2020. Macro-level determinants of post-retirement health and health inequalities: a multilevel analysis of 18 European countries. *Soc. Sci. Med.* 245, 112669.
- DeSalvo, K.B., Bloser, N., Reynolds, K., He, J., Muntner, P., 2006. Mortality prediction with a single general self-rated health question. *J. Gen. Intern. Med.* 21, 267–275.
- Esping-Andersen, G., 1990. *Three Worlds of Welfare Capitalism*. Polity Press, Cambridge, UK.
- European Commission Directorate General for Employment, 2018. *Social Affairs and Inclusion. Informal Care in Europe: Exploring Formalisation, Availability and Quality*. Publications Office of the European Union, Luxembourg. <https://data.europa.eu/doi/10.2767/78836>. (Accessed 20 October 2021). accessed.
- European Union, 2019. European system of integrated social protection statistics. ESSPROS. <https://doi.org/10.2785/144196>.
- Eurostat, 2020. National Accounts. <https://ec.europa.eu/eurostat/web/national-accounts/overview>. (Accessed 7 October 2020). accessed.
- Eurostat, 2020. EU Labour Force Survey. <https://ec.europa.eu/eurostat/web/lfs>. (Accessed 23 September 2020). accessed.
- Ferrarini, T., Nelson, K., Sjöberg, O., 2014. Decomposing the effect of social policies on population health and inequalities: an empirical example of unemployment benefits. *Scand. J. Publ. Health* 42, 635–642.
- Forthofer, R.N., Lee, E.S., Hernandez, M., 2007. Linear regression. In: Forthofer, R.N., Lee, E.S., Hernandez, M. (Eds.), *Biostatistics*, second ed. Academic Press, San Diego, pp. 349–386.
- Hardy, M.A., Acciai, F., Reyes, A.M., 2014. How health conditions translate into self-ratings: a comparative study of older adults across Europe. *J. Health Soc. Behav.* 55, 320–341.
- Hillier-Brown, F., Thomson, K., McGowan, V., et al., 2019. The effects of social protection policies on health inequalities: evidence from systematic reviews. *Scand. J. Publ. Health* 47, 655–665.
- Hyde, M., Jakub, H., Melchior, M., Van Oort, F., Weyers, S., 2006. Comparison of the effects of low childhood socioeconomic position and low adulthood socioeconomic position on self rated health in four European studies. *J. Epidemiol. Community Health* 60, 882.
- Jolidon, V., Bracke, P., Burton-Jeangros, C., 2021. Macro-contextual determinants of cancer screening participation and inequalities: a multilevel analysis of 29 European countries. *SSM - Popul. Health* 15, 100830.
- Keyes, K.M., Galea, S., 2016. *Population Health Science*. Oxford University Press, Oxford ; New York, NY.
- Korpi, W., Palme, J., 2007. The Social Citizenship Indicator Program. SCIP.
- Leong, D.P., Teo, K.K., Rangarajan, S., et al., 2015. Prognostic value of grip strength: findings from the Prospective Urban Rural Epidemiology (PURE) study. *Lancet* 386, 266–273.
- Luke, S.G., 2017. Evaluating significance in linear mixed-effects models in R. *Behav. Res. Methods* 49, 1494–1502.
- Lundberg, O., 2008. Commentary: politics and public health—some conceptual considerations concerning welfare state characteristics and public health outcomes. *Int. J. Epidemiol.* 37, 1105–1108.
- Lundberg, O., Yngwe, M.Å., Bergqvist, K., Sjöberg, O., 2015. Welfare states and health inequalities. *Can. Publ. Pol. Anal. Polit.* 41, S26–S33.
- Mussida, C., Patimo, R., 2021. Women’s family care responsibilities, employment and health: a tale of two countries. *J. Fam. Econ. Issues* 42, 489–507.
- Perneger, T.V., Gayet-Ageron, A., Courvoisier, D.S., Agoritsas, T., Cullati, S., 2013. Self-rated health: analysis of distances and transitions between response options. *Qual. Life Res.* 22, 2761–2768.
- Rhemtulla, M., Brosseau-Liard Pé, Savalei, V., 2012. When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychol. Methods* 17, 354–373.
- Settersten, R.A., Bernardi, L., Härkönen, J., et al., 2020. Understanding the effects of Covid-19 through a life course lens. *Adv. Life Course Res.* 45, 100360.
- Sieber, S., Cheval, B., Orsholits, D., et al., 2019. Welfare regimes modify the association of disadvantaged adult-life socioeconomic circumstances with self-rated health in old age. *Int. J. Epidemiol.* 48, 1352–1366.
- Sieber, S., Cheval, B., Orsholits, D., et al., 2020. Do welfare regimes moderate cumulative dis/advantages over the life course? Cross-national evidence from longitudinal SHARE data. *J. Gerontol. Ser. B* 75, 1312–1325.
- Wahrendorf, M., Blane, D., 2015. Does labour market disadvantage help to explain why childhood circumstances are related to quality of life at older ages? Results from SHARE. *Aging Ment. Health* 19, 584–594.
- Wang, Y., Marcotte, D.E., 2007. Golden years? The labor market effects of caring for grandchildren. *J. Marriage Fam.* 69, 1283–1296.
- Ware, J.E., Gandek, B., 1998. Overview of the SF-36 health survey and the international quality of life assessment (IQOLA) project. *J. Clin. Epidemiol.* 51, 903–912.