Health Resilience: Concept and Empirical Evidence to Reduce Health Inequalities among the Elderly

Mergenthaler, Andreas

Veröffentlichungsversion / Published Version
Arbeitspapier / working paper

Bundesinstitut
für Bevölkerungsforschung

BiB Working Paper 2/2012

Health resilience: Concept and empirical evidence to reduce health inequalities among the elderly

Andreas Mergenthaler

URN: urn:nbn:de:bib-wp-2012-025

Abstract

In the face of persistent health inequalities in later life, the objective of the study is to examine whether distinct forms of health lifestyles and individual or collective social capital predict the probability of health resilience among a cohort of men and women aged 65 and older from lower social classes. A longitudinal study design based on four waves of the German Socio-Economic Panel (2002 to 2008) was employed. The study cohort included 2,075 participants. Analyses were performed using hierarchical-linear models, cluster analyses and binary logistic regressions. The main outcome measures were health-related quality of life, based on a modified SF12, and a dichotomised measure for health resilience based on the SF12 scores. A social gradient was observed for the physical health of men and for the mental health of women, respectively, with participants from lower social classes reporting lesser scores of health-related quality of life compared to participants with higher socioeconomic status. Regarding the physical resilience of elderly men, a moderate health conscious lifestyle was the most pronounced predictor (OR=9.5, $p<0.1\%$). Social capital did not elevate the probability of physical resilience among men. Mental resilience of women was strongly associated with a health conscious lifestyle as well as a moderate health risky lifestyle (OR=4.2, $p<0.1\%$ in each case). Quantitative aspects of social capital, like an above average number of friends and close relatives, were positively associated with mental resilience of elderly women (OR=1.9, $p<0.1\%$ and OR=1.3, $p<5\%$, respectively). The data provides evidence that health conscious as well as moderate health risky lifestyles and quantitative aspects of individual social capital serve as protective factors for health resilience among older men and women with low socioeconomic status. The findings could be used as guidelines to promote health resilience among the elderly in lower social classes and thus to reduce health inequalities in later life.

Acknowledgements

The author gratefully acknowledges the German Institute for Economic Research, Berlin, for providing the data of the German Socio-Economic Panel (SOEP) for the analysis.

Introduction

In most developed countries, the demographic change results in an increasing share of old and very old people. The topic of health inequalities in later life therefore became an increasingly important issue for socio-epidemiological research in recent years. Most investigations from single European countries as well as comparative studies show deteriorating health effects of low levels of education, income and former occupational class during professional life in the age groups 65 years and older (Dalstraa et al., 2006; Knesebeck et al., 2007; Matthews et al., 2005). Regarding the dynamics of health inequalities in old age, most of the evidence points towards a decline of the socioeconomic gradient with increasing age (McMunn et al., 2009; Herd, 2006; Robert et al., 2009), while others observe continuing or even increasing levels of disparities (Prus, 2007; Chandola et al., 2007).

Despite the growing amount of descriptive evidence on health inequalities, comparatively small efforts have been made to explain those phenomena and to find practical pathways that lead to more equal health chances. The present paper addresses the question how socioeconomic disparities in health among the elderly could be reduced. It adds to the hierarchical perspective of socio-epidemiological research, which focuses on health disparities between social classes, a "horizontal" perspective that addresses the social determinants of health differentials within socioeconomic status groups. The main concept involved in this approach is that of health resilience.

The concept of health resilience

In social and health sciences, resilience as a general concept is commonly defined on the basis of two dimensions. It combines the prevalence of some form of environmental risk causing vulnerability to certain individual outcomes with, as a response to that risk factor, the individual ability of a positive adjustment to an adverse situation (Haase, 2004; Schoon, 2006; Masten, 2001). Thus, one of the main heuristic benefits of resilience perspective is the emphasis of individual variability within groups of persons who face similar health risks, pointing at the probabilistic nature of risk concepts (Masten 1999).

Since most of the research on resilience focuses on children and adolescents, only few studies have addressed resilience issues in old age (Hildon et al., 2008; Hildon et al., 2010; Netuveli et al., 2008). Hence, a research deficit concerning resilience processes, their causes and consequences in elderly people can be stated. Three types of resilience can be conceptualized for older age groups. The first two types address the ability to maintain or to regain an adequate functional status after being exposed to chronic strain or traumatic life events. The third one refers to the ability of elderly persons to cope with experiences of individual loss (e.g. the death of the partner) (Ong et al., 2009; Mancini & Bonanno, 2009). While the third type is mainly relevant for the highest age groups of the "forth age", the first ones also provide a framework to promote the process of healthy ageing within the members of the "third age".

The paper focuses on the second type of resilience, which is the maintenance of a relatively high health-related quality of life in old age compared to peers. Drawing on the conceptual considerations of the general term of resilience, a more specific concept of "health resilience" is defined. Health resilience applies to those individuals within low socioeconomic status groups, who manage to sustain an above average health in the course of ageing, despite harmful material, behavioural or psychosocial influences. The focus of health resilience is on the interaction between socioeconomic risk factors and protective resources, which elderly people from lower social classes can access in order to maintain a good health-related quality of life.

Positive adaptation to socioeconomic health risk in old age is assumed to be feasible through the amount of protective resources that a person accesses. These factors include attributes of an individual, like positive self-perceptions, as well as the individual's social environment, like the family or the neighbourhood as a wider social context (Schoon, 2006; Masten, 2009). In the domain of health resilience, collective health conscious lifestyles (Cockerham et al., 1997, Cockerham, 2005) as well as the amount of individual and collective social capital (Kawachi & Berkman, 2000) are two forms of protective resources, which seem especially promising in advancing positive adaptation to socioeconomic health risks among the elderly. Both concepts are widely discussed in recent public health research and there is empirical evidence supporting the assumption of health promoting effects of both resources (Cockerham et al., 2002, Veenstra, 2005, De Silva et al., 2005, Poortinga, 2006). Moreover, both concepts seem to vary within socioeconomic classes to a certain degree. Hence, one can assume a certain explanatory power of those resources regarding within-class differences in health outcomes. The objective of the study is to examine whether distinct forms of health lifestyles as well as individual and collective social capital predict the probability of health resilience among a cohort of elderly men and women from lower social classes.

Data and variables

The data are from a cohort of older men and women, who participated in the German Socio-economic Panel Study (SOEP). The SOEP started in 1984 as a representative longitudinal study of private households in Germany. The analysis included data from waves 2002, 2004, 2006 and 2008. A total number of 2,075 people aged 65 and older at baseline who participated in all of the waves were included in the analysis thus, the study cohort comprised a total of 8,300 person-years. It was drawn from the samples A (Western Germany), C (Eastern Germany) and two supplement samples starting in 1998 and 2000, respectively. A longitudinal weight designed by the German Institute of Economic Research (DIW, Berlin) for the panel data of the SOEP was employed.

Health-related quality of life and health resilience

A main outcome measure was the health-related quality of life. It was measured by a modified form of the SF12v2 (Ziebarth, 2010). The SF12v2 is part of the personal questionnaire of the SOEP and is surveyed every 2 years since the year 2002. This multidimensional measure addresses subjective as well as functional, mental and physical aspects of health-related well-being. The basic items of the questionnaire are merged by factor analysis into eight subscales, containing information on general health, physical, social and role functioning, bodily pain, vitality and mental health. These sub domains are condensed into two scales: the Physical Component Score (PCS) and the Mental Component Score (MCS). Both scores range from a minimum of 0 up to a value of 100, indicating the maximum score for health-related quality of life.

Health resilience was measured by a dichotomised variable based on the scores of the SF12v2. In lower social classes, health resilience was defined as maintaining an above average score of the SF12v2 in relation to all participants of the study cohort of the same sex and age over the whole period of analysis. Thus, a study participant from a lower social class who reported a PCS or MCS score below average at least in one of the waves observed was labelled as vulnerable.

Social class and risk-mechanisms

The social class of a participants' household was constructed as an index based on three dimensions of the individual socioeconomic status: highest level of education, current equivalent household income, and last or current occupational position. The data of these sub dimensions were converted into ordinal scales with scores ranging from 1 to 7. These scores were added to the individual socioeconomic status of each participant. Missing values were imputed by the mean values of the two other scales. Finally, the scores of the individual socioeconomic status were aggregated on the household level with the highest individual score indicating the social class of the household. According to this household-level ordinal scale, five social classes were differentiated by drawing cut points of similar width: lowest, lower middle, middle, higher middle and upper middle.

In order to control for systematic differences in class-related risk exposure between health resilient and vulnerable persons, several variables were constructed and included in the analysis. These variables comprised information about the economic situation of the household, household conditions as well as structural characteristics of the household's surroundings and the level of satisfaction with several aspects of the current material welfare. The economic situation of a household referred to the occurence of relative poverty during the time of observation. It was measured by a binary index based on the categories of "relative poverty", including households who reported 60% or less of the median equivalent household income of the sample, and "relative affluence" of household reporting more than 60%. These data were combined to an index of poverty which was calculated as the quotient of the sum of the time points in relative poverty and the total number of waves within the observation period. The index took the value of 0 for persons, who did not experience poverty at any time and 1 for persons, who lived in poor households throughout the period of observation. Household conditions were measured by an indicator of household density, which was calculated as the quotient of the size of the place of residence in m^2 and the number of persons living in the household at each wave. Additionally, an additive indicator was constructed on the basis of the numbers of household amenities, like the availability of a kitchen, a bath, central heating, a basement or a balcony as well as consumer goods like a car, television, microwave or a washing machine. Structural characteristics of the household's surroundings were measured by an index variable combining the subjective reporting on the level of impairment by noise, air pollution or a lack of public green spaces as well as the quality of the infrastructure. The level of satisfaction with the current material welfare was measured by a binary indicator comprising the domains of current household income, place of residence, social security and the standard of living in general. Below average scores were labelled as "not satisfied", while above average scores were categorized as "satisfied".

Protective factors: Health lifestyles and social capital

Health lifestyles were measured on the basis of health-related behaviours and attitudes. Data on tobacco and alcohol consumption as well as sleeping habits, subjective health consciousness regarding nutrition and the regularity of sporting activities were included to ascertain different beneficial and detrimental aspects of health-related behaviours. Additionally, the Body Mass Index (BMI) was calculated on the basis of the reported height and weight of the respondents as a proxy for associated behaviours, like low-effort physical activities, that are not included in the question on sporting activities. An indicator on tobacco consumption was constructed in a life course perspective by calculating the "smoke-years" of each respondent. This scale is calculated as the product of the length of time and the intensity of tobacco products consumed including the amount of cigarettes, pipes or small cigars per day (Leffondré et al., 2002). The data on the regularity of sporting activities was obtained on the basis of different scales during

the observation period. Thus, the values were standardized using z-transformation. On the basis of these values, an additive index was calculated as a proxy for the amount of sports during an individual's life course. Data on individual alcohol consumption included information on the frequency of drinking beer, wine, alcoholic mixed drinks (e.g. cocktails) and spirituous beverages. These data were summarized to an additive index, too. Data on sleeping habits were only collected in 2008 so the information was kept constant for the whole period of observation. The questions regarding the sleeping habits of the respondents referred to the average numbers of hours of sleep during a working day or at the weekend. On the basis of these data, an index variable was calculated to describe the average sleep duration of a respondent during one week. Regarding health-related attitudes, the willingness to take health risks and worries concerning one's own health were considered. As for sleeping habits, the data on the willingness to take health risks was only collected for one year during the observation period and therefore held constant for all waves included in the analysis. For both dimensions of health lifestyles, various imputation techniques (e.g. median values of the available data points as well as regression models) were employed in order to replace missing values.

The perceived amount of social capital was assessed on the individual and the neighbourhood level. Both structural and cultural aspects of social capital were considered (van Deth, 2008). The structural dimension comprised the self-reported amount of emotional and instrumental social support, the number of close friends and relatives and the degree of contacts with the neighbours as well as the quality of relationships of the people in the neighbourhood. The level of general trust in other people and expectations of reciprocity were addressed in the cultural dimension. As for some indicators of health lifestyles, several data on social capital was available only for one wave, like emotional and instrumental social support, the frequency of social interactions among the neighbours as well as the perceived crime rate of the community. These data were held constant throughout the observation period. Regarding the perceived neighbourhood-level social capital, variables were also adjusted according to the spatial mobility of the respondents.

Statistical methods

To examine the effect of the social class of the household on the health-related quality of life of the elderly across the observation period, multiple hierarchical-linear models (growth curve models) were calculated. Growth curve models assume a hierarchical data structure of at least two interdependent levels of observation, e.g. several time points measured for each study participant. Hence, these models are especially suited to estimate individual outcomes with time-dependent covariates. An individual outcome (Y_{ti}) in a hypothetic longitudinal data set is estimated by the following basic model:

$$Y_{ti} = ß_1 * X_{ti}(1) + ß_2 * X_{ti}^{(2)} + \ldots + ß_p * X_{ti}^{(p)} + u_{1i} * Z_{ti}^{(1)} + \ldots + u_{qi} * Z_{ti}^{(q)} + \varepsilon_{ti}$$

The value t (t=1,...,n) is an index of the ni longitudinal observation of the dependent variable on the individual level. The value i (i=1,...,m) indicates a study participant as the observational unit of analysis. The general model includes two groups of covariates, namely X and Z. The first group comprises p covariates, $X^{(1)},\ldots, X^{(p)}$ that are associated with the fixed effects. The second group includes q covariates $Z^{(1)},\ldots, Z^{(q)}$ which are associated with the random effects $u_{1i},\ldots, u_{qi}$, that are specified for each unit of observation. Additionally, the parameter ε_{ti} denotes residual values, which are associated with each observation of a study participant (West et al., 2007).

On the basis of these general assumptions, two growth curve models were calculated. The analysis was stratified for sex. Model 1 adjusted for age (centred for the median age of the study cohort stratified by sex), age square, the year of each wave of the SOEP included in the observation period and social class. Interaction effects were separately calculated for age and age square with regard to the year of observation and social class, respectively. In addition to the fixed effects of social classes, model 2 estimated linear age effects and the interaction between social class and age. Model 2 was mainly employed to test the statistical robustness of model 1. The interaction effect between social class and age provides information of the dynamic of health disparities in the course of ageing in both models.

Cluster analyses were conducted to identify distinct groups of health lifestyles. To refine the data for the analysis, the items on health-related behaviours and attitudes were transformed to z-scores. In the first step, a hierarchical cluster analysis of a 10% random sample of the study cohort was progressed in order to give an indication for the optimal number of clusters using the elbow-criterion. Since no clear evidence could be drawn from this method, a k-means cluster algorithm was calculated for solutions between 1 and 12 clusters. To evaluate these solutions, several test statistics like the sum of squared error of the clusters were calculated. On the basis of these values, solutions with 2, 3 and 4 clusters underwent a revision of their plausibility with regard to content. The solution with 4 clusters offered a set of distinctive lifestyle groups regarding the internal proportions of health conscious and risky behaviours and attitudes within each cluster. Hence, it was used for further analysis.

Finally, multiple logistic regression models were used to estimate the odds ratios of the protective factors of health resilience compared to health vulnerability. Four models were calculated for men and women of the study cohort, respectively. The first model addresses the effects of health lifestyles on resilience, controlling for the risk mechanisms identified as well as for age. The second and the third model were used to estimate the effects of individual and collective social capital, respectively. In the fourth model all protective resources that showed a statistically significant effect on health resilience in the previous models were included.

Results

Basic characteristics of the study cohort

In order to assess the representativeness of the study cohort, the distributions of sociodemographic characteristics like sex, age, martial as well as retirement status and region of living at baseline were compared to the corresponding official data from the German Federal Statistical Office.

Table 1: Basic characteristics of the study cohort

Basic characteristics	Year/period of observation: 2002 – Study cohort $N_{persons}$	2002 – Study cohort %	2002 – Official statistics %	2002 - 2008 – Study cohort $N_{person\text{-}years}$	2002 - 2008 – Study cohort %
Sex:					
Male	1,219	44.4	39.5	4,876	44.4
Female	1,527	55.6	60.5	6,108	55.6
Age:					
65-79	2,513	91.5	76.8	8.916	81.2
80 and above	232	8.5	23.2	2,065	18.8
Martial status:					
Married	1,881	68.5	54.7	7,049	64.2
Single	90	3.3	6.1	350	3.2
Separate/divorced	123	4.5	5.2	517	4.7
Widowed	651	23.7	34.0	3,066	27.9
Retired:					
Yes	2,519	91.7	97.1	10,365	94.4
No	227	8.3	2.9	616	5.6
Region:					
Western Germany	2,028	73.9	78.9	8,069	73.5
Eastern Germany	717	26.1	21.1	2,913	26.5

Notes: The numbers of observations are based on weighted longitudinal data of the SOEP including the waves of 2002, 2004, 2006 and 2008.

The sex ratio slightly differs in the study cohort, as male respondents with a share of 44% are over-represented during the whole period of observation comparing to a share of only 40% in the official data. Due to the longitudinal design of the data, the study participants are continually ageing, thus increasing the share of the highest age group (80 years and above) with each wave. Regarding the whole period of observation, the highest age group is nevertheless under-represented in comparison to the share in the official data, as shown in table 1. These differences in the age structure are expressed in the different shares in martial status and retirement status, when comparing the study cohort to the official statistics. In the study cohort, a higher share of people is married, corresponding with a lower share of single or widowed persons. Regarding the whole observation period, roughly 94% of the respondents of the SOEP-cohort are retired while around 97% of the German population of the same age group were retired in 2002 (table 1). The share of persons living in western or eastern Germany, respectively, only slightly differs between the study cohort and the German population with a higher share of the study cohort living in eastern Germany. This regional distribution remains relatively constant throughout the observed time period, pointing at the relatively low spatial mobility of elderly people. Altogether, the comparison between the sociodemographic characteristics of the SOEP-cohort with the German population of the same age shows only minor variations. Hence, the evidence can be expected highly representative for the German population.

Health inequalities

A health gradient is observed for the physical dimension of health-related quality of life of elderly men in the study cohort. Although the Physical Component Scale (PCS) generally declines in a constant manner in the course of ageing for all respondents, the level of decline is clearly associated with social class. Male respondents from the upper middle class report the highest level of the PCS throughout the observed period of time and for all age groups while members from the most deprived social class have the lowest PCS-scores (table 2). In contrast, social class does not affect the level of the Mental Component Score (MCS) of the SF12v2 among men.

Table 2: Effects of social class on the summary measures of the Physical Component Scale (PCS) and the Mental Component Scale (MCS) of the SF12v2 among the male participants of the study cohort

Fixed effects and interactions	Physical Component Scale (PCS)		Mental Component Scale (MCS)	
	Model 1 (n=3,684)	Model 1 (n=3,684)	Model 1 (n=3,684)	Model 1 (n=3,684)
Constant	44.76***	44.90***	52.50***	53.58***
Age (centred):				
Age	-0.45**	-0.40***	-0.17	-0.18
Age^2	-0.01		0.004	
Year:				
2002	1.78***		1.52**	
2004	0,32		1.76***	
2006	0.07		0.78	
2008	Ref.		Ref.	
Social class:				
Lowest	-5.11***	-5.45***	-0.44	-1.67
Lower middle	-3.94***	-3.71***	-0.84	-1.10
Middle	-3.52***	-2.88***	-1.10	-1.00
Higher middle	-1.94*	-1.58*	-0.13	-0.64
Upper middle	Ref.	Ref.	Ref.	Ref.
Interactions:				
Age*lowest	0.08	0.02	0.06	-0.02
Age*lower middle	0.02	-0.03	0.01	-0.05
Age*middle	0.04	0.01	-0.06	-0.11
Age*higher middle	0.03	0.003	0.09	0.04
Age*upper middle	Ref.	Ref.	Ref.	Ref.
Age^2 * lowest	-0.003		-0.02	
Age^2 *lower middle	0.02		0.01	
Age^2 *middle	0.03		0.02	
Age^2 *higher middle	0.01		-0.01	
Age^2 *upper middle	Ref.		Ref.	

Notes: The numbers of observations (person-years) and the model's estimates are based on weighted longitudinal data of the SOEP. *: p<5%; **: p<1%; ***: p<0.1%. Reference categories of variables with more than two categories are indicated by "Ref.". Data on the interactions of age and year is not shown.

Health inequalities among elderly women are more inconsistent and weaker compared to the male respondents. A gradual decrease of health-related quality of life in the two lower social classes is observed only for the MCS but not for the PCS. Furthermore, the health decline is statistically significant only for women from the lower middle class and the lowest social class. Hence, no consistent health gradient could be observed throughout the social hierarchy for the MCS of elderly women.

Table 3: Effects of social class on the summary measures of the Physical Component Scale (PCS) and the Mental Component Scale (MCS) of the SF12v2 among the female participants of the study cohort

Fixed effects and interactions	Physical Component Scale (PCS)		Mental Component Scale (MCS)	
	Model 1 (n=4,604)	Model 1 (n=4,604)	Model 1 (n=4,604)	Model 1 (n=4,604)
Constant	41.92***	41.95***	51.62***	51.86***
Age (centred):				
Age	-0.42*	-0.51***	-0.49*	-0.18
Age^2	-0.02		0.01	
Year:				
2002	1.08**		0.27	
2004	0.20		-0.16	
2006	-0.23		-0.70*	
2008	Ref.		Ref.	
Social class:				
Lowest	-1.72	-1.14	-2.79*	-2.51*
Lower middle	-1.85	-1.74*	-1.96	-2.07*
Middle	-2.53**	-2.28*	-1.13	-1.32
Higher middle	-1.71	-1.07	-0.45	-0.31
Upper middle	Ref.	Ref.	Ref.	Ref.
Interactions:				
Age*lowest	0.04	0.07	-0.05	-0.05
Age*lower middle	0.13	0.10	0.09	0.04
Age*middle	0.13	0.12	0.20	0.20
Age*higher middle	0.10	0.10	-0.08	-0.05
Age*upper middle	Ref.	Ref.	Ref.	Ref.
Age^2 * lowest	0.02		0.02	
Age^2 *lower middle	0.01		0.003	
Age^2 *middle	0.01		-0.004	
Age^2 *higher middle	0.02		0.005	
Age^2 *upper middle	Ref.		Ref.	

Notes: The numbers of observations (person-years) and the model's estimates are based on weighted longitudinal data of the SOEP. *: p<5%; **: p<1%; ***: p<0.1%. Reference categories of variables with more than two categories are indicated by "Ref.". Data on the interactions of age and year is not shown.

For both men and women, health inequalities do neither cumulate nor converge in the course of ageing. Rather, the interaction coefficients of age and social class point towards a continuity of health inequalities in the study cohort (tables 2 and 3). Results from sensitivity analyses regarding the impact of selective mortality on the dynamics of the health gradient do not show a significant change in estimate (data not shown).

Hence, health inequalities related to social class seem to sustain in a relatively constant magnitude up to the highest age groups throughout the observation period. Especially the two lowest social classes seem to impose socioeconomic health risks on the PCS of elderly men and the MCS of women in the study cohort, respectively. The following analyses on health resilience will therefore focus on these two socioeconomic groups.

Health resilience and risk-mechanisms

In the observed period from 2002 to 2008 around 20% of the men from the lowest social class and some 22% from households of the lower middle class are classified as being health resilient regarding physical health. Among elderly women, the share of health resilient persons with respect to the MCS is smaller. It reaches about 10% in the lowest social class and roughly 17% in the lower middle class.

Table 4: Health resilience among elderly men and women

Dimension of SF12v2 - sex	Social class	Observation period 2002 - 2008	
		N	%
Physical Component Scale (PCS) - Men	Lowest (n=265)	54	20.4
	Lower middle (n=1,399)	310	22.2
Mental Component Scale (MCS) - Women	Lowest (n=819)	85	10.4
	Lower middle (1,976)	330	16.7

Notes: The numbers of observations (person-years) are based on weighted longitudinal data of the SOEP.

Regarding the analysis of systematic differences in risk exposure between resilient and vulnerable persons, only the household density for physical health resilience and the degree of satisfaction with the material welfare could be identified (data not shown). Thus, these two indicators as well as the age of the respondents were implemented in the following analyses to adjust for the effects of health lifestyles and social capital.

Protective factors

The preferred solution of the cluster analysis yielded a group of four health lifestyles which could be ordered in a hierarchical manner according to the share of health conscious and health risky behaviours and attitudes. The “health conscious” lifestyle is practiced during 30% of the individual observations and displays high scores of PCS and MCS. An above average share of women practices this lifestyle. Virtually all members report to pay strong attention to healthy nutrition and an unwillingness to take health risks. In over 22% of the individual observations, the members of this lifestyle have no health-related sorrows. Regular sporting activities are relatively common and correspond with the low share of obesity of only around 12%. Also the share of active smokers is the lowest of all lifestyle groups (table 5).

The “moderate health conscious” lifestyle is practiced during 17% of the individual observations. Its members have comparable levels of PCS and MCS to the members of the health conscious lifestyle. Regarding the median age, it is the youngest lifestyle group in the study cohort. The high shares of individual observations, in which the participants reported both the willingness to take health risks as well as daily or weekly sporting activities, is the most striking characteristics of this lifestyle. Furthermore, it has the highest share of current smokers among all lifestyle groups (table 5).

Table 5: Characteristics of health lifestyles in the period of observation

Characteristics	Health lifestyles				
	Health conscious (n=3,316)	Moderate health conscious (n=1,860)	Moderate health risky (n=2,363)	Health risky (n=3,442)	Study cohort (n=10,981)
Median:					
Physical Component Scale (PCS)	44.1	44.5	43.9	34.3	41.7
Mental Component Scale (MCS)	55.3	54.6	53.8	47.0	52.5
Age	73	72	73	74	73
Percentage:					
Women	59.2	44.6	49.7	62.1	55.6
Oldest old (80 and above)	19.1	12.9	16.9	23.0	18.8
Pay strong attention to healthy nutrition	99.8	58.5	0.2	61.6	59.4
Willingness to take health risks	0.0	39.4	0.0	2.8	7.6
No health-related sorrows	22.4	17.2	19.9	0.0	13.9
Daily or weekly sporting activity	16.0	17.6	7.4	7.8	11.8
Never engaged in sporting activities	62.6	59.4	78.1	82.1	71.6
Current smokers	5.8	14.2	12.6	8.3	9.5
Heavy smokers (pack-years>500)	2.9	9.8	8.4	4.5	5.7
Above average alcohol consumption	35.9	20.9	31.6	45.3	35.4
Obesity (BMI>30)	12.2	19.4	22.0	24.8	19.5
Less than 7.5 hours of sleep per day	46.8	37.9	47.3	50.3	46.5

Notes: The numbers of observations (person-years) are based on weighted longitudinal data of the SOEP including the waves of 2002, 2004, 2006 and 2008.

The "moderate health risky" lifestyle accounts for about 22% of the individual observations and has a relatively high share of male participants. It is characterized by an absence of participants who report to pay strong attention to healthy nutrition. Additionally, it has the lowest share of only about 7% of individual observations in which the participants report regular sporting activity. The high prevalence of physically inactive persons among the moderate health risky lifestyle corresponds with the relatively high share of obesity of around 22% (table 5).

The "health risky" lifestyle is practiced during 31% of the individual observations. Having a median age of 74, it is the oldest lifestyle group in the study cohort. In accordance, it also has the highest share of women with 62% practicing this lifestyle. The health risky lifestyle has the highest share of detrimental health behaviours and attitudes of all the lifestyle groups identified. This is illustrated by the relatively high percentages of people who never engage in sports, who report an above average alcohol consumption, who are classified as obese according to an BMI of over 30 and who sleep less than 7.5 hours a day on average (table 5). On this account, the health risky lifestyles was used a reference category in the further analysis to estimate the health effects of the two health conscious lifestyles and the moderate health risky lifestyle.

The effects of these lifestyles on health resilience after adjustment for several risk-mechanisms and age of the respondents were estimated in models 1a and 1b, respectively, as presented in table 6. The odds ratio for physical health resilience in elderly men practicing a moderate health risky lifestyle is almost 12 times higher compared to men who practiced the health risky lifestyle. The health conscious lifestyle only shows a

relatively small odds ratio of almost 4. Surprisingly, the odds ratio for being resilient is also markedly elevated for the members of the moderate health risky lifestyle compared to the members of the health risky group. Model 1a also shows significant differences in the protective effect of health lifestyles between the lowest social class and the lower middle class. The effect of the moderate health risky lifestyle is considerably elevated for men from the lowest social class, while the influence of the moderate health conscious lifestyle is less pronounced in this status group (table 6).

Regarding the mental health resilience of elderly women, the health conscious, moderate health conscious and the moderate health risky lifestyle show an odds ratio of around 4 when compared to the health risky lifestyle. As for the physical resilience in men, no clear hierarchy shows according the degree of health consciousness within a lifestyle group. Conspicuous differences between the lowest social class and the lower middle class regarding the effects of some lifestyles on mental health resilience of women can be observed. Women belonging to households of the lowest social class can expect lower protective effects of a health conscious as well as a moderate health risky lifestyle compared to women from the lower middle class. For the moderate health conscious lifestyle, no class-specific differences could be observed for the mental health of older women (table 6).

Separate analyses on the effects of individual and collective social capital on health resilience show a higher relevance for mental resilience of elderly women compared to the physical health of men. Especially the quantitative aspects of individual social capital seem to play a significant role for mental health resilience of elderly women. Female respondents with an above average number of close friends have a more than two-times elevated chance of being resilient compared to women with a smaller number of friends. A more than 50% elevated chance of mental health resilience could be observed for women with an above average number of relatives in contrast to women with a below average number of relatives (table 6). With respect to collective social capital, only above average expectations of reciprocity are significantly associated with health resilience among men and women, respectively (table 6).

Table 6: Binary logistic regression models for the association between protective factors and health resilience in the lowest class and the lower middle class

Protective factors and model fitting	Health resilience							
	Physical Component Scale (PCS) - men				Mental Component Scale (MCS) - women			
	Model 1a (n=1,612)	Model 2a (n=1,538)	Model 3a (n=1,484)	Model 4a (n=1,535)	Model 1b (n=2,728)	Model 2b (n=2,643)	Model 3b (n=1,821)	Model 4b (n=2,650)
Age (centred)	0.96**	0.97**	0.95***	0.96**	0.98	0.99	0.98	0.99
Household density	1.01	1.00	1.01*	1.01	-	-	-	-
Satisfaction with material welfare	1.52**	1.73***	1.72***	1.51**	3.40***	3.74***	3.71***	3.07***
Health lifestyle:								
Health conscious	3.95***			3.45***	4.34***			4.20***
Moderate health conscious	11.66***			9.50***	3.84***			3.34***
Moderate health risky	5.43***			4.67***	4.43***			4.15***
Social capital:								
High social support		0.85				0.87		
Above average number of close friends		1.38*		1.17		2.13***		1.93***
Above average number of relatives		1.14		-		1.51**		1.34*
High level of trust			0.95				0.84	
High reciprocity			1.70***	1.26			1.44*	1.16
High neighbourhood social capital			0.93				1.20	
Health conscious*lowest	1.17			2.23	0.58*			0.71
Moderate health conscious*lowest	0.32**			0.45	1.04			1.13
Moderate health risky*lowest	2.02**			2.68**	0.46**			0.48*
Social support*lowest		0.69				0.86		
Friends*lowest		1.06		0.82		0.91		1.06
Relatives*lowest		1.53		-		0.75		0.99
Trust*lowest			1.00				1.00	
Reciprocity*lowest			0.73	0.65			0.76	0.84
Neighbourhood social capital*lowest			1.58				0.64	
Model fitting:								
R^2	0.17	0.04	0.06	0.17	0.17	0.14	0.10	0.20

Notes: The numbers of observations (person-years) and the model's estimates (odds ratios) are based on weighted longitudinal data of the SOEP. *: p<5%; **: p<1%; ***: p<0.1%. Estimates on social class effects were not possible due to the insufficient number of cases in the lowest social class. Reference categories not shown.

Regarding all protective factors included in the models 4a and 4b, only some health lifestyles and the degree of satisfaction with the current material welfare could be identified as protective factors for physical resilience among elderly men. The highest odds of physical resilience compared to the group that practiced a health risky lifestyle are observed for participants, who report a moderate health conscious lifestyle. A moderate health risky lifestyle shows a remarkably high odd for physical resilience. This effect was even stronger among elderly men from the lowest social class. Neither individual nor neighbourhood social capital elevates the odds of physical resilience among men (table 6). Mental resilience of elderly women is associated with a health conscious lifestyle as well as a moderate health risky lifestyle. Quantitative aspects of social capital, like an above average number of friends and close relatives, are positively associated with mental resilience of elderly women. Satisfaction with the current material welfare also significantly elevates the odds for older women of being mentally resilient.

Conclusion

The aim of the study was to examine whether certain types of health lifestyles and social capital serve as protective factors in the process of health resilience among the elderly in the face of health risks imposed by low social class. An age-invariant social class gradient could be observed for the physical well-being of older men and the mental health of women. For women, health inequalities were weaker and more inconsistent compared to men. The observation of a mental health gradient in elderly women points to the higher overall vulnerability of mental health problems compared to men, especially for women in households with low socioeconomic resources (Asthana & Halliday, 2006). In contrast, men from lower social classes are at higher risk for physical health problems due to hazardous environmental exposures and bodily stress during their former working life as they are more likely to have worked in manual occupations compared to more privileged social classes.

The results of the study provide evidence that health conscious as well as moderate health risky lifestyles and quantitative aspects of individual social capital serve as protective factors in the process of health resilience among older men and women from lower social classes. For men living in households of the lowest social class and the lower middle class, some forms of health lifestyles, namely the moderate health conscious and the moderate health risky lifestyle, seem to be the strongest predictors of physical resilience.

For the process of mental resilience among elderly women, the protective factors identified were more numerous compared to the physical well-being of men. Especially satisfaction with the current material welfare and an above average number of friends and close relatives increased the odds of mental resilience. One reason for this observation might be that the social capital provided by those intimate social relations serves as a beneficial health support for the higher share of old women living in widowhood and thus elevates the likelihood of mental resilience. For mental resilience as well, a qualitative difference between the health risky and all other lifestyles groups could be observed in which a health conscious lifestyle and a moderate health risky lifestyle were the best predictors of mental resilience.

Regarding the impact of health lifestyles on mental and physical resilience, the findings suggest a qualitative distinction between health conscious and moderate health risky lifestyles that seem to promote health resilience, compared to a health risky lifestyle that was clearly associated with vulnerability to physical as well as mental health risks. Thus, health resilience among elderly men and also to some extend among women could be most adequately promoted not only by fostering health conscious lifestyles, but through the prevention of an accumulation of health risky behaviours and attitudes.

The protective factors identified in the present study add to the debate on concepts of "healthy ageing", which explicitly imply resilience processes as a prerequisite for independence, autonomy and participation in different domains of social life (Hansen-Kyle, 2005; Ryff & Singer, 2009). Furthermore, these protective factors could be addressed by social and health policies for practical interventions aiming at a reduction of health inequalities in older age groups. One strategy for this approach would be to reduce "health gaps" between the most deprived and the most affluent status groups by promoting health resilient processes in groups with low socioeconomic status. Strategies addressing health resilience promotion in older adults from lower socioeconomic status would be most promising, when embedded within volunteer activities from peers. Besides the beneficial aspects of those volunteer programs in promoting individual social capital and the prevention of a clustering of risky lifestyle choices of other persons, several studies point to the fact, that those activities promote the health and well-being of the elderly volunteers as well (Lum & Lightfood, 2005; Hinterlong et al., 2007). Considering volunteering within a resilience framework, those activities may be conceptualised as an independent protective factor in resilience processes among the elderly in future studies.

There are some aspects however that limit the scope of the study. Health resilience was defined as a long-term process, which could be measured only throughout the whole observation period from 2002 to 2008 and not as a single incidence. Additionally, the data on health-related behaviours and attitudes as well as on social capital showed different extends of completeness in the SOEP. Hence, analyses on causal inference in general or more specified etiological pathways were not possible. The results of the statistical analyses are therefore only descriptive.

The parameters of the model fitting in models 1 to 4 suggest that health lifestyles and certain aspects of social capital as well as the satisfaction with the material welfare altogether only account for around one fifth of the odds of being resilient. Hence, the explanatory power of the protective factors is not very high. Health resilience can be expected to be a complex process in the course of human ageing, depending on a multitude of factors which might play a conspicuous role as supplements of the protective factors already identified.

The social determinants of health resilience identified in this study provide a basis for further investigations and first steps towards the development of practical approaches to reduce health inequalities among the aged. The aim of future studies on this topic is to fully disentangle the determinants of resilience processes among elderly people. This clearly requires a multidisciplinary approach since protective factors are most likely to not only operate on the societal level, but also on interdependent biological, psychological and further ecological levels.

References

Asthana, S., & Halliday, J. (2006). Health inequalities during older age: research evidence. In Asthana, S., & Halliday, J. (Ed.), *What works in tackling health inequalities? Pathways, policies and practice through the lifecourse* (pp. 475-505). Bristol: The Policy Press.

Chandola, T., Ferrie, J., Sacker, A., & Marmot, M. (2007). Social inequalities in self reported health in older age: follow-up of prospective cohort study. *BMJ*, 334, 990-996.

Cockerham, W.C., Rütten, A., & Abel, Th. (1997). Conceptualizing contemporary health lifestyles: moving beyond Weber. *The Sociological Quarterly*, 38, 321-342.

Cockerham, W.C., Snead, C.M., & Dewaal, D.F. (2002). Health lifestyles in Russia and the socialist heritage. *Journal of Health and Social Behavior*, 43, 42-55.

Cockerham, W.C. (2005). Health lifestyle theory and the convergence of agency and structure. *Journal of Health and Social Behavior*, 46, 51-67.

Dalstraa, J.A.A., Kunst, A.E., & Mackenbach, J.P. (2006). A Comparative Appraisal of the Relationship of Education, Income and Housing tenure with less than Good Health among the Elderly in Europe. *Social Science and Medicine*, 62, 2046-2060.

De Silva, M., McKenzie, K., Harpham, T., & Huttly, S.R.A. (2005). Social capital and mental illness: a systematic review. *Journal of Epidemiology and Community Health*, 59, 619-627.

Haase, J.E. (2004). Resilience. In Petersen, S., & Bredow, T.S. (Ed.), *Middle range theories: application to nursing research* (pp. 341-367). Lippincott: Williams & Wilkins.

Hansen-Kyle, L. (2005). A concept analysis of healthy aging. *Nursing Forum*, 40, 45-57.

Herd, P. (2006). Do functional health inequalities decrease in old age?: educational status and functional decline among the 1931-1941 birth cohort. *Research on Ageing*, 28, 375-392.

Hildon, Z., Smith, G., Netuveli, G., & Blane, D. (2008). Understanding adversity and resilience at older ages. *Sociology of Health and Illness*, 30, 726-740.

Hildon, Z., Montgomery, S.M., Blane, D. Wiggins, R.D., & Netuveli, G. (2010). Examining resilience of quality of life in the face of health-related and psychosocial adversity at older ages: what is "right" about the way we age?. *The Gerontologist*, 50, 36-47.

Hinterlong, J.E., Morrow-Howell, N., & Rozario, P.A. (2007). Productive engagement and late life physical and mental health: findings from a nationally representative panel study. *Research on Ageing*, 29, 348-370.

Kawachi, I., & Berkman, L.F. (2000). Social Cohesion, Social Capital, and Health. In Berkman, L.F., & Kawachi, I. (Ed.), *Social Epidemiology* (pp. 174-190). Oxford: Oxford University Press.

Leffondré, K., Abrahamowicz, M., Siemiatycki, J., & Rachet, B. (2002). Modeling smoking history: a comparison of different approaches. *American Journal of Epidemiology*, 156, 813-823.

Lum, T.Y., & Lightfoot, E. (2005). The effects of volunteering on the physical and mental health of older people. *Research on Ageing*, 27, 31-55.

Mancini, A.D., & Bonanno, G.A. (2009). Predictors and parameters of resilience to loss: toward an individual difference model. *Journal of Personality*, 77, 1805-1831.

Masten, A.S. (1999). Resilience comes of age. Reflections on the past and outlook for the next generation of research. In Glantz, M.D., & Johnson, J.L. (Ed.), *Resilience and development. Positive life adaptations* (pp. 281-296). New York: Kluwer Academics/ Plenum Publishers.

Masten, A.S. (2001). Ordinary magic. Resilience processes in development. *American Psychologist, 56, 227-238.*

Masten, A.S. (2009). Ordinary magic. Lessons from research on resilience in human development. *Education Canada*, 49, 28-32.

Matthews, R.J., Smith, L.K., Hancock, R.M., Jagger, C., & Spiers, N.A. (2005). Socioeconomic factors associated with the onset of disability in older age: a longitudinal study of people aged 75 and over. *Social Science and Medicine*, 61, 1567-1575.

McMunn, A., Nazroo, J., & Breeze, E. (2009). Inequalities in health in older ages: a longitudinal investigation of the onset of illness and survival effects in England. Age and Ageing, 38, 181-187.

Netuveli, G., Wiggins, R.D., Montgomery, S.M., Hildon, Z., & Blane, D. (2008). Mental health and resilience at older ages: bouncing back after adversity in the British Household Panel Survey. *Journal of Epidemiology and Community Health*, 62, 987-991.

Ong, A.D., Bergeman, C.S., & Boker, S.M. (2009). Resilience comes of age: defining features in later adulthood. *Journal of Personality*, 77, 1777-1804.

Poortinga, W. (2006). Social capital: an individual or collective resource for health?. *Social Science and Medicine*, 62, 292-302.

Prus, S.G. (2007). Age, SES, and health: a population level analysis of health inequalities over the lifecourse. *Sociology of Health and Illness*, 29, 275-296.

Robert, S.A., Cherepanov, D., Palta, M., Cross Dunham, N., Feeny, D., & Fryback, D.G. (2009). Socioeconomic status and age variations in health-related quality of life: results from the National Measurement Study. *Journal of Gerontology: Social Sciences*, 64B, 378-389.

Ryff, C.D., & Singer, B. (2009). Understanding healthy aging: key components and their integration. In Bengston, V.L., Silverstein, M., Putney, N.M., & Gans, D. (Ed.), *Handbook of theories of aging* (pp. 117-144), New York: Springer.

Schoon, I. (2006). *Risk and resilience. Adaptation in changing times*. Cambridge: Cambridge University Press.

Van Deth, J.W. (2008). Measuring social capital. In Castiglione, D.; van Deth, J.W.; & Wolleb, G. (Ed.), *The handbook of social capital* (pp. 150-175), Oxford: Oxford University Press.

Veenstra, G. (2005). Location, location, location: contextual and compositional health effects of social capital in British Columbia, Canada. *Social Science and Medicine*, 60, 2059-2071.

Von dem Knesebeck, O., Wahrendorf, M., Hyde, M., & Siegrist, J. (2007). Socio-Economic Position and Quality of Life among Older People in 10 European Countries: Results of the SHARE Study. *Ageing and Society*, 27, 269-284.

West, B.T., Welch, K.B., & Galecki, A.T. (2007). *Linear mixed models: a practical guide using statistical software*. London, New York: Chapman & Hall/CRC.

Ziebarth, N. (2010). Measurement of health, health inequality, and reporting heterogeneity. *Social Science and Medicine*, 71, 116-124.