

# A meta-analysis into the causal effect of retirement on health

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# A META-ANALYSIS INTO THE CAUSAL EFFECT OF RETIREMENT ON HEALTH

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## **ABSTRACT:**

In this meta-analysis I try to answer the question what the causal effect of retirement on health is. There are many conflicting results in the literature, partly because of the endogenous relationship between retirement and health. I've collected 576 results from 61 studies around the world into the causal effect of retirement on health. 15% of the results were negative, 50% were not significant and 36% were positive. These results do not support the 'use it or lose it' hypothesis, indicating the health of retirees is expected to worsen after retirement because of inactivity. Although the results of retirement on health are more often positive than negative, this research does not have to be a cause of concern for policy makers who want to raise the retirement age. The negative effects of postponed retirement on health care expenditure are likely smaller than the benefits for the treasury.

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## 1. Introduction

According to data from the World Population Prospects, one in six people worldwide will be over the age of 65 in 2050. In North America and Europe, one in four persons are projected to be over 65 in 2050 (UN, 2019). To cope with the costs of an ageing society, most European countries have increased the retirement age (Finnish Centre for Pensions, 2019). Although increasing the retirement age has a relieving effect on social security programs, the positive total welfare effects could be smaller if later retirement adversely affects health.

A lot of research has been focused on the effect of retirement on health. Being in worse health could lead to an earlier selection into retirement and this endogenous relationship means an association between retirement and health does not infer causation. That is why recent (economic) research has been focused on finding a causal relation between retirement and health. Due to a lack of consent on the effects, scholars remain interested in the topic (Kolodziej & García-Gómez, 2019: 85). The topic is also of interest to actuaries, individuals, businesses and governments of course (Horner & Cullen, 2016: 1)

In this thesis, I have collected all studies that researched the causal effects of retirement on health and analyzed them in one meta-analysis. I have included 576 results from 61 different studies, reaching from Europe to Australia. There are some existing literature reviews, but those reviews do not look at causality per se. This meta-analysis contributes to the research by including only results that deal with the endogenous relationship of retirement and health and that use methods to infer causality. It also contributes to the research by the total number of studies that are included. Earlier literature studies looked (qualitatively) at a small number of studies, while all studies with a research design that fell within the depth of this thesis are included.

The main results of this thesis show that the causal effect of retirement on health is insignificant in almost half of the results. 15% of the results are negative, while 36% of the results are positive. There is some heterogeneity in the results, as the effects for health measures categorized as general, mental and physical health are significantly higher than the effects for mortality.

The outline of this thesis is as follows. In the next section I will discuss some of the theoretical perspectives that are able to explain the direction of the effect. I will also explain how the different health measures included in this study are measured and I will look at some earlier review studies. In the third part I will describe the data collection and categorization process, followed by a description of the available data within the field of health and retirement and the empirical strategy. In the fourth part I will discuss some summary statistics, followed by the main results and results on the heterogeneity of the effects. I will end with a conclusion.

## 2. Theory

### 2.1 The demand for health model before and after retirement

Economic research in this field is often based on the human capital model for the demand for health of Grossman (1972: 223-225). In this model, health is a durable capital stock that 'depreciates with age and can be increased by investment'. Health depreciation increases over time and health deteriorates, but the health stock can be increased by investment. If health

falls below a certain level, people die. People demand health for two reasons. As a consumption aspect, being healthy gives people the ability to consume their time, whether they prefer working or prefer leisure. Being unhealthy is a source of disutility. As an investment aspect, the investment in health influences the amount of time people are ill. Once someone is retired, there is no longer a motive to invest in health in order to raise productivity. For this reason, health may decline after retirement. On the other hand, the extra leisure time after retirement enters the utility function as a consumption good, which could lead to an increase of investment in health. Following this theoretical model, there is no unambiguous predicted effect of retirement on health (Dave et al, 2008: 500). I will describe some of the theoretical mechanisms in the next part of this paper.

## 2.2 Phases after retirement

In her research on the effect of retirement on health, Leimer (2018: 4-5) describes the five phases of retirement that are outlined by Atchley (1980). The first phase is preretirement, which can be separated in the remote phase and the near phase. In the remote phase retirement is seen as something that is occurring far in the future. In the near phase, people start to anticipate their nearing retirement and they may alter their lifestyle to improve their health. Vo & Tran (2019: 4-5) describe this preimpact as similar to Ashenfelter's dip, a decline in outcomes prior to the actual participation in a program. This means that the health of retirees can be impacted by simply nearing retirement, as retirement can be seen as a previously expected participation in a program. A similar preretirement effect can also come from the decreasing incentive to invest in (mental) health for workers late in their career. Rohwedder and Willis (2010: 128) call this the "on-the-job" retirement effect. The anticipation of retirement can have both positive and negative effects. Nearing retirement can decrease the amount of stress from work, but can also decrease the incentive to invest.

Second is the honeymoon phase, a euphoric phase where the retiree can enjoy its newly found freedoms. This phase is theorized to have a positive influence on self-assessed health measures. This is also in line with the Horner (2014: 126), who theorizes that since retirement is often associated with a drop in pay, people who choose to retire will only do so if they receive some improvement in their quality of life. The improvement of quality in life could have an influence of self-assessed measures of health. After the honeymoon phase comes the disenchantment phase, when a retiree realizes retirement is not only an extended vacation, but also has downsides. The fourth phase is reorientation, a phase where alternatives are developed that lead into the final phase of stability.

## 2.3 'Use it or lose it' hypothesis

The idea behind the 'use it or lose it' hypothesis, or the mental-exercise hypothesis is very attractive to people, because it introduces the idea that people have a form of control over their (mental) rate of decline (Salhouse, 2006: 69-70). Following the Grossman model for the demand of health (1972), investing in (mental) exercises can both increase the health capital and decrease the level of depreciation. The relation between mental health and mental exercise derives some of its intuitive plausibility from the proven relation between physical exercise and physical health. Salhouse (2006: 82) found little evidence for this hypothesis, partly because the research into the topic was not focused on causality. Although there was a

significant positive association of engaging in mental activity and the level of cognitive performance, the evidence of a causal relationship is not convincing.

Variants of this hypothesis are the unengaged lifestyle hypothesis (Rohwedder & Willis, 2010: 127) and the Dumbledore hypothesis of cognitive ageing. According to the unengaged lifestyle hypothesis, mental health depreciates without cognitive stimulation. Following the Dumbledore hypothesis of cognitive ageing, cognitive vitality is both influenced by the depreciation of health and the investment in health, as is the case in the model of Grossman (1972). The theory of the Dumbledore hypothesis is that the choices we make show who we truly are, far more than our abilities. Following this hypothesis, the pattern of life and engaging in intellectual challenge has a greater influence on mental health than the depreciation process (Stine-Morrow, 2007: 296).

Most of the theories in the literature on exercising and the depreciation of health focus on mental health. The same mechanisms apply for physical and general health as well, but there the mechanisms are more intuitive and do not need an explanation. The basic idea is that retirement could lead to inactivity, negatively impacting general/physical/mental health. Retirement could positively impact health if the activities of continued working are a burden to people.

#### 2.4 Health measurement in the literature

Health is a broad concept and is measured differently throughout the literature. In the next part I will introduce the different health measurements and I will give a representative example of how they are measured.

Health is often measured with surveys. In those surveys people are asked to rate their own health and people have to answer a number of questions regarding their mental and physical health. An example is the SF12 measure, with questions on heart attacks, high blood pressure, psychological problems, being overweight and other health-related subjects. Self-reported health is a very subjective measure prone to reporting bias. The SF12 measure combines specific questions on different subjects, which makes it less prone to reporting bias, although it remains a subjective measure (Eibich, 2015: 3). The SF12 measure can be used to create a general health index, but can also be used to create a mental or physical health index.

Depression in Europe is usually measured with the EURO-D scale of depressive symptoms (Kolodziej & García-Gómez, 2019: 86), while depression in the US is measured with the Center for Epidemiological Studies Depression Scale (CESD; Neuman, 2008: 185). Both scales are formed by answering a number of questions on depressive symptoms, creating an index that gives a global insight into how depressed individuals are.

Cognition is measured by a word recall test, sometimes combined with a fluency test and a numeracy test. In a word recall test, respondents are asked to memorize 10 words and recall these words twice, immediately and after some delay. Word recall is sometimes complemented by a verbal fluency test, where respondents are asked to name as many animals as possible within a minute (Coe & Zamarro, 2011: 80) and a numeracy test, where individuals are asked to do some simple calculations based on real life situations (Mazzonna & Peracchi, 2017: 133).

Muscle strength is often proxied by grip strength, which is measured in longitudinal panel studies as the Health and Retirement Study (US), the English Longitudinal Study of Ageing (ELSA) and the Survey of Health, Ageing and Retirement in Europe (SHARE). Respondents are instructed to stand up and push a dynamometer as hard as they can (Bertoni et al., 2017: 117). The BMI is derived by dividing the self-declared weight in kilograms by the square of the self-declared height in meters (Godard, 2016: 32). Difficulties with Activities of Daily Living (ADL) are also collected from surveys, when people are asked whether they have difficulties performing tasks as bathing, eating and walking across a room (Neuman, 2008; 185). Chronic conditions are measured by the binary question whether people suffered from or had any chronic illness or condition (Hessel, 2016: 21) or by accumulating the number of affirmative answers on a set of questions on different chronic conditions (Rose, 2018: 93).

Hospitalization, drug prescription and doctor visits are also measured in longitudinal panel studies (Gorry et al., 2018: 2072), although a few studies have been able to use administrative data for these measures. An example is the study of Grøtting and Lillebø (2019: 1), who use Danish administrative data to look at hospitalization. Hagen (2018: 193) uses Swedish administrative data to look at hospitalizations and drug prescriptions. Research on the effect of retirement on mortality is always based on administrative data, see for instance the studies from Bozio, Garrouste & Perdrix (2019: 1) and Hagen (2018: 193).

### 2.5 Heterogeneous effects

In the next part I will explain which other variables I have included in the research. It is not hard to imagine that the previous working conditions can impact the transition from work to retirement. Van der Heide et al. (2013: 2) among others argue that the difference in mental and physical workload of white- and blue-collar workers can influence the health effects of retirement. The effects of retirement on physical health for blue-collar workers with physically demanding jobs could very well be more beneficial than the effects for white-collar workers (Coe & Lindeboom, 2008: 17).

There are of course many differences between the sexes, making it interesting to distinguish between the effects for men and women. The working conditions of men and women also differ in most countries, which could be of influence as well.

Heller-Sahlgren (2017: 67) looks at the long- and short-term effects of retirement, and stresses that the effects may differentiate. If (nearing) retirement leads to a decreased investment in health, the negative effects are likely to operate with a lag. On the other hand, retirement may lead to stress and dissatisfaction in the short run, as opposed to the honeymoon effect. Even though long- and short-term are differently defined throughout the literature, including this variable may provide some insight into the different effects in the short- and long-term.

To study the probable impact of retirement on health care costs, I make a distinction between objective and subjective health care measures. Focusing on the more objective measures is important to understand how retirement policies will affect health care costs (Gorry et al. 2018: 2068). It is also important because if retirement is perceived as a choice, people who retire will do so to improve their lives. That improvement can lead to people having a more

positive attitude towards their health, even if that is not reflected by the objective health measures.

## 2.6 Endogeneity

The main problem for establishing a relation between retirement and health is the endogenous relationship between both variables. Atchley (1975: 17-18) noted that health problems are often the cause of retirement, rather than a consequence. This is confirmed by among others Bound et al. (1998: 200), who found health to be a very important determinant in labor force patterns for older workers. This means there is a form of reversed causality that needs to be addressed (Bound, 2015: 6). A simple health comparison between individuals before and after their retirement is not suited to find the effects of retirement on health, even if the effects of retirement do not come with a lag (Mazzonna & Peracchi, 2017: 129).

The literature identifies three different ways to address this reverse causality, relying on a regression discontinuity design (RD), an instrumental variable design (IV) or a difference-in-difference design (DD). A good example of a RD design is given by Eibich (2015: 6). For a RD design, an assignment variable that (partly) determines whether people are treated is needed. Individuals above the retirement age are treated, opposed to individuals below the retirement age. A discontinuity in the outcome variable (health) around the threshold can be interpreted as the causal effect of the treatment, although only the short-run effects immediately after retirement can be estimated. Studies using a RD design often use retirement eligibility as assignment variable (e.g. Eibich, 2015; Fé & Hollingsworth, 2016 and Zhang et al., 2018).

The IV design also uses the retirement eligibility to infer a causal relation. The assumption of an IV design is that the instrument (retirement eligibility) only influences the outcome variable (health) through the instrumented variable (retirement). If this assumption is violated, the estimation is biased and inconsistent (Bingley & Martinello, 2013: 294). Studies with US data use the variation within the different retirement schemes as instrument, studies that include multiple countries use the variation in the retirement eligibility age between countries. Scholars believe retirement eligibility is a valid instrument and the only way retirement eligibility influences health is through retirement itself (e.g. Bingley & Martinello, 2013; Kolodziej & García-Gómez, 2019 and Chung et al., 2009).

The third way to address this endogenous relationship is through a DD design. If countries implement reforms, scholars use these reforms as a form of natural experiments. The group that is affected by the reform is compared over time with the group that is not affected by the reform. The difference between the trends of the groups over time is the causal effect of the reform, assuming the differences between both groups would have remained the same without the reform (e.g. Shai, 2018 and Blake & Garrouste, 2017).

## 2.7 Earlier review studies

To my best knowledge, there are three existing review studies on the effect of retirement on health. Van der Heide et al. (2013) qualitatively analyzed 22 longitudinal studies. They found strong evidence of a positive effect of retirement on mental health, with ten studies indicating that retirement is beneficial for mental health and three studies finding no effect. None of the studies they analyzed found a negative effect of retirement on mental health. The results for

perceived general health were mostly insignificant or found no effect (6), while three studies found a positive effect and one study found a negative effect. The results for physical health were equally mixed, with six studies indicating no effect, two positive results and four negative results. Van der Heide et al. (2013) conclude more research is needed. The studies Van der Heide et al. researched were not specifically designed to find causation, a key goal on this research.

Zulka, Hansson and Hassing (2018) looked at the impact of retirement on cognitive functioning, considering 20 studies with a longitudinal design. They found conflicting evidence on the association between retirement and cognition. They find some evidence for the impact of prior occupation, indicating that retirees from blue-collar or physical demanding jobs may benefit more from retirement than retirees coming from less physically demanding jobs. Zulka et al. (2018) focus on association, opposed to the focus on causation in this research.

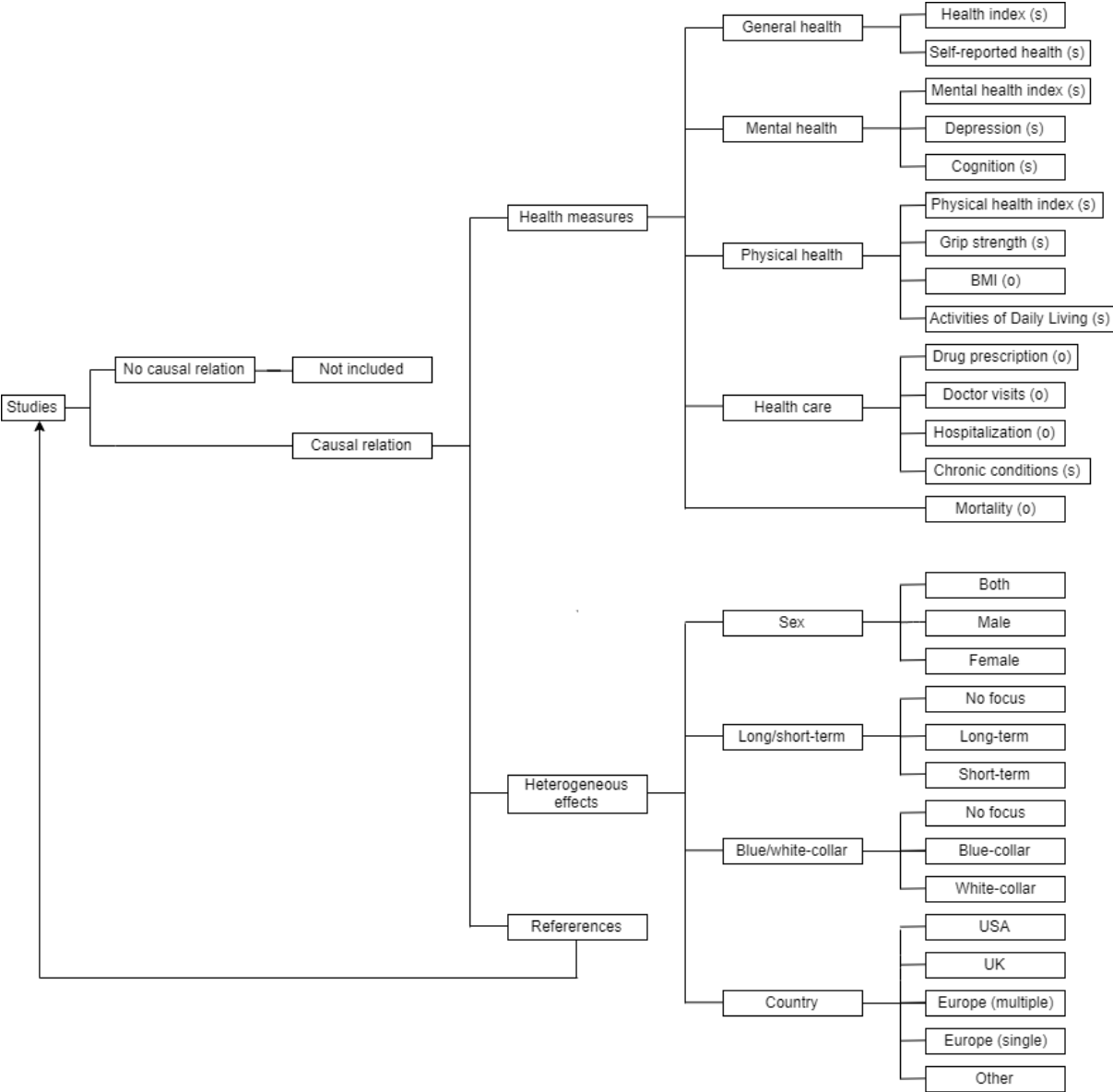
The third review study on the effect of retirement on health is from Nishimura, Oikawa and Hiroyuki (2018). They try to explain the different effects of retirement on health found in previous studies. They replicate eight previous studies and they create their own results using data from five different datasets to look at different health parameters in eight different countries. The definition of retirement does not significantly influence the outcomes in their replication studies. Other studies confirm this finding in robustness tests (e.g. Gorry et al., 2018: 2083 and Kolodziej & García-Gómez, 2019: 89), making the retirement definition not one of the main interests of this study. The analysis method and the surveyed countries do influence the results, indicating heterogenous results across countries. Their own results indicate that the effects of retirement on self-reported health, depression and ADL are mostly positive, while the effects on depression and cognition were more mixed and the effects for BMI are mostly negative. The study of Nishimura et al. (2018) looks at relatively few studies, in contrast to this research.

### 3. Methods

#### 3.1 Data collection and categorization

The Survey of Health, Ageing and Retirement and Europe (SHARE) lists on their website the journal articles that use SHARE-data. I have searched through all English articles on effects of retirement on health, based on the title. When in doubt, I consulted the abstract or the article. If articles looked at retirement and health, but did not address causation or endogeneity, they were not included. The references in the included articles were used to find new articles, and the references in those articles were used as well. To be able to include the more recent papers, I used Google Scholar to find which articles cited some of the more cited articles in this field (Coe & Zamarro, 2011; Bingely & Martinello, 2013; Mazzonna & Perachhi, 2017; Bonsang, Adam & Perelman, 2012). All articles that were reviewed by Van der Heide et al. (2013), Zulka et al. (2018) and Nishimura et al. (2018) were also considered. A combined total of more than 170 studies were more closely reviewed and 61 have been included. Figure 1 presents a graphic review of the data collection and categorization.

**Figure 1: data collection and categorization**



*Note: the heterogenous effects variables are collected from each study to explain heterogeneity within the overall results of this thesis. I have defined the health measures as either subjective (s) or objective (o).*

The papers that are included in this study focus on the causal relationship between retirement and health. Studies using only a regression with confounding variables are not included. Studies using 2SLS with generic instruments are not included in this research. An example is Kerkhof and Lindeboom (1997), the oldest study addressing the endogenous relation between health and retirement according to Nishimura, Oikawa and Motegi (2018). Kerkhof and Lindeboom (1997) introduce fixed effects two-stage instrumental variable approach, including instruments as gender and lifestyle variables. These instruments do not meet the exclusion restriction requirement, because the only channel through which they influence health is not retirement, following Angrist and Pischke (2015: 120). The oldest research included in this review is the research of Kofi Charles (2004), who uses two sets of TSLS estimates, one of them

making use of the discontinuous retirement incentive structure of US social security. With this model, he finds a positive effect of retirement on depression and loneliness, contrary to the negative effects found in the OLS and fixed effects estimates. Later studies routinely use early and full pension eligibility as instruments in their instrumental variable research design.

The papers that are included in this thesis focus on health outputs. Papers that focus on health inputs as smoking, drinking and exercising are not included (see for example Zhao et al, 2017 and Kampfen & Maurer, 2016). I have sorted the included outputs (listed in figure 1) into five health categories: general, mental, physical, health care and mortality. The effects on all health measures were categorized as positive, not significant or negative, following what is good for health. That means an increase in the number of depression symptoms is categorized as negative and an increase in the mortality rate and a decrease in the grip strength is categorized as negative. Figure 1 presents the data collection and categorization process.

Most studies about the causal effect of retirement on health have been done in the past ten years and publication in academic journals is sometimes a lengthy process. That is why I also include working papers that meet the inclusion criteria. A problem of meta-analysis is that it is often prone to publication bias. Publication bias comes from the habit of reviewers, researchers and editors to treat significant results more favorably, while ignoring insignificant results (Stanley, 2005: 310). This bias is partly dealt with by including papers that are not published. Another advantage of this study is that multiple results from a single paper are included. A lot of scholars look at multiple health measures and publish multiple heterogeneous results. All those results are included, even if the scholar is mostly focused on the significant results. Papers from all academic fields are included, although non-economic papers are often less focused on causation and therefore do not meet the inclusion criteria.

### 3.2 Available data on retirement and health

In their paper describing the credibility revolution in micro-economics, Angrist and Pischke (2010: 6) argue that a clear-eyed focus on the research design is at the heart of the improvement of the field. One of the reasons they give for the revolution is the increased availability of more and better micro-data. The research in this paper benefits especially from longitudinal panel studies focusing on health and retiring as the Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA), the Survey of Health, Ageing and Retirement in Europe (SHARE) and many others. HRS started in 1992 and has since been followed by many other studies, including in developing countries. Multiple scholars combine these longitudinal panels for their research (see for instance Bonsang & Perelman, 2007; Rohwedder & Willis, 2010; Bingley & Martinello, 2013; Fonseca et al., 2015 and Nishimura et al., 2018). Some scholars make use of administrative data (e.g. Nielsen, 2019; Horner & Cullen, 2016 and Kuhn et al., 2018)

The increased number of studies focusing on the effect of retirement on health are part of a process of accumulating knowledge on this subject, a necessary road to make results overcome their internal validity and become more general, according to Angrist and Pischke (2010: 23-24). The point of this research is not to add to the accumulation of empirical evidence into the subject, but to take a step back and to see what can be learned from the existing evidence. In the last ten years, several scholars have focused on the causal effect of

retirement on health. They looked at self-reported health, mental health, physical health, hospitalization and many other components of health and found mixed results. The aim of this research is to accumulate those results and to see if there are any conclusions that can be drawn from the earlier results.

### 3.3 Estimated models

In the result section, I will use two Ordinary Least Square (OLS) regression models to describe the causal effects of retirement on health. The dependent variable is the effect of retirement on health for a given study, categorized as either negative (-1), not significant (0) or positive (1). All the other variables are categorized as dummy variables. In the model discussed in section 4.2, all health measures are included. The first specification is a simple model where the different health measures are added to the equation. In the second specification the country dummies are included and in the third specification the other variables are included as well. The objective/subjective variable is excluded from the model in section 4.2. All mental and general health measures are defined as subjective and mortality is defined as objective, making the objective/subjective variable coincide to much with the health measures. In the model discussed in section 4.3, the dependent variable is split by health measures.

## **4. Data and estimation results**

### 4.1 Summary statistics

Table 1 shows the characteristics of the included studies. 61 studies are included in the analysis, with a total of 576 different results. The causal effect of retirement on health is negative in 14,76% of the results and positive in 35,59%, while remaining insignificant in 49,65% of the results. The oldest research that is used is from 2004, the latest is from 2020 (the average is 2016,8). The length of the datasets that are used in the included results ranges from 1 year to 46 years, with an average of 11,5 years.

The results are split by different health measures, sex, the focus on short- or long term, subjective and objective measures, blue- or white-collar workers and the researched countries. The objective health measure includes BMI, drug prescription, doctor visits, hospitalization and mortality, the other health measures are characterized as subjective. The countries that are categorized as Other include results from Japan, China, South-Korea, Australia and Israel. The European results are divided into results for single European countries and results that include multiple European countries.

In the case of publication bias, insignificant results are likely to be underrepresented (Stanley, 2005: 311). In this research, they form the majority of the results as almost half of the results are insignificant. This indicates that publication bias does not seem to be a big factor in this research.

One of the most notable results is the lack of significant results for mortality. Most of the results for mortality are not significant, while most studies researching the effect of retirement on mortality use large administrative datasets and the insignificance cannot be explained by a lack of data. The more likely explanation is that the causal effect of retirement on mortality is very small or even non-existent. The effects for the other health measures are on average more positive than negative.

**Table 1**  
**Summary statistics.**

	Negative	Not significant	Positive	Total
<b>All results</b>	14,76	49,65	35,59	576
<b>Health measure</b>				
<i>General</i>	11,57	41,32	47,11	121
Health index	24,14	37,93	37,93	29
Self-reported health	7,61	42,39	50	92
<i>Mental</i>	15,28	50,93	33,8	216
Mental health index	18,18	39,39	42,42	33
Depression	10,75	44,09	45,16	93
Cognition	18,89	62,22	18,89	90
<i>Physical</i>	16,31	46,1	37,59	141
Physical health index	0	28,57	71,43	21
Grip strength	35	30	35	20
BMI	27,27	56,82	15,91	44
Activities of Daily Living	7,14	50	42,86	56
<i>Health care</i>	17,91	50,75	31,34	67
Drug prescription	0	0	100	3
Doctor visits	34,78	43,48	21,74	23
Hospitalization	10	66,67	23,33	30
Chronic conditions	9,09	36,36	54,55	11
<i>Mortality</i>	9,68	87,1	3,23	31
<b>Sex</b>				
Both	18,42	43,86	37,72	228
Male	14,81	53,44	31,75	189
Female	9,43	53,46	37,11	159
<b>Short-term/long-term</b>				
No focus	11,08	53,54	35,58	424
Short-term	13,33	58,67	28	75
Long-term	36,36	19,48	44,16	77
<b>Subjective health measure</b>	13,26	45,84	40,90	445
<b>Objective health measure</b>	19,85	62,60	17,56	131
<b>Blue/white-collar</b>				
No distinction	14,8	45,74	39,46	446
Blue-collar	23,94	50,7	25,35	71
White-collar	3,39	77,97	18,64	59
<b>Country</b>				
USA	19,32	32,95	47,73	88
UK	18,07	50,6	31,33	83
Europe (one country)	2,26	72,93	24,81	133
Europe (multiple countries)	19,17	49,74	31,09	193
Other	16,54	33,07	50,39	127

*Notes: The given numbers in the first three columns are percentages, the last number is the total amount of studies. The total number of countries is higher than the total number of studies, because some results included multiple countries.*

The results that are focused on the long-term effects are in just 20% of the results not significant, compared to over 50% for results that look at the short-term effects and results without a focus on the short- or long-term. The results in the long-term are both more often positive and negative. This seems to be in line with the hypothesis of Heller-Sahlgren (2017: 67) that the effect of retirement operates with a lag.

One of the most notable things for the different countries is the lack of negative results for single European countries. Just 2,26% of the results are negative and 72,93% of the results are not significant. The results for multiple European countries are negative in 19.17% and not significant in 49,74% of the results. The differences in the results between single and multiple European countries might be explained by the different methods that are used. Multiple European countries are often analyzed using an instrumental variable approach, exploiting the different eligibility ages across countries. Research into single European countries often exploits reforms, whereas the group that is treated by the reform is compared to the not-treated group.

**Table 2: OLS on the causal effects of retirement on health**

	Model 1		Model 2		Model 3	
Healthcare	0.199	(0.146)	0.253	(0.154)	0.238	(0.154)
Physical health	0.277**	(0.134)	0.341**	(0.142)	0.309**	(0.142)
Mental health	0.250*	(0.129)	0.347**	(0.141)	0.316**	(0.141)
General health	0.420***	(0.136)	0.486***	(0.146)	0.469***	(0.146)
Mortality (reference category)	-	-	-	-	-	-
UK (reference category)			-	-	-	-
USA			0.127	(0.119)	0.164	(0.121)
Europe (single country)			0.134	(0.103)	0.120	(0.104)
Europe (multiple countries)			-0.0905	(0.0975)	0.0015	(0.105)
Other country			0.154	(0.101)	0.204**	(0.102)
Blue- & white-collar					0.0927	(0.0962)
White-collar (reference category)					-	-
Blue-collar					-0.126	(0.118)
No focus on short- or long-term					0.225**	(0.0895)
Focused on long-term (reference category)					-	-
Focused on short-term					0.150	(0.110)
Men & women					0.0855	(0.0691)
Only men (reference category)					-	-
Only women					0.118	(0.0719)
Constant	-0.0645	(0.121)	-0.189	(0.154)	-0.512**	(0.205)
N	576		576		576	
Adj. R-squared	0,014		0,028		0,041	

Standard errors in parentheses.

\* p<0.10, \*\*p<0.05, \*\*\*p<0.01

#### 4.2 Main findings

The results of the main analysis are presented in table 2. The dependent variable is the effect of retirement on health, categorized as negative (-1), not significant (0) or positive (1). The first specification includes the combined health measures. The coefficients of physical health, mental health and general health are all significantly more positive than the reference category (mortality). If the different countries are included in the second specification, the coefficients of general health, mental health and physical health remain significantly more positive than the reference category. The country coefficients are not significant.

In the third specification, all variables are included. Physical health, mental health and general health remain significant. General health has the highest coefficient, indicating the results of retirement on general health are the most positive. The coefficients for most of the countries are not significant, except for the Other countries, where the coefficient is significantly positive. This supports the findings of Nishimura et al. (2018), who found heterogeneity in the effects of retirement and health across countries. The coefficients from Europe and the USA do not differ significantly from the UK however.

The coefficient for the results with no focus on the long-term are significantly higher than the reference category, the results that are focused on the long-term. This means the results on the long-term are less positive than the results without a focus. This is in line with the idea of Heller-Sahlgren (2017) that the effects of retirement operate with a lag.

The coefficients for blue-collar workers do not significantly differ from the white-collar workers. This means these results do not support the idea that retirement has a different effect on health for different working conditions. The results for men and women also do not significantly differ. This means this research does not provide any evidence that the effects of retirement on health differ across sexes.

#### 4.3 Heterogeneity of the results

In table 3 the results are presented for the different health measures. The dependent variable is the result of the effect of retirement on health. The lack of significant coefficients can partly be explained by the number of studies that are included. A total of 576 results are included in this research, but that total is divided by the different health measures. With fewer results, not all differences can be detected on a significant level. This is most apparent in the last column on the effects of retirement on mortality. This column includes only 31 results, which are all categorized as objective and based only in single European countries and the UK, whereas there are only two results for the UK.

The model for healthcare has the highest adjusted r-squared and is able to explain 40% of the variation. The coefficients for blue-collar workers and the variable for both blue-and white-collar differ significantly from the reference category (white-collar workers). It should be noted that there are only 5 observations for white-collar workers on the healthcare measure, so this result should be treated with caution. The same caution is needed for the significant result of the long-term measure, as only 6 results are included for on the healthcare measure.

**Table 3: OLS on the heterogeneity of the causal effect of retirement**

	Physical	Healthcare	Mental	General	Mortality
UK (reference category)	-	-	-	-	-
USA	0.289 (0.234)	0.241 (0.306)	0.0940 (0.181)	0.0222 (0.325)	<sup>a</sup>
Europe (single country)	0.441** (0.194)	0.245 (0.260)	0.184 (0.165)	-0.454 (0.299)	0.481* (0.273)
Europe (multiple countries)	0.206 (0.207)	-0.208 (0.261)	0.0688 (0.151)	-0.324 (0.297)	<sup>a</sup>
Other country	0.759*** (0.204)	-0.810*** (0.255)	0.597*** (0.155)	-0.265 (0.290)	<sup>a</sup>
Blue- & white-collar	0.161 (0.191)	-0.731** (0.280)	0.0329 (0.151)	0.235 (0.200)	-0.0313 (0.201)
White-collar (reference category)	-	-	-	-	-
Blue-collar	-0.182 (0.234)	-0.831*** (0.309)	-0.0251 (0.182)	-0.0796 (0.250)	-0.250 (0.254)
Objective health measure	-0.708*** (0,129)	-0,382 (0,240)	<sup>b</sup>	<sup>b</sup>	<sup>c</sup>
Subjective health measure (ref. category)	-	-	-	-	-
No focus on short- or long-term	0.226 (0.196)	-0.742** (0.294)	0.527*** (0.131)	0.297* (0.167)	-0.00682 (0.224)
Focused on long-term (reference category)	-	-	-	-	-
Focused on short-term	0.0689 (0.230)	-0.698** (0.294)	0.348** (0.172)	0.0689 (0.215)	<sup>d</sup>
Men & women	0.158 (0.136)	-0.0609 (0.170)	0.0788 (0.109)	0.0514 (0.149)	0.123 (0.161)
Only men (reference category)	-	-	-	-	-
Only women	0.117 (0.138)	0.0661 (0.182)	-0.0332 (0.112)	0.304* (0.158)	0.171 (0.159)
<i>Constant</i>	-0.328 (0.334)	1.960*** (0.468)	-0.463* (0.250)	0.142 (0.393)	-0.547 (0.414)
N	141	67	216	121	31
adj. R-squared	0,187	0,399	0,129	0,064	0,002

Standard errors in parentheses.

\* p&lt;0,10, \*\*p&lt;0,005, \*\*\*p&lt;0,01

*Notes: <sup>a</sup> There are no results for mortality in the USA, Europe (multiple) and Other countries.**<sup>b</sup> All mental and general health measures are subjective.**<sup>c</sup> Mortality is always categorized as objective.**<sup>d</sup> There are no results for mortality on the long-term, making short-term the reference category for mortality.*

The significant positive coefficient for Other countries from table 2 can be derived by the positive coefficient for mental and physical health in table 3, which are both significantly more positive than the reference category and the highest of all countries. The effect of retirement on physical health is also significantly higher in single European countries.

The positive effect for general health is higher for women than for men, the only health measure with a significantly different coefficient for men and women. As the general health measure consists of self-reported health and a health index, this could indicate that women feel healthier after retirement.

## 5. Conclusion

Many countries have raised the retirement age in the last years, anticipating an ageing society. It is important for policymakers to consider the health effects of retirement when they adjust the retirement age. There has been much research into the causal effect of retirement on health, but the literature does not provide an unambiguous answer to this question. To provide further insight into this question, I have collected global results into the causal effects of retirement on health and combined those results in a meta-analysis.

I have collected results on 14 different health measures, ranging from self-reported health to grip strength and mortality. Taken together, the causal effect of retirement on health is not significant in half of the results, negative in 15% and positive in 36%. Although the results are heterogenous across countries and health measures, the results presented in this paper do not support the 'use it or lose it' hypothesis. Retirement in most cases does not have a negative, but a non-significant or positive effect on health. I do find some evidence that the negative effects of retirement operate with a lag, as the results are less positive if the long-term effects are considered.

I also find heterogenous results across countries, indicating that the effects of retirement differ between countries. The effects of retirement are significantly more positive in the category Other countries. Although the coefficients of the USA and Europe are not significant, these results provide some evidence that the effects of retirement on health may differ across countries. The institutional settings within countries might be of interest in explaining the differences across countries. Future research could benefit from more research into some of these other countries (e.g. China, Japan, Australia), to be able to explain the differences between individual countries.

The results for single European and multiple European countries also differ, although this is not shown in the regression analysis as the distribution of both variables remains centered around the middle value (not significant). The difference can partly be explained by the different estimation methods, where research into multiple European countries exploits the different eligibility ages across countries and research into single European countries exploits reforms. This difference could be further exploited in new research, as the different estimation methods might provide insight into the variation across results.

An interesting distinction that can be made in future research is the difference between results that are obtained from surveys and the results that are obtained from administrative data. Most of the results in this research are based on longitudinal panel designs, (e.g. ELSA,

HRS and SHARE). Some scholars however have been able to obtain administrative data and it might be interesting to see whether the results that are obtained from surveys match the data from administrative datasets. In this research I have distinguished objective and subjective health measures, as well as health measures that are related to health care costs and other measures. The health care variable is the only variable that is not significant, indicating that the effects of retirement on health care are less positive. The objective health measures for physical health are significantly more negative than the subjective health measures. These results indicate that the effect of retirement is less positive if it comes to actual health care expenses, something that could be further explored using administrative datasets.

This research shows that the effect of retirement on health is rarely negative and mostly positive or not significant. Policy makers do not have to fear that inactivity after retirement has large effects on the health of retirees, and the increase in leisure time may turn out to have some positive health effects. Policy makers do also not have to fear for the negative effect of raising the retirement age. Although the effects of retirement are more positive than negative, most of the results are insignificant, indicating that the total effects are not very big. Focusing on the downsides of a postponed retirement can help to mitigate the effects, but it is important to keep in mind that the health effects do not seem to be very big. The reluctance of having to work longer may be a bigger concern.

There are always individual cases and sectors where a postponed retirement can negatively impact health, but this is independent of the exact retirement age. Employers and employees in severe working environments need to address the difficulties of working in high age, but this does not depend on a retirement age of 65 or 66. Problems from severe work in high age can arise with any retirement age and should be addressed independently. Although retirement can be a relief for people with severe jobs, this research does not give much reason to believe the negative effects of postponing retirement outweigh the financial benefits.

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## 8. APPENDIX: DATA OF INCLUDED STUDIES

Authors	#	Year	Pos	Not sig	Neg	Both blue and white	White collar	Blue collar	Health index	Mental health index	Physical health index	Grip strength	Self-reported health	Depression	Cognition (word recall etc.)	BMI	ADL	Mortality	Drug prescription	# doctor visits	Hospitalization	Chronic condition	Objective	Subjective	Short-term	Long-term	Short-term RD	D-in-D	IV	Both	Male	Female	EU single	EU multiple	USA	Other country	SHARE (EU)	HRS (US)	ELSA (UK)	Other dataset	Year data begin	Year data end	Note						
Kolodziej & Garcia-Gómez	1	2019	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2013	All included				
Kolodziej & Garcia-Gómez	1	2019	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2013	White collar			
Kolodziej & Garcia-Gómez	1	2019	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2013	Blue collar			
Kolodziej & Garcia-Gómez	1	2019	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2013	Male results			
Kolodziej & Garcia-Gómez	1	2019	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2013	Female			
Coe & Zamarro	2	2011	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2004	Self-reported				
Coe & Zamarro	2	2011	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2004	Health index			
Coe & Zamarro	2	2011	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2004	Depression			
Coe & Zamarro	2	2011	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2004	Word recall			
Bingley & Martinello	3	2013	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	1	1	1	0	2004	2004	Both				
Bingley & Martinello	3	2013	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	2004	2004	Male				
Bingley & Martinello	3	2013	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	1	1	1	0	1	1	1	0	2004	2004	Female			
Mazzonna & Peracchi	4	2017	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, long term			
Mazzonna & Peracchi	4	2017	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, long term		
Mazzonna & Peracchi	4	2017	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, female, long term		
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, male, long term		
Mazzonna & Peracchi	4	2017	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, female, long term		
Mazzonna & Peracchi	4	2017	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, white collar, long term		
Mazzonna & Peracchi	4	2017	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, white collar, long term		
Mazzonna & Peracchi	4	2017	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, blue collar, long term		
Mazzonna & Peracchi	4	2017	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, blue collar, long term		
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, short term	
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, short term	
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, male, short term	
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, female, short term	
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, male, short term
Mazzonna & Peracchi	4	2017	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, female, short term
Mazzonna & Peracchi	4	2017	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, white collar, short term
Mazzonna & Peracchi	4	2017	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, white collar, short term
Mazzonna & Peracchi	4	2017	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Health index, blue collar, short term
Mazzonna & Peracchi	4	2017	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	2004	2007	Word recall, blue collar, short term
Hagen	5	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2005	2009	Mortality
Hagen	5	2018	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2005	2009	Drug prescription
Hagen	5	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2005	2009	Hospitalization
Neuman	6	2008	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1992	2004	Male, self-reported
Neuman	6	2008	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1992	2004	Male, ADLs
Neuman	6	2008	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1992	2004	Male, depression
Neuman	6	2008	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1992	2004	Female, self-reported
Neuman	6	20																																															





Authors	#	Year	Pos	Not sig	Neg	Both blue & white collar	Blue collar	Health index	Mental health index	Physical health index	Grip strength	Self-reported health	Depression	Cognition (word recall etc.)	BMI	ADL	Mortality	Drug prescription	# doctor visits	Hospitalization	Chronic condition	Objective	Subjective	Short term	Long term	RD	D-in-D	IV	Both	Male	Female	EU single	EU multiple	USA	Other country	SHARE (EU)	HRS (US)	ELSA (UK) dataset	Other	Year data begin	Year data end	Note										
Shai	20	2018	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, poor health						
Shai	20	2018	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, poor health					
Shai	20	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, physician visits					
Shai	20	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, physician visits					
Shai	20	2018	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, <12 years of schooling, health index					
Shai	20	2018	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, >12 years of schooling, health index					
Shai	20	2018	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, <12 years of schooling, health index					
Shai	20	2018	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, >12 years of schooling, health index					
Shai	20	2018	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, <12 years of schooling, physician visits					
Shai	20	2018	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Older control group, >12 years of schooling, physician visits					
Shai	20	2018	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, <12 years of schooling, physician visits					
Shai	20	2018	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1996	2009	Younger control group, >12 years of schooling, physician visits					
Bertoni et al.	21	2018	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Short term		
Bertoni et al.	21	2018	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Long term		
Bertoni et al.	21	2018	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Short term, blue collar		
Bertoni et al.	21	2018	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Long term, blue collar		
Bertoni et al.	21	2018	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Short term, white collar		
Bertoni et al.	21	2018	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Long term, white collar			
Bertoni et al.	21	2018	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Short term, male		
Bertoni et al.	21	2018	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Long term, male	
Bertoni et al.	21	2018	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Short term, female	
Bertoni et al.	21	2018	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2004	2007	Long term, female	
Clouston et al.	22	2017	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1992	2012	Model 4, looking at reversed causation	
Lei & Liu	23	2018	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, word recall
Lei & Liu	23	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Female, word recall
Lei & Liu	23	2018	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, mental intactness
Lei & Liu	23	2018	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Female, mental intactness
Lei & Liu	23	2018	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, word recall, blue collar
Lei & Liu	23	2018	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, word recall, white collar
Lei & Liu	23	2018	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, mental intactness, blue collar
Lei & Liu	23	2018	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	2011	2015	Male, mental intactness, white collar
Lei & Liu	23	2018	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0																							

Authors	#	Year	Pos	Not sig	Neg	Both blue and white collar	White collar	Blue collar	Health index	Mental health index	Physical health index	Grip strength	Self-reported health	Depression	Cognition (word recall etc.)	BMI	ADL	Mortality	Drug prescription	# doctor visits	Hospitalization	Chronic condition	Objective	Subjective	No focus on long term	Short term	RD	D-in-D	IV	Both	Male	Female	EU single	EU multiple	USA	Other country	SHARE (EU)	HRS (US)	ELSA (UK)	Other dataset	Year data begin	Year data end	Note											
Zhu	30	2016	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	2001	2011	Retirement status, self-reported health										
Zhu	30	2016	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	2001	2011	Retirement status, physical health							
Zhu	30	2016	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement status, mental health									
Zhu	30	2016	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement status, overall health									
Zhu	30	2016	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement duration, self-reported health									
Zhu	30	2016	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement duration, physical health									
Zhu	30	2016	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement duration, mental health									
Zhu	30	2016	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Retirement duration, overall health									
Johnston & Lee	31	2009	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1997	2005	Bad health						
Johnston & Lee	31	2009	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1997	2005	Mental health					
Johnston & Lee	31	2009	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1997	2005	BMI					
Latif	32	2011	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1994	2006	Psychological well-being, all						
Latif	32	2011	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1994	2006	Psychological well-being, male						
Latif	32	2011	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1994	2006	Psychological well-being, female						
Charles	33	2004	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	1981	1995							
Bloemen et al.	34	2017	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1999	2005	Male					
Bloemen et al.	34	2017	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1999	2005	Female					
Mazzonna & Peracchi	35	2012	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2006	Male, immediate recall				
Mazzonna & Peracchi	35	2012	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2006	Male, delayed recall				
Mazzonna & Peracchi	35	2012	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2006	Female, immediate recall				
Mazzonna & Peracchi	35	2012	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2006	Female, immediate recall				
Belloni et al.	36	2016	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Male				
Belloni et al.	36	2016	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Female				
Belloni et al.	36	2016	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Male, blue-collar				
Belloni et al.	36	2016	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Male, white-collar				
Belloni et al.	36	2016	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Female, blue-collar				
Belloni et al.	36	2016	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2004	2013	Female, white-collar				
Zhang et al.	37	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Doctor visits		
Zhang et al.	37	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Hospitalization	
Zhang et al.	37	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Self-reported health	
Zhang et al.	37	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Doctor visits, male	
Zhang et al.	37	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Self-reported health, male	
Zhang et al.	37	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Doctor visits, female	
Zhang et al.	37	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Hospitalization, female	
Zhang et al.	37	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Self-reported health, female	
Zhang et al.	37	2018	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	Mental health	
Zhang et al.	37	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2011	2013	BMI
Zhang et al.	37	2018	0	1	0																																																	



Authors	#	Year	Pos	Not sig	Neg	Both blue & white collar	White collar	Blue collar	Health index	Mental health index	Physical health index	Grip strength	Self-reported health	Depression (word recall etc.)	BMI	ADL	Mortality	Drug prescription	# doctor visits	Hospitalization	Chronic condition	Objective	Subjective	No focus on	Short term	Long term	Short term	RD	D-in-D	IV	Both	Male	Female	EU single	EU UK	EU multiple	USA	Other country	SHARE (EU)	HRS (US)	ELSA (UK) dataset	Other	Year data begin	Year data end	Note														
Leimer	41	2017	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	2004	2015	Self-assessed health, honeymoon, blue collar												
Leimer	41	2017	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2004	2015	No clinical depression, honeymoon, blue collar									
Leimer	41	2017	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2004	2015	No limitations in ADL, honeymoon, blue collar									
Leimer	41	2017	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2004	2015	Maximum grip strength, honeymoon, blue collar								
Leimer	41	2017	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2004	2015	Total words recalled, honeymoon, blue collar							
Nielsen	42	2019	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Hospitalization, reform						
Nielsen	42	2019	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Mortality, reform						
Nielsen	42	2019	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Hospitalization, RD						
Nielsen	42	2019	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Mortality, RD						
Nielsen	42	2019	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Hospitalization, RD, female						
Nielsen	42	2019	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Mortality, RD, female						
Nielsen	42	2019	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Hospitalization, RD, male						
Nielsen	42	2019	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1980	2010	Mortality, RD, male						
Calvo	43	2013	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1992	2010	Self-reported physical health, short term					
Calvo	43	2013	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1992	2010	Self-reported physical health, long term					
Calvo	43	2013	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1992	2010	Emotional health, short term					
Calvo	43	2013	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1992	2010	Emotional health, long term					
Caroli et al.	44	2016	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2004	2013	Doctor visits					
Coe & Zamarro (utilization)	45	2015	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1992	2008	US, doctor visits				
Coe & Zamarro (utilization)	45	2015	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1992	2008	US, hospitalization				
Coe & Zamarro (utilization)	45	2015	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2004	2006	EU, doctor visits				
Coe & Zamarro (utilization)	45	2015	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2004	2006	EU, doctor visits					
Coe & Zamarro (behaviors)	46	2015	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1992	2008	USA		
Coe & Zamarro (behaviors)	46	2015	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2004	2006	EU			
Coe & Zamarro (behaviors)	46	2015	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2002	2006	UK		
Kuhn et al.	47	2018	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1972	2017	Male, age at death		
Kuhn et al.	47	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1972	2017	Female, age at death	
Kuhn et al.	47	2018	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1972	2017	Male, age at death, blue collar
Kuhn et al.	47	2018	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1972	2017	Male, age at death, white collar
Barney & Defebvre	48	2018	0	1	0	1	0	0	0	0																																																	





Authors	#	Year	Pos	Not sig	Neg	Both blue & white	White collar	Blue collar	Health index	Mental health index	Physical health index	Grip strength	Self-report health	Depression	Cognition (word recall etc.)	BMI	ADL	Mortality	Drug prescription	# doctor visits	Hospitalization	Chronic condition	Objective	Subjective	No focus on short/long term	Short term	RD	D-in-D	IV	Both	Male	Female	EU single	EU UK	EU multiple	USA	Other country	SHARE (EU)	HRS (US)	ELSA (UK) dataset	Other	Year data begin	Year data end	Note			
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Physical health, female, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	2001	2011	Mental health, female, retirement duration
Mavromaras et al.	59	2013	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	2001	2011	Overall health, female, retirement duration
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning	
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	2001	2011	Mental health		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning, male		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2001	2011	Mental health, male			
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning, female		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Mental health, female			
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	2001	2011	Mental health, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning, male, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Mental health, male, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Physical functioning, female, retirement duration		
Mavromaras et al.	59	2013	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	2001	2011	Mental health, female, retirement duration	
Che & Li	60	2018	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	1991	2006	White collar male (only group included in research)		
Feng et al.	61	2020	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Male		
Feng et al.	61	2020	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Female		
Feng et al.	61	2020	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Male, high education		
Feng et al.	61	2020	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Female, high education		
Feng et al.	61	2020	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Male, low education		
Feng et al.	61	2020	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	2011	2015	Female, low education		