Dutch case study: Childhood socioeconomic status and health at older age.

How does childhood socioeconomic status affect self-perceived health at older ages in the Netherlands?

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Abstract

Already, research has been performed, showing the health gap that exists based on socioeconomic status. This study tries to strengthen the existing literature on the relationship between childhood socioeconomic status and health at an older age. This study analyses secondary quantitative data from the SHARE database. It uses data from 2019/2020, which was collected by performing interviews with Dutch citizens older than 60. The research looks for a relationship between childhood socioeconomic status, with the level of education as an explanatory variable for socioeconomic status and self-perceived health as the binary outcome variable. The main question is formulated as follows: How does childhood socioeconomic status affect self-perceived health at older ages in the Netherlands? The literature suggests that a relationship between education and health at older age exists. The Chi-square test showed a weak relation between the level of education and self-perceived health. However, when controlling with cofounders in a binary regression, no differences in the odds ratio for the level of education were found. This indicates that for the population, no inferences can be made on education impacting self-perceived health. The results are not in line with the expectations created in the theoretical framework. The insignificance of the explanatory variable in the binary regression makes it hard to draw conclusions. Multiple shortcomings of the research are discussed in the discussion section, referring to possible explanations on why the results do not match the expectations from the literature. Further research could focus on which policies would help with decreasing the health inequalities gap.

Introduction

A large volume of literature has been written on socioeconomic inequalities and health. In his paper, (Marmoth, 2005) has identified social factors as the root of social inequalities in health. He argued that the socio-economic level of the household and level of education influence the mortality rate. Moreover, multiple studies from different countries found statistical evidence that life expectancy differs based on education, occupation, and social class which are measurements of the socioeconomic situation (SES) (Sasson, 2016; Valkonen and Martikainen, 2006; Hattersly, 1999). Hattersley (1999, for example, followed a sample from the English and Welsh consensus during the 1970s and the 1990s, ranking the people from the consensus based on social class, from higher professional to unskilled manual laborer. Results showed that during these twenty years, the life expectancy gap between groups had widened. The difference in life expectancy for the lowest and highest social group had grown to 4 years for men and 1.1 years for women. Men from the highest social class were expected to live 9.5 years longer than men from the lowest social class and women from the highest social class were expected to live 6.4 years longer than women from the lowest social class. Further studies have shown that low educational attainment meant an increase in the risk of cardiovascular disease (Winkleby et al., 1992) and there seems to be a correlation between socioeconomic status and multiple chronic diseases (Adler and Ostrove, 2006). Furthermore, Socioeconomic status has also been linked to mental health problems, obesity, and diabetes (Reiss, 2013; Everton et al., 2002). Thus, it can be assumed that socioeconomic inequalities lead to worse health outcomes.

A lot of research has been performed on health inequalities for both adults and children (Marmoth, 2005; Phelan et al., 2010). The inequalities are present over the life course, starting in childhood with experiences and exposures affecting later life health. The literature that has already been written presents childhood as a crucial time for future health (Bravemen and Barclay, 2009; Alwin and Wray, 2005). Different health outcomes later in life are frequently a result of disparities in childhood socioeconomic status. It is possible to identify a few effects of socioeconomic inequalities. Firstly, Education has frequently been used as an indicator of socioeconomic status and is one of the most important predictors of health. Research has shown that education is closely related to socioeconomic status. Thus, when parents have a high socioeconomic status, their children have more chances on performing well at school (Buchmann and Park, 2009). Consequently, when higher educated, there is a higher chance of being healthy at an older age than when being lower educated (Alwin and Wray, 2005). Secondly, children growing up in families of higher socioeconomic status seem to enjoy more physical activities and tend to eat healthier than children born in low socioeconomic status families (Lynch et al., 1997). The dietary- and physical activity habits are transferred from parents to their children. These habits and patterns form factors that attribute to a healthy or unhealthy lifestyle and have consequences for the later life health of the children. On average, lower-educated persons tend to smoke more, drink more heavily, and have a higher BMI than higher-educated persons (Cutler and Lleras-Muney, 2010). Furthermore, lower-educated persons on average, are exposed to more adverse working conditions than higher-educated persons (Monden, 2005). Socioeconomic inequalities in childhood thus seem to impact the differences that appear in later life health.

Similar to the example of Hattersley (1999), in many other European countries, the health inequality gap is widening as well (Gheorghe et al., 2016; Mackenbach, 2012). This means that differences in life expectancy between groups based on education, occupation, or income are increasing. For example, Georghe et al. (2016) found that for the Netherlands, the difference in expected healthy years between low and high-educated people grew from 7 to more than 8 years for men and grew from 6 to more than 7 years for women. This increasing gap in life expectancy between groups with different socioeconomic positions implies that children born into lower SES families suffer from worse health outcomes compared to children from higher SES families and thus start their life more disadvantaged (Chen et al., 2002).

The literature suggests that a health gap exists, meaning that lower-educated persons are expected to be unhealthier and expected to have shorter lives than higher-educated persons. Although a vast number of studies have already been performed on the effects that socioeconomic conditions in childhood have on

health at older ages, almost no recent research has been performed for the Netherlands. Further analysis of data on Dutch citizens will strengthen the existing literature. The strengthening of the existing literature is needed to create the urge for installing policies that could decrease the health inequality gap that exists. This study will use childhood education as an indicator for childhood SES. Based on the importance of childhood education for later life health, the study seeks to answer the following question:

How does childhood socioeconomic status affect self-perceived health at older ages in the Netherlands?

- Do differences between gender exist?
- Do cohort differences exist?

To find an answer to these questions, first, a theoretical framework will be created, using theories on the relationship between childhood SES and health. Furthermore, concepts relevant to the research will be discussed in this framework and a conceptual model will be created to operationalize the concepts used for the theoretical framework. The literature used for the theoretical framework and the conceptual model will help with creating hypotheses for analyzation of the data. Afterward, it must be decided which data will be used and which tests are the most suitable for answering the research questions. Tests that are run create results that can be interpreted and compared to the expectations created in the theoretical framework.

Theoretical framework

Later life health outcomes are developed over the life course (Ben-Shlomo and Kuh, 2002). The factors that influence health throughout life can be explained by the life course approach. This approach combines social, psychological, and biological models that link the causes of disease. The life course model consists of different stages in life, which are childhood, adolescence, young adulthood, and further adult life. Part of the Life-course approach is the idea that environmental conditions may have long-term effects on health. Time is of importance in the approach, for example, cancer and cardiovascular diseases have long latency periods.

In the life course approach, socioeconomic status is regarded as one of the social mechanisms that influence health. There are numerous ways to measure socioeconomic status. This socioeconomic status refers to the position that individuals or groups hold within society. This position is influenced by social and economic factors, such as education, housing conditions, occupation, and income (Galobardes et al., 2006).

The exposures in a particular stage of life can have consequences for later life health effects, which makes such a stage important (Lynch and Smith, 2005). These stages are time windows where exposure can have a stronger effect on health than exposure in other time frames. Such a time window is often referred to as a critical period. The idea of this critical phase has its origins in several theories of developmental processes, particularly biological development. The factors impacting long-term health can form a social, biological, or psychological chain of risk, which is a series of linked exposures that increase disease risk because one negative experience or exposure tends to lead to another which can lead to another (Kuh and Ben-shlomo, 2004). The negative experiences and exposures have to do with the physical environment such as conditions of the home, the neighborhood, and conditions at school (Cohen et al., 2010). Over time, single exposures accumulate, leading to mechanisms that can explain the effect of remaining in an unfavorable socioeconomic situation. Consequently, a chain of risks can be formed, where adverse or beneficial exposures or experiences will add up, creating probabilistic links. These chains of risks suggest that the effect of exposures accumulates over the life course. As a result of the accumulated exposures, adult health can be affected. Thus, through different mechanisms, exposures are responsible for health outcomes. These mechanisms influence factors such as psychological maturation, health behavior, and physiological growth. It can be concluded that pathways exist between social and physical exposures and biological outcomes.

Following Cohen et al. (2010), childhood may be described as a critical period, where exposure to SES-associated conditions will have a stronger effect on health than other time frames or will have irreversible consequences for health. Moreover, different cohort studies have been performed that link socioeconomic circumstances in childhood to later health in adult life. According to Birnie et al. (2011), childhood SES influences the physical capability levels in adulthood. Other research has found evidence that a low childhood SES increases the risk of cardiovascular diseases (Galobardes et al., 2006). Furthermore, low socioeconomic SES in childhood has been connected to a higher body mass index in adulthood to a greater risk of developing obesity (Senese et al., 2009; Bann et all., 2018). Evidence has also been found that low childhood socioeconomic status also increases the risk of dying of strokes, lung cancer, stomach cancer, and respiratory diseases (Galobardes et al., 2004). Moreover, the study of Galobardes et al. (2004) also indicated that having a low socioeconomic position meant having a higher risk of a violent death or a death related to alcohol and drug abuse. Low childhood SES thus seems to increase the chance of dying from different causes and it is related to health in later life. Thus, early life factors such as socioeconomic status seem to have an impact on long-term health and contribute to cumulative biological system damage.

As mentioned earlier, the physical exposures in the home, the neighborhood, and conditions at school lead to accumulations that influence later life health. Some elaboration is needed to explain links between childhood SES and later life health outcomes such as described above. Having a low childhood SES indicates a higher chance of exposure to an unhealthy lifestyle (Cohen et al. 2010). Pampel et al. (2010) explain that for people with a low SES, experiencing stress forms an important reason for

unhealthy behavior. Stress can be caused by the struggle to make ends meet, experiencing more negative events such as unemployment and financial loss, and having fewer opportunities to achieve positive goals. This stress triggers unhealthy behavior such as overeating, smoking, and drinking. Thus, when having a low socioeconomic status, children are more likely to have greater exposure to unhealthy eating habits. Moreover, research points out that children who grew up in low socioeconomic circumstances have fewer opportunities for physical activities and fewer educational opportunities (Ben-Shlomo and Kuh, 2002). The level of physical activity and dietary habits in childhood consequently influences health in the long term (Cohen et al., 2010). On the contrary, people with a high SES can let their children participate in organized sports. These children are also more likely to have cognitive abilities which are better and are also more likely to achieve higher levels of education (Pedron et al. 2021). Furthermore, high-SES groups may adopt healthy lifestyles and activities to differentiate themselves from lower-SES ones (Pampel et al. 2010). It can be concluded that childhood SES is a determent for health behavior in adulthood.

Socioeconomic status can be measured by different indicators. Education is frequently used as an indicator of socioeconomic status (Galobardes et al., 2006). It is strongly determined by the parental characteristics and within the life course framework, can be conceptualized as an indicator of early life socioeconomic status. Education can be measured as years of education completed or by assessing educational degrees. As an important determinant for future employment and income, it can capture the influence of childhood status on adult health. Based on the existing international literature and the life course approach, it is expected that childhood socioeconomic status can be related to health at an older age.

In his paper, Lynch (2003) mentions two different hypotheses the regarding the effect that education has on health. the first one being the age-as-leveler hypothesis and the second one being the cumulative (dis)advantage hypothesis. The age-as-leveler hypothesis assumes that the effect of education on health is the biggest in middle adulthood, after which the effect of education on health declines with aging. On the contrary, the cumulative advantage hypothesis assumes that the effect that education has on health increases with age. Thus, both hypotheses are contradictory but assume that the effect that education has on health differs per cohort. However, as Dupre (2007) writes in his article, in the literature, conflicting evidence exists for the two hypotheses. Education influences the health through different mediators. Lynch (2003) has described three different kinds of mediators through which education influences health. These three mediators consist of: economic-, interpersonal-, and behavioral mediators. Mazzonna (2014) found significant results for one of these mediators influencing the differences in gender in the relation between education and health at an older age. He used the retrospective information on the employment history of respondents in the SHARE dataset to make inferences. The results showed that for men schooling influenced the occupational pattern, an economic mediator, which consequently affected their self-rated health at an older age. Moreover, the study showed that improvement in working conditions had a positive effect on self-rated health for men. However, because women have a much lower labor force attachment, the improvement of the working conditions did not show significant effects on women their self-rated health. Thus, although men and women could have the same levels of education, differences exist in working conditions and labor market participation. The labor market participation of women, for example, is much lower than that of men. In this way, the influence that education has on health at an older age might differ between gender.

Literature on the Dutch population needs to be discussed to create hypotheses. Although some literature on the Netherlands has been published, most of the research on the subject dates to the first years of the twenty-first century. Different studies show the relationship that exists between childhood SES and health at an older age in the Netherlands. Hyde et al. (2006) for example, found evidence that a disadvantaged childhood meant an increased likelihood of reporting poor health with significant relations for both men and women. Furthermore, van Kippersluis et al. (2010) analyzed data from the Central Bureau of Statistics from 1983-2000, showing the lifelong effect education has on health, which was also influenced by the accumulating advantages over the life course that education causes. The data from CBS showed a clear difference between educational levels and self-perceived health in later life. Another study on the Dutch population has found significant relations between years of education and

health for both men and women (Groot and Maassen van den Brink, 2007). Because health is not only determined by education, the authors also controlled for genetic, biological, environmental, and other social factors. Moreover, Groot and Maassen van den Brink (2007) show that the effect of education on health is larger for older men than for men in younger cohorts in the Dutch population. On the contrary, among women, the effect of education on health decreased with age. A more recent study focused on the years of good health between the ages 50 to 69 and the differences between higher and lower educated (Rubio Valverde et al. 2022). The data from 2006-2018 indicated that the lowest educated were expected to live fewer years in good health compared to higher educated people. Furthermore, the study also showed that in these years, the population did not witness a reduction in this health gap. Among men, the health inequalities slightly increased, whereas for women a bigger increase in inequalities was found.

This research follows the social pathway, where the childhood socioeconomic situation will be connected to health at old age, through analysis of a dataset on the Dutch population. Health outcomes as a result of low socioeconomic situations in childhood and specifically education have been researched through multiple studies. Whereas most studies on the topic have focused on Scandinavian countries because these countries have big data sets available, not much research has been performed on the Dutch population. The literature suggests that a relationship exists between education and health at an older age. Furthermore, education could have different influences on health dependent on age, with contractionary evidence existing. Besides this, it could also be that differences in gender exist in the relationship between education and health.

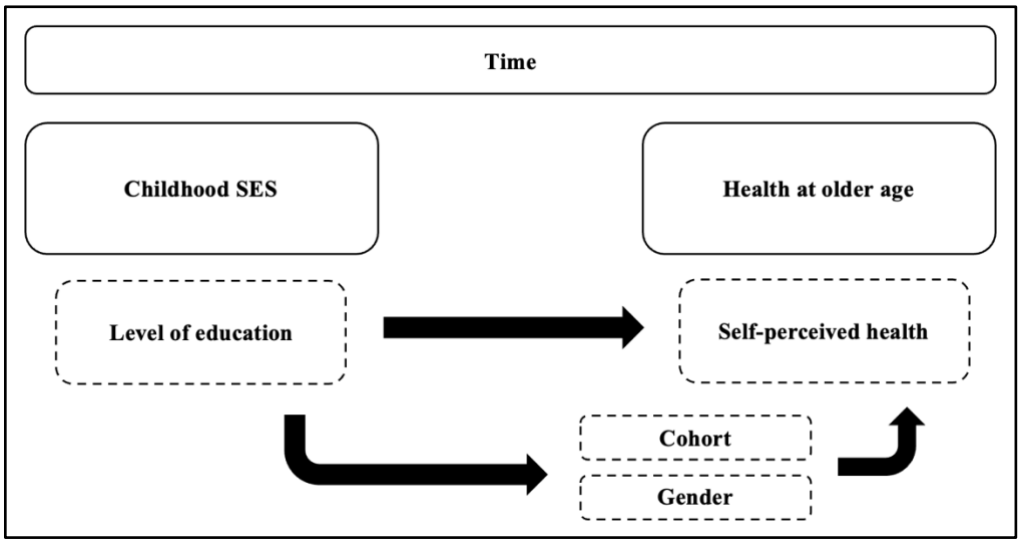

Figure 1: conceptual model

For figure 1, the information provided in the theoretical framework was used. It can be expected that lower socioeconomic status during childhood increases the risk of reporting bad health at older ages. One of the indicators of socioeconomic status is education, which will be used as an explanatory variable. Self-perceived health will be used as the dependent variable. Differences in cohorts and gender will be tested to see if the results are in line with the literature. Following the framework, the following hypotheses can be created.

- In the population, a relationship exists between education and health at an older age.
- In the population, there is a difference between men and women in the relationship between childhood SES (measured through education) and health at an older age.
- In the population, there is a difference between birth cohorts in relationship between childhood SES (measured through education) and health at an older age.

Methodology

For the testing of the hypotheses and answering the research questions, secondary quantitative data is analyzed. The sample that is used, was selected from the SHARE database (SHARE, 2022). SHARE: Survey of Health, Ageing, and Retirement in Europe is the largest European social science panel study. SHARE is a research infrastructure that can be used by researchers to study the effects of health, social, economic, and environmental policies in Europe and Israel. It provides microdata that can give insight into public health and living conditions of European citizens that are over 50 years of age. The database consists of multiple waves of data, starting with wave 1 in 2004. The most recent data collection wave, wave 8, dates from 2020. The database contains microdata on more than 140.000 persons from 28 European countries and Israel. In total, more than 530.000 in-depth interviews were conducted spread over the different waves. The qualitative data of SHARE, which was gathered by performing interviews, has been coded in the easySHARE database (EasySHARE, 2022). This resulted in reduced complexity for the subset of variables.

Because this research focuses on the Netherlands, only Dutch cases are selected to statistically test hypotheses that were constructed along the sub-questions of the research. Furthermore, only data from wave 8, which was gathered in 2019 and 2020, is used as this presents the most recent information. Besides this, only cases of persons that are older than 60 years of age will be selected, as this is the age range for old age people which is set by the UN (2022).

To operationalize the conceptual model and run tests, independent and dependent variables must be selected. The independent variable must be an indicator of childhood SES. To measure this the level of education was chosen. For this research, self-perceived health is used as the dependent outcome as research has found an association between self-perceived health and mortality (Burström and Fredlund, 2001). Another study performed by Idler and Benyamini (1997) analyzed twenty-seven international journals and showed consistent findings of self-perceived health being a predictor for mortality. To find the answer to the sub-questions and test the hypotheses (as can be seen in the theoretical framework), the variables "*gender*" and "*cohort*" were used. Furthermore, Control variables are installed to see how the relationship between education and health changes when accounting for other factors. These consist of behavioral and economic factors. The behavioral control variables consist of information on smoking and vigorous activities. Data on the ability of a household to make ends meet is used as a control variable to analyze adult inequalities. Although income information exists, the information is based on household income and not individual income, which makes it of no use as a control variable. Furthermore, no variables on past occupation or unemployment are available in the dataset. Thus, the amount of control variables is limited. After selecting Dutch cases, cases from wave 8, respondents over 60 years of age, and removing missing cases, the sample that is used for the research contained 1521 cases. An overview of the cases can be seen in figure 2.

Cross table: Variables and self-perceived health

How do you perceive your own health?		Bad Health		Good Health	
		Count	Row N %	Count	Row N %
Level of education	Primary education or first stage of basic education	41	38,7%	65	61,3%
	Lower secondary education or second stage of basic education	169	33,8%	331	66,2%
	Secondary and post-secondary non-tertiary education	116	29,1%	283	70,9%
	First or second stage of tertiary education	118	22,9%	398	77,1%
Gender	Male	200	28,4%	504	71,6%
	Female	244	29,9%	573	70,1%
Cohort	1920-1940	99	34,4%	189	65,6%
	1940-1950	182	28,0%	468	72,0%

	1950-1960	163	28,0%	420	72,0%
Smoke at the present time	Yes	75	44,1%	95	55,9%
	No	369	27,3%	982	72,7%
Ever smoked daily	Yes	303	32,7%	625	67,3%
	No	141	23,8%	452	76,2%
Frequency of doing vigorous activities	Hardly/Never	212	47,5%	234	52,5%
	One to three times a month	20	28,2%	51	71,8%
	Once a week	57	24,3%	178	75,7%
	More than once a week	155	20,2%	614	79,8%
Is household able to make ends meet	With great difficulty	13	48,1%	14	51,9%
	With some difficulty	60	43,8%	77	56,2%
	Fairly easily	143	34,6%	270	65,4%
	Easily	228	24,2%	716	75,8%

Figure 2: Cross table showing the division of cases between categories within the variables

The method that is used to answer the research questions is a two-step approach. At first, a three-way chi-square test would be the most suitable test to analyze the data. The reason for this is that the independent variable and the dependent variable consist of ordinal data. The relationship between the independent variables, "*cohort*", and "*gender*", are put into a three-way cross table, showing the chi-square statistic for these variables together with "*level of education*" on one side and the dependent binary variable "*self-perceived health*" on the other side. Secondly, after running this test, the binary regression is run to control for the effects other variables might have on the association of "*level of education*" and "*self-perceived health*".

A nominal regression would initially be an option because the outcome variable "*self-perceived health*" is a nominal variable. However, when recoding the variable into a dummy variable, the ability arises to run a binary logistic regression, which makes the data easier to analyze. The variable of self-perceived health was coded from one, which indicates excellent health, to five, which indicates poor health. To be able to run a binary regression the variable was recoded into a dummy variable indicating "bad health" and "good health", with 1-3 representing good health and 4-5 representing bad health. The dummy variable uses 0 to represent bad health and 1 to represent good health. Due to the limited number of cases, the level of education *"isced-97"* was also recoded, to increase the number of cases per category. At first, the variable consisted of six categories, but for level 4 "*post-secondary non-tertiary education*" only 15 respondents were present and for level 6 "*second stage of tertiary education*" only 5 respondents were present. The cases of level 4 and level 3 were merged creating a new category and the same thing was done for level 5 and level 6, as can be seen in figure 2. Moreover, cohorts needed to be created to be able to compare them. The variable "*year of birth*" was categorized, changing the variable from a continuous into an ordinal variable, consisting of 3 categories, with two ten-year categories and one twenty-year category. The analysis scheme in figure 3 shows all the steps that were described above.

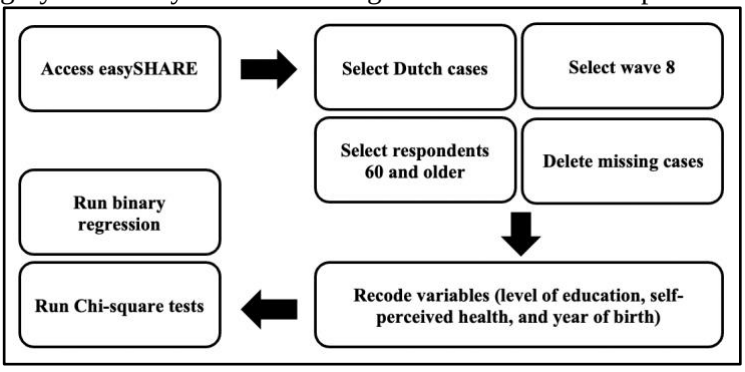

Figure 3: Data analysis scheme

Results

Chi Square tests

To test the hypotheses of the sub-questions, two different chi-square tests with an interaction effect were run. The aim of running these tests was to measure if a significant relationship exists between level of education and self-perceived health per gender and if a relationship exists between level of education and self-perceived health per cohort. The hypotheses for the tests were formulated as follows:

- H0= There is no relationship between childhood SES, measured through the level of education, and self-perceived health within the population for men.
- H0= There is no relationship between childhood SES, measured through the level of education, and self-perceived health within the population for women.
- H0= There is no relationship between childhood. SES, measured through the level of education, and self-perceived health within the population per birth cohort.

Chi-Square Test: Gender and level of education * Self-perceived health

Gender: female=1, male=0		Value	df	Significance
Male	Pearson Chi-Square	14,265[b]	3	,003
	N of Valid Cases	704		
Female	Pearson Chi-Square	6,661[c]	3	,084
	N of Valid Cases	817		
Total	Pearson Chi-Square	19,738[a]	3	<,001
	N of Valid Cases	1521		

*Figure 4: Chi-square test. Gender and education * self-perceived health*

Chi-Square Test: Cohort and education * Self-perceived health

Cohort		Value	df	Significance
1920-1940	Pearson Chi-Square	,507[b]	3	,917
	N of Valid Cases	288		
1940-1950	Pearson Chi-Square	12,634[c]	3	,005
	N of Valid Cases	650		
1950-1960	Pearson Chi-Square	12,636[d]	3	,005
	N of Valid Cases	583		
Total	Pearson Chi-Square	19,738[a]	3	,000
	N of Valid Cases	1521		

*Figure 5: Chi-square test. cohort and education * self-perceived health*

As can be seen in Figure 4 above, the chi-square test is significant for the male respondents, whereas the chi-square test for the female respondents is insignificant. The percentage of male respondents with only primary education that perceived their health as bad health was about twice as high compared to the male respondents that enjoyed tertiary education, namely 42,9% against 22,0%. The differences in the female data are smaller than those of the male data, with 35,9% of the female respondents who only enjoyed primary education perceiving their health as bad health against 23,8% of females who attended tertiary education perceiving their health as bad health. The significant result of the chi-square test for men indicates that there is a relationship between Men and their level of education and self-perceived health in the population. Thus, the hypothesis on men can be rejected. Although a relationship exists for the male respondents, the interpretation of the association is weak when running a Cramer's V test (see figure 8 in the appendix). The insignificance of the chi-square test on the female respondents results in the acceptance of the 0-hypothesis. it can be assumed that no relation exists between females and their education and self-perceived health.

The chi-square test in figure 5 indicates that for some of the birth cohorts, a relationship exists with self-perceived health. Among the respondents that were born before 1940, almost no differences exist in self-perceived health per level of education (see figure 9 in the appendix). However, for the second and third birth cohort, differences in self-perceived health based on education are visible. For example, for the respondents that were born between 1940 and 1950 almost half of the respondents that enjoyed primary education indicated their health as bad health, whereas for the respondents that completed

tertiary education a majority of 77,6% perceived their health as good health. It can be concluded that the null hypothesis can be accepted for the oldest birth cohort, whereas the null hypotheses for the last two birth cohorts can be rejected. For these cohorts, it can be assumed that in the population a relationship exists between on one hand the birth cohort and the education and on the other hand the self-perceived health. The Cramer's V test indicates that for the second as well as the third birth cohort a weak association can be found (see figure 10 in the appendix). The "total" boxes of both chi-square tests contain the same numbers and indicate that overall, without using cofounders, a relationship exists between education and self-perceived health. The third null hypothesis can be rejected because of the insignificant result the chi-square test has. Thus, in the population, a relationship between education and self-perceived health exists. However, the Cramer's test shows that the association between education and self-perceived health is weak.

Binary logistic regression

The binary regression was run to see the effect that confounding variables have on education and its relation to the outcome variable self-perceived health. More importantly, the binary regression can indicate whether the odds ratios of falling into the categories differ from the reference category. The objective of this regression was to see if the regression made it possible to make inferences on how much more likely somebody that finished tertiary education perceives their health as good health, compared to somebody that has only finished primary education.

Binary regression

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Level of education (Primary education or first stage of basic education)			3,539	3	,316			
Lower secondary education or second stage of basic education	-,007	,236	,001	1	,977	,993	,625	1,578
Secondary and post-secondary non-tertiary education	,177	,246	,517	1	,472	1,193	,737	1,933
First or second stage of tertiary education	,262	,247	1,125	1	,289	1,300	,801	2,110
Gender: female=1, male=0	,000	,124	,000	1	,999	1,000	,785	1,275
Cohort (1920-1940)			,248	2	,884			
1940-1950	,060	,163	,136	1	,712	1,062	,772	1,462
1950-1960	,000	,171	,000	1	,998	1,000	,715	1,398
Do not smoke at the present time Yes=1, No=0	,096	,047	4,197	1	,040	1,100	1,004	1,206
Have never smoked daily Yes=1, No=0	,075	,033	5,030	1	,025	1,077	1,009	1,150
Activities that are vigorous (Hardly/Never)			74,618	3	<,001			
One to three times a month	,767	,287	7,142	1	,008	2,153	1,227	3,777
Once a week	,927	,183	25,566	1	<,001	2,527	1,764	3,619
More than once a week	1,156	,137	71,115	1	<,001	3,177	2,429	4,156
Is household able to make ends meet (with great difficulty)			18,208	3	<,001			
With some difficulty	,270	,452	,357	1	,550	1,310	,540	3,177
Fairly easy	,479	,427	1,259	1	,262	1,615	,699	3,730
Easily	,901	,423	4,550	1	,033	2,463	1,076	5,637
Constant	-1,290	,509	6,425	1	,011	,275		

Variable(s) entered on step 1: is level of education, Gender: female=1, male=0, Cohort, Do not smoke at the present time, Have never smoked daily, Activities that are vigorous, Is household able to make ends meet.

Figure 6: Binary logistic regression with covariates

The null hypothesis for this test can be constructed as follows:

- H0= In the population, the odds ratio of perceiving health as good health, is the same for people that have different educational levels.

To be able to run the binary regression, multiple assumptions needed to be met. The data used is not paired and the outcome variable is a binary variable. Furthermore, a spearman correlation was run for all variables in the regression to check for possible correlations, which were not present. After running the regression, the omnibus tests showed the significance of the model, and the Hosmer and Lemeshow test supported the regression (see figures 11 and 12 in the appendix). The total variance explained by the model summary (see figure 13 in the appendix) is 0,090 for the Cox & Snell R square and 0,129 for the Nagelkerke R square. These numbers indicate the fit of the model. It can be concluded that the fit of the regression that is run, is low, explaining between an estimated 9% and 12,9% of the variance.

Figure 6 shows the use of the lowest value as the reference category, which can be seen on the left side of the model in cursive letters. The binary logistic regression indicates that there are no significant differences in the odds ratio between the reference category of education, primary education, and the other three educational categories in the respondent's perceiving health. As a result, the null hypothesis can be accepted. Although the chi-square tests showed a weak association between education and self-perceived health, the variables that are imported in the regression have cofounding effects on the significance of the level of education. It can be concluded that the odds ratios of the different categories are indifferent. The fit of the model improved with every variable that was added. Although no inferences for the population can be made of the effect of the level of education on self-perceived health, in the sample there seems to be a positive effect of having a higher level of education on perceiving health as good health. The log odds number, which can be seen as B in the regression, is positive for all categories and indicates the effect in the sample. Other variables in the model are significant, indicating differences in odds ratios between the reference category and other categories in self-perceived health. For example, smoking or having ever smoked daily results in a higher chance of perceiving health as bad health in the population. According to the Log odds, which is marked with Exp(B) in the regression, the chance for a non-smoker to perceive their health as good health is 10% higher than that of someone who smokes. The regression also shows that people who sport more than once a week, are over 3 times more likely to perceive their health as good health. Someone who easily manages to make ends meet also has a significantly higher chance of perceiving health as good health than somebody who makes ends meet with great difficulty.

Discussion

This study has researched the relation between childhood SES, measured through education, and health at an older age, measured through self-perceived health for Dutch data. The main question was formulated as follows: How does childhood socioeconomic status affect self-perceived health at older ages in the Netherlands? The analyzed data initially showed a weak association between education and self-perceived health. However, the addition of confounding covariates to the binary logistic regression produced insignificant results regarding the odds ratios for the level of education. This makes it hard to answer the main question. What can be concluded, based on the results, is that no differences in odds ratios were found for education, implicating that no differences in health exist based on education in the sample. Furthermore, with education being an indicator of childhood SES, no inferences can be made on the relation between childhood SES and health in the population. Thus, this research suggests that although a weak relation between the level of education and health exists, that level of education does not have significant effects on the chances of perceiving health as bad health. Similar results were found for the sub-questions: Do differences between gender exist? and Do cohort differences exist? Whereas figure 4 showed a significant relationship between men, education, and self-perceived health, it also showed an insignificant relation between women, education, and self-perceived health. However, in the regression, no significance in odds ratios was found based on gender, but in this test, the variable was used as a covariate. Thus, it can be concluded from the chi-square test, that in the population, of men a relation exists between education and self-perceived health. It can be concluded that a difference in gender exists, as the chi-square tests show a relation for men whereas, for women, no relationship exists. The chi-square tests in figure 5 showed the significance of the two youngest cohorts. Whereas for these two cohorts, a relation was found between education and self-perceived health, no relation between education and self-perceived health was found for the oldest cohort. Thus, differences were found based on cohort, although the question arises whether the effect of education for the oldest birth cohort was measured correctly because the cohort contains respondents older than 80 years. It could be that because of this age, no relation was found between education and self-perceived health.

The results of this study are not in line with the expectations created in the theoretical framework. The framework suggests that childhood is a critical period for health and an accumulated risk of exposure would lead to differences in health outcomes based on educational levels. International studies as well as studies on the Dutch population have shown the relation between childhood SES and health at an older age with a health inequalities gap that exists measured through education. In the Netherlands, people with lower educational levels are expected to live fewer years in good health than highly educated people (Rubio Valverde et al., 2022). The data used for this research indicates that contrary to the level of education, significant differences in odds ratios exist for some of the behavioral covariates. The possible gender differences discussed in the framework were found by running the Chi-square test (see figure 4). As the study of Groot and Maassen van den Brink (2007) showed that for men, the effect of education on health increased when growing older. On the contrary, the same study indicated that for women, the effect of education on health decreased with age. Therefore, it might be that the results differ for men and women, with a significant relationship found for men and no significant relation found for women. This might be explained by some of the findings of Mazzonna (2014). He showed that for women, the lower labor force participation could have decreased the impact education has on health at an older age. Based on the framework, it was expected that possibly, differences between education and health exist for cohorts. The results of the chi-square test (see figure 5) were in line with the age-as-leveler hypothesis as described by Lynch (2003), although it was not possible to test the cumulative advantage hypothesis.

Multiple data-related reasons exist for the 0-hypotheses of the tests, that have been accepted. Thus, some causes can be found that may help to explain why the results are not in line with the expectations created in the framework. The first possible explanation is the number of cases that were used for the research. The data that was used for this research contained a sufficient number of 1521 cases, but some of the cells in the tests did not contain a large number of cases as can be seen in figure 2. This makes the data less reliable than it would have been with more cases in some of the cells. For example, the reference category in the level of education contains the smallest number of cases of all levels (see figure 2).

Similar remarks can be made for the chi-square tests on gender and cohorts (see figures 7 and 9 in the appendix). The number of respondents with primary education is sufficient to run these tests, but what can be stated is that the reliability of the test does not benefit from such a small number. The second thing that could be the cause for insignificant results is the outcome variable, self-perceived health. In the methods, it is stated that self-perceived health is usable as an outcome variable because research has proven the relation it has with mortality. However, a paper written by Bago d'Uva et al. (2008) has provided evidence, which suggests that self-rated health is not a reliable variable to measure health inequalities. The authors used the SHARE dataset to research to which extent self-reported health biases the measurements of health inequalities. According to Bago d'Uva et al. (2008), higher-educated people are more likely to rate their health status as negative compared to lower-educated people. Of all the countries that were analyzed, the Netherlands was one of three countries that showed the greatest impact when correcting the data. By correcting the data, the health inequalities increased, indicating that Dutch respondents were not performing well in rating their own health. For this research, it implies that the use of the variable self-perceived health can explain the insignificant outcomes which were not expected when following the literature in the framework. It can be concluded that the results might have been influenced by the subjectivity of the variable self-perceived health, which consequently makes the results unreliable.

There are some limitations and flaws that must be discussed. Firstly, this research uses education as an indicator of childhood SES. Although in the literature a relationship exists between Childhood SES and education, it is not the best option to use this as the variable explaining childhood SES. It would have been better to use variables concerning parents' income or parents' educational level or parents' job as these are better indicators for childhood SES (Galobardes et al., 2006). However, the dataset does not contain this information. Secondly, information on income could not be used to control for adult inequalities, because the data on income consisted of household information and not personal information. Consequently, the personal information often contained income for the other persons in the household, making the variable unusable.

As mentioned in the introduction, this paper has been written to strengthen the literature on the relationship between childhood socioeconomic status and health at an older age. Expected was, that based on the level of education, differences in self-perceived health at an older age would have appeared in the data analysis. However, the results did not match the expectations. Possible flaws make it hard to draw conclusions. Nevertheless, based on the literature, it can be assumed that childhood SES does influence health at an older age. The existing health gap can partially be explained by childhood SES. If the health effects of education are large, then policy on education might be a tool reduce the health inequalities that exist. Further research could focus on what kind of policy could be installed that would decrease the existing health gap. Furthermore, research could be done to analyze the effect of some policies that have already been installed to decrease health inequalities.

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Appendix

Gender and level of education * Self-perceived health				How do you perceive your own health?			
				Bad health		Good health	
				Count	Row N %	Count	Row N %
Gender	Male	Level of education	Primary education	18	42,9%	24	57,1%
			Lower secondary education	66	35,3%	121	64,7%
			Secondary and post-secondary education	55	27,8%	143	72,2%
			Tertiary education	61	22,0%	216	78,0%
			Total	200	28,4%	504	71,6%
	Female	Level of Education	Primary education	23	35,9%	41	64,1%
			Lower secondary education	103	32,9%	210	67,1%
			Secondary and post-secondary education	61	30,3%	140	69,7%
			Tertiary education	57	23,8%	182	76,2%
			Total	244	29,9%	573	70,1%

*Figure 7: Cross table, Gender, and level of education * Self-perceived health.*

Phi and Cramer's V test Gender				
Gender: female=1, male=0			Value	Approximate Significance
Male	Nominal by Nominal	Phi	,142	,003
		Cramer's V	,142	,003
	N of Valid Cases		704	
Female	Nominal by Nominal	Phi	,090	,084
		Cramer's V	,090	,084
	N of Valid Cases		817	
Total	Nominal by Nominal	Phi	,114	,000
		Cramer's V	,114	,000
	N of Valid Cases		1521	

Figure 8: Cramer's V test on Gender.

Birth cohort and level of education * Self-perceived health				How do you perceive your own health?			
				Bad health		Good health	
				Count	Row N %	Count	Row N %
Cohort	1920-1940	Level of education	Primary education	15	33,3%	30	66,7%
			Lower secondary education	43	36,8%	74	63,2%
			Secondary and post-secondary education	21	32,8%	43	67,2%
			Tertiary education	20	32,3%	42	67,7%
	1940-1950	Level of education	Primary education	20	48,8%	21	51,2%
			Lower secondary education	67	29,9%	157	70,1%
			Secondary and post-secondary education	45	27,8%	117	72,2%
			Tertiary education	50	22,4%	173	77,6%
	1950-1960	Level of education	Primary education	6	30,0%	14	70,0%
			Lower secondary education	59	37,1%	100	62,9%
			Secondary and post-secondary education	50	28,9%	123	71,1%
			Tertiary education	48	20,8%	183	79,2%

*Figure 9: Cross table, birth cohort and level of education * self-perceived health.*

Phi and Cramer's V test birth cohort				
Birth cohort			Value	Approximate Significance
1920-1940	Nominal by Nominal	Phi	,042	,917
		Cramer's V	,042	,917
	N of Valid Cases		288	
1940-1950	Nominal by Nominal	Phi	,139	,005
		Cramer's V	,139	,005
	N of Valid Cases		650	
1950-1960	Nominal by Nominal	Phi	,147	,005
		Cramer's V	,147	,005
	N of Valid Cases		583	
Total	Nominal by Nominal	Phi	,114	,000
		Cramer's V	,114	,000
	N of Valid Cases		1521	

Figure 10: Cramer's V test on birth cohort.

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	144,184	14	<,001
	Block	144,184	14	<,001
	Model	144,184	14	<,001

Figure 11: Omnibus test of binary logistic regression.

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	4,771	8	,782

Figure 12: Hosmer and Lemeshow test of the binary logistic regression.

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1692,745[a]	,090	,129

Figure 13: Model summary of the binary logistic regression