The impact of Socio-economic Status on Self-assessed Health in Switzerland

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Summary

Health inequalities within populations is a current problem practically all governments are dealing with. Over time, the living environment has improved, as well as many developments in the medical field are made. Yet inequalities between different socio-economic classes persist (Marmot, 2005). Socioeconomic status (SES) is an important concept which should be taken into account in policy making aimed at tackling health inequalities. This is because SES is not merely an influencer of subsequent health-risk behaviours, but a direct predictor of health (Link & Phelan, 1995; Brunner, 2017). In the case of Switzerland, research on the direct relation between SES and health has only partly been conducted. The aim of this thesis is therefore study this relationship with the following research question:

''What is the influence of socioeconomic status on the development of self-assessed health status in Switzerland?''

In order to question this relation, data from the Swiss Household Panel was utilized. The sample consisted of 9479 cases, with which two ordinal regressions have been conducted. In the first model, the relation between self-assessed health status and the SES variables income and education was analysed. For the second model, the health behaviour variables physical activity and smoking were added, in order to monitor the mediating nature of these variables on relation between the self-assessed health and SES.

It was concluded that SES significantly influences self-assessed health status. Respondents with low education or low income had a lower probability to have a higher self-assessed health status than middle education and income, and vice versa for the respondents with a high education or income. Furthermore, the addition of health behaviour variables did not result in considerable changes in the relation between SES and self-assessed health status.

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1 - Introduction

1.1 Background & Research problem

Inequalities in (public) health within and among populations is a pressing issue throughout the world (Marmot, 2005). Despite the countless attempts of implementing policies by governments and organisations, clear differences remain. Link and Phelan introduced their *fundamental cause theory* in 1995, in which they advocate that social economic factors are key variables to be taken into account when observing and addressing inequalities in health as well as implementing policies to tackle these issues. This is because the social economic context is key in predicting health risk factors, and has been doing so through changes of other relevant mechanisms.

Socioeconomic status has now for many years proven to be a crucial factor in predicting health and health behaviour related developments (Winters-Miner et al., 2015; Pekkanen et al., 1995). Mackenbach et al. (2008) analysed data from 22 European countries, and found that poorer self-assessments of health status is substantially higher in lower SES-classes. Lower educational level would especially be a significant influencing factor in this relationship, which coincides with the findings of Hu et al. (2016) in a European context and with Bopp & Minder (2003), who focussed their research on Switzerland. Similarly to virtually all other industrialized countries, Switzerland has experienced persistent inequalities in SES. Galobardes et al. (2003) analysed longitudinal Swiss data in order to inquire trends in risk factors among different SES-groups, and found that lifestyle related diseases are more prominent with lower SES groups, and that these differences remained stable over time. They predicted that this would be the case over the next decades, indirectly assuming a likewise trend in the case of self-assessed health.

Since the research of Bopp & Minder (2003) and Galobardes et al. (2003), the relation between different SES-groups and health in the Swiss context has not been investigated broadly. Therefore this relationship is an interesting topic to discover both its importance for future Swiss policies aimed to tackle public health inequalities, as well as to test the predicted trend of Galobardes et al. (2003) that a lower SES would continue to be related to a lower self-assessed health. In other words, the aim of this research is to discover how SES relates to health and health behaviour in Switzerland of a more recent date, resulting in the following research question:

''What is the influence of socioeconomic status on the development of self-assessed health status in Switzerland?''

This will be answered through the following sub-questions:
I - In what way do the different socioeconomic aspects relate and interact with an individual's self-assessed health status?
II - and how do health behavioural characteristics in turn mediate in this relation?

1.2 Thesis structure

The thesis is structured as follows: first the relevant concepts will be discussed in the theoretical framework. This will function as the basis for the content of the thesis, including a conceptual model to visualize the relation of the concepts, aimed at answering the research questions. The methodology section introduces and describes the data, the chosen variables and the statistical analysis that will be conducted. Afterwards the results of these statistical tests will be elaborated upon, through the discussion of the output and the relation with the literature. Last, conclusions will be drawn based on the findings, including implications of the thesis and suggestions for future research.

2 - Theoretical framework

In order to design and build upon the conceptual model that will function as the foundation of the theoretical and statistical analysis of this thesis, further elaboration on some key concepts and how these will be defined and relate to one another is needed.

2.1 Socioeconomic status

Socioeconomic status has been widely used and applied in many different contexts, often used to describe economic and sociological differences in a society. As the concept implies, it describes the sociological and economic positon of an individual related to others, regularly measured through educational, occupation and income related metrics (Winters-Miner et al., 2015). Based on- and through assessment of these metrics, people are generally divided into different groups, which are based on either low-medium-high scores in SES, or the 'least advantaged' to 'most advantaged' SES classification (Galobardes et al., 2006 in Winters-Miner et al., 2015). SES is complex measure, though research indicates that SES has proven to be a strong determent of health. SES seems to have a noteworthy impact on multiple diseases, such as cardiovascular and respiratory diseases, as well as mental health disorders (Brunner, 2017 & Falconnier, 2019).

Link and Phelan (1995) made a significant contribution to the notion that SES factors are not merely influencing a series of risk behaviours that are known to effect health, but that SES is a fundamental concept in affecting and predicting health inequalities. A large-scale research was conducted by Mackenbach et al. (2008), and found that inequalities in poor self-assessed health based on different SES backgrounds were present throughout the whole of Europe. The general observed trend is that, on average, the more advantaged individuals are, the healthier they are. More specifically, less-than-good self-assessed health is more prevalent among lower education (Hu et al., 2016). Though it is worth noting that SES is important to health for *all* levels of SES, not only influencing the disadvantaged (Adler & Ostrove, 2006), and relative to every epidemiological context (Phelan et al. 2010). SES inequalities have persisted through time, regardless all the attempts to counteract this phenomenon (Phelan et al. 2010 & Dean 2017).

2.2 Health behaviour

Health behaviour in literature is frequently expressed through habits of smoking, alcohol consumption, physical activity and diet (e.g. fruit intake/ obesity), which are in turn also risk factors of one's health (Due et al. 2011, Stringhini et al. 2010, Brunner, 2017). Health behaviour is directly and indirectly shaped and influenced through different contexts and processes. Health behaviour is rooted in family, social and community contexts (Hauensteln et al., 2019), as well as the environment (Adler & Ostrove, 2006). For example, low income neighbourhoods generally have more liquor stores and less access to nutritious food (Makenbach et al., 1993. in Adler & Ostrove 2006), which can in relation to individuals vulnerability characteristics negatively influencing health behaviours, emphasising the role of environment and SES.

Due et al. (2011) also found that health inequalities in adulthood are partly related to socially patterned health behaviour and relational dimensions. Socially patterned *health behaviour* in the development from adolescence to adulthood is rooted in the upbringing of children. This indicates that children in less advantaged socioeconomic backgrounds are at higher risk of developing adverse behavioural patterns, as well as mental and physical health issues in later stages of life (Due et al. 2011).

Stringhini et al. (2010) found through their research that health behaviour is an important influencer of the relation between SES and mortality. They concluded that, when accounted for the health behaviours smoking, alcohol consumption, diet and physical activity, people from a lower SES position had a 1.60 times higher risk of death from all causes as opposed to those from a high SES background. Although their conclusions were drawn based on mortality, these findings are very much related to health as well. Mackenbach et al. (2008), based on their research, claimed that obesity, which has strong links to diet, is not a very strong predictor in inequalities in health and mortality among different SES groups. This partly contradicts Stringhini et al.'s findings. Mackenbach et al. (2008) simultaneously support the aforementioned relation of Stringini et al., as they concluded that smoking is a major predictor of inequalities among SES groups.

2.3 Conceptual model

Based on the theoretical framework and the central research questions, the following conceptual model has been designed.

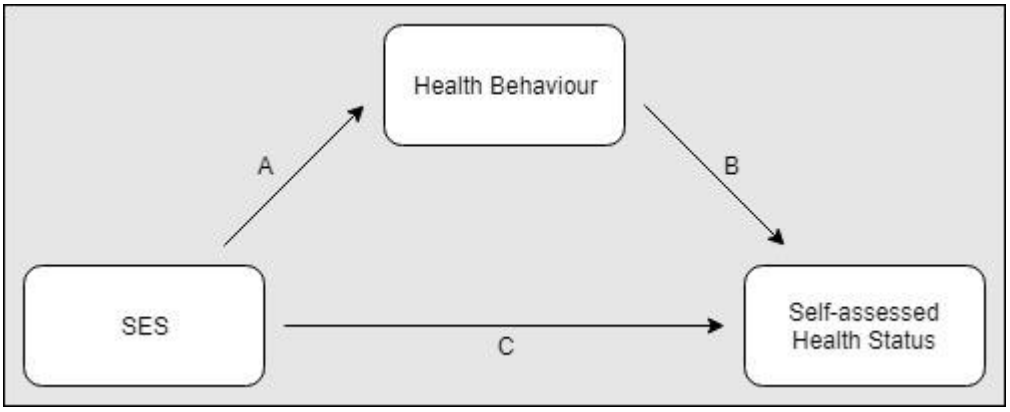

Figure 1 - Conceptual model

As depicted in the model, the main relation that is investigated is how *SES* factors influence *Self-assessed Health status* (path C in figure 1). The SES variables that are taken in consideration are *education* and *income.* There is also an expected mediating influence of *Health behaviour* factors on this relationship (through path A and B). The health behaviour variables that will be assessed are *smoking* and *physical activity.*

2.4 Hypothesis

Based on the Theoretical framework and the conceptual modal the following hypothesis is formulated: *I hypothesise that (I) 'low education' will significantly differ from 'medium education' in influencing the dependent variable self-assessed health status, and (II) that both non-smoking and heavy smoking will significantly differ from light smoking in predicting self-assessment of health.*

3 - Methodology

3.1 Overview Dataset

The research method used in this paper will be exclusively based on quantitative secondary data. Because of the nature of the research question, in combination with the time frame and the available resources, the usage of quantitative secondary is most sufficient to significantly support or predict any relations between the researched variables.

The dataset that will be used to investigate the research questions is the Swiss Household Panel (SHP). The SHP has collected longitudinal household and individual data in Switzerland to observe how (social) factors change over time (Voorpostel et al., 2018). SHP entails annually collected data, ranging back from 1999, and is still adding data yearly. The dataset consists of 3 samples, SHP_I (7.799 individuals, first interviewed in 1999), SHP_II (3.654 individuals, first interviewed in 2004) and SHP_III (6.090 individuals, first interviewed in 2013). Households were selected through stratified random sampling in each of the seven major regions (NUTS II) in Switzerland. In all the seven regions, each household or individual had the same chance to be included in the SHP panel (Voorpostel et al., 2018). The dataset is suitable for the analysis as the SHP consists of micro data, which includes information of individuals on a large range of variables. The SHP interviews the same individuals every year, asking (mostly) the same questions. The main method of data collections has been computer-assisted telephone interviewing (CATI). Since 2010, respondents who are unenthusiastic or unwilling to participate were given the option to complete the questionnaires face-to-face. The SHP data is collected in annual 'waves'. In this research wave 17 will be analysed, meaning data collected from September 2015 till February 2016 will be used, as this wave has the most complete data related the subject of interest compared to other recent waves.

3.2 Variables

Table 1 shows the variables from the SHP database that will be used in the statistical analysis. The independent variables *Highest level of education achieved* and *Yearly Household Income* are categorised in 3 categories: namely low, medium and high. For the variable *Physical activity* the same categories are used, with the addition of the category *no physical activity.* The variable *Smoking* is divided into the categories non-, light and heavy smoker. These distinctions are made to effectively compare the variables at play, and to measure their interaction with the dependent variable *self-assessed health status.*

Self-assessed Health status	Self-assessment of health status - ordinal	
SES-indicators	Education [categorised low/medium/high education] - ordinal	Yearly Household income: [categorised low/medium/high income] - ordinal
Mediating health behaviours	Physical activity: [categorised no/low/medium/high physical activity] - ordinal	Smoking: [categorised non-/light/heavy smoker] - ordinal

Table 1 - Concepts and related variables

The low-medium-high categorisation of the variable *education* is based on the highest level of education achieved by the respondents. Based on the distinction made by Faeh et al. (2011), the three categories are: (*I)* compulsory schooling (International Standard Classification of Education '97 (ISCED) 1 & 2), (*II)* high school / vocational training (ISCED 3 & 4) and (*III)* university / upper vocational training (ISCED 5&6). The categorisation based on ISCED makes that comparisons with other literature and countries are more easily made, since the Swiss education system is quite different from other countries.

The distinction between the three income categories: low, medium and high, in the variable *Yearly household income nett* is made based on the distinction of the middle class made by Nguyen and Romy (2017). Translating this distinction to the data, results in the following three categories: (*I*) a *low yearly household income* of < 70.000 CHF, (*II*) a *medium yearly household income* between 70.000 and 165.000 CHF and a *high yearly household income* of > 165.000 CHF. Note that these distinctions are merely a subdivision of the '*poor**er**'*/'*rich**er**'* and the 'average/middle class', and for example it does not necessarily entail that an individual with a low yearly household income is *'poor'.*

The variable *Physical Activity is* constructed through the average number of days per week the respondent performs physical activities. Based on the paper of Musich et al. (2017) the following 'no-low-medium-high' categorisation is applied to the dataset: (*I) no activity,* 0 days per week, (*II) low activity*, 1 to 2 days per week, (*III)medium activity,* 3 to 4 days per week, (*IV) high activity,* 5 or more days per week.

The subdivisions 'non-light-heavy' of smoking are based on the number of cigarettes that are smoked daily, following the guidelines provided by Boulos et al. (2009). Individuals that do not smoke are marked as (*I) non-smoker,* people who smoke up to 11 cigarettes a day are marked as a (*II) light smoker,* the last category being *heavy smoker (III),* consisting of individuals who smoke more than 11 cigarettes a day. The boundary between light and heavy smoker is set to 10 cigarettes a day. This is because heavy smokers, who are asked to reduce their smoking on a day, usually have little problems reducing to around 15 cigarettes a day. They however struggle to reduce the cigarettes below 10, as they experience much more discomfort on/below this threshold (Boulos et al., 2009).

Finally, the variable *Self-assessment of health status* consists of the following categories: *not very well/not well at all, so so (average), well* and *very well*. This variable did not need any reconfigurations, as the original variable and its values from the dataset were conform to the desired specifications. The categories *not very well* and *not well at all* were merged after consideration, because of the remarkably low number of respondents of the category not well at all (.1%, 11 out of 9479 cases).

3.3 Statistical tests

In order to answer the research questions, two ordinal regressions will be executed. Model 1 serves to give insight into the first sub-question, model 2 into the second. The variable *Self-assessment of health status* will serve as the dependant variable in both models. The variables *Education* and *Yearly Household income* will function as the independent variables in model 1, whereas the variables *Physical activity* and *Smoking* will be added in model 2, serving as the mediating independent variables. In both the models a variety descriptive control variables

are included, namely *Sex, Age,* (interview) *Language, Region of residence* and *Partnership status.*

For the variable *language* the language of the interview was used. This is because the alternative variable *first language: personal use* had large amount of languages included (14), which wouldn't influence the ordinal regression for the better. Instead the *language of interview* [Italian, German and French] proved suitable to the analysis, as it has fewer categories and consists of the three main languages spoken in Switzerland.

The variable *region of residence* consists of the following categories *[with their respective included Cantons]*: Lake Geneva *[Vaud, Valais, Geneva]*, Middleland *[Berne, Fribourg, Solothurn, Neuchatel, Jura]*, North-west Switzerland *[Basle-Town, Basle-Country, Argovia]*, Zurich *[Zurich]*, East Switzerland *[Glarus, Schaffhausen, Appenzell Inner-Rhodes, Appenzell Outer-Rhodes, St. Gall, Grisons, Thurgovia, Ticiono]* and Central Switzerland *[Lucerne, Uri, Schwyz, Obwalden, Nidwalden, Zug]*.

There are essentially four steps in measuring mediation (Baron & Kenny, 1986, Judd & Kenny, 1981 and James & Brett, 1984, in Kenny, 2018), namely:

Step 1	Show correlation between the causal variable (SES) and the outcome (Self-assessed health status). (Path C in the conceptual model, see figure 1)
Step 2	Show correlation between the causal variable (SES) and the mediating variable (Health behaviour). (Path A in the conceptual model)
Step 3	Show correlation between the mediating variable (Health behaviour) and the outcome (Self-assessed health status). (Path B in the conceptual model)
Step 4	Establish whether the mediating variables (SES) completely or partially mediates the causal-outcome (SES - Self-assessed health status) relationship

Table 2 - Four steps of mediation

The first three steps confirm whether mediation occurs. The fourth step tests whether the addition of the mediating variable solely or partially predicts the outcome.

Additionally, the ordinal regression models have been tested on multicollinearity and proportionality of the effects across levels of the response variable. The outcomes of the models are only valid when there is no multicollinearity, meaning that the independent variables cannot be highly correlated with each other. Also, proportional odds have to be tested in order to ensure that each independent variable has an identical effect at every cumulative split of the ordinal dependent variables (Lærd statistics, 2018).

3.4 Reflection on SHP data

To ensure the quality of the data, extensive monitoring, evaluation and training of the supervisors and interviewers takes place. Table 3 shows the response rate of individuals in the three different samples for every wave. The initial response rate in the first wave were 85% for SHP_I, 76% for SHP_II and 81% for SHP_III, of which the response rate dropped to about half of the initial (base year) conducted interviews in 2017; 54%, 50% and 56% respectively, see table 3 (Voorpostel et al., 2018).

Table 3 - Response rate of individuals per wave, SHP_I- SHP_II- SHP_III

Number of *persons* interviewed in SHP_I, SHP_II and SHP_III (1999-2017)

Year	Wave	SHP_I n =	%* A	%** B	SHP_II n =	%* A	%** B	SHP_III n =	%* A	%** B	SHP_I+II + III n =
1999	1	7,799	100	100							7,799
2000	2	7,073	91	91							7,073
2001	3	6,601	85	93							6,601
2002	4	5,700	73	86							5,700
2003	5	5,220	67	92							5,220
2004	6/1	4,413	57	85	3,652	100	100				8,065
2005	7/2	3,888	50	88	2,647	72	72				6,535
2006	8/3	4'091	52	105	2,566	70	97				6,657
2007	9/4	4,630	59	113	2,349	64	92				6,979
2008	10/5	4,494	58	97	2,409	66	103				6,903
2009	11/6	4,800	62	107	2,307	63	96				7,107
2010	12/7	5,057	65	105	2,487	68	108				7,544
2011	13/8	5,103	65	101	2,479	68	100				7,582
2012	14/9	5,032	65	99	2,411	66	97				7,443
2013	15/10/1	4,880	63	97	2,324	64	96	6,088	100	100	13,292
2014	16/11/2	4,678	60	96	2,147	59	92	5,262	86	86	12,087
2015	17/12/3	4,596	59	98	2,072	57	97	4,498	74	85	11,166
2016	18/13/4	4,311	55	94	1,909	52	92	3,809	63	85	10,029
2017	19/14/5	4,232	54	98	1,836	50	96	3,411	56	90	9,479

*These percentages are calculated on the basis of the number of interviews conducted in the first year (1999, 2004 or 2013).
**These percentages are calculated on the basis of the number of interviews conducted in the previous year. They may therefore exceed 100%.

Source: Voorpostel et al., 2018.

Because of attrition of the sample, weighting is generally applied in order to make accurate statements about the population in general. In the case of research methods that cover a single wave, cross-sectional weighting is required (Voorpostel et al., 2018). After consideration a weighting variable was excluded from the analysis, as weighting in regression analysis has its limitations, as its application and implications can be unclear (Gelman, 2007). Furthermore, the variety of control variables sufficiently account for the present attrition.

Also, as only private households are included in the Swiss Household Panel, generalisations and conclusions regarding the whole Swiss population based on the sample and regression analysis must be made with caution.

4 - Results

4.1 Descriptives

Tables 4 through 9 show the descriptive statistics of the dependent and independent variables *health status, education, yearly household income nett, physical activity and smoking* that take part in the statistical analysis. The descriptives and regressions are based on 9479 of the 13950 original cases. The reason for this is that three of the five main variables only included information from individual questionnaires (as opposed to proxy questionnaires and grid only). This subsequently resulted in the exclusion of children age 1 to 13, as they conducted their interviews through their parents/caregivers.

Model 1 has 677 missing cases (table 18, appendix), model 2 has 740 (table 19, appendix). The variable *yearly household income* is the main contributor to these missing cases, as 677 cases in this variable are missing (table 6). An alternative regression has been executed in which these missing cases were included as an independent category to test whether they show similarities or dissimilarities with one of the other yearly household income categories, which showed no distinct relationship.

Tables 13 through 17 (see appendix) show the descriptive statistics of the control variables *age, interview language, partnership status, sex* and *region of residence.* The average age of the sample is 50 years, with a range of 14 to 97 years. Of the respondents, 5.2% conducted the interview in Italian, 67.8 % in German and 27% in French. A large part of the sample is currently in a relationship, namely 74%. The sample consists of 4349 male participants (45.9%) and 5130 female participants (54.1%).

Table 4 - Health Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not very well / not well at all	187	2.0	2.0	2.0
	So so (average)	1212	12.8	12.8	14.8
	Well	6179	65.2	65.2	80.0
	Very well	1896	20.0	20.0	100.0
	Sum	9474	99.9	100.0	
Missing	Total	5	.1	.	.
Total	.	9479	100.0	.	.

Table 5 - Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low Education	1139	12.0	12.0	12.0
	Middle Education	4797	50.6	50.6	62.6
	High Education	3543	37.4	37.4	100.0
Total		9479	100.0	100.0	

Table 6 - Yearly household income Nett

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low income, < 70000	1992	21.0	22.6	22.6
	Medium Income, 70000 - 165000	5052	53.3	57.3	79.9
	high income, > 165000	1768	18.7	20.1	100.0
	sum	8812	93.0	100.0	
Missing	.	667	7.0	.	.
Total	.	9479	100.0	.	.

Table 7 - Physical Activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No physical activity	1699	17.9	18.1	18.1
	Low physical activity	2982	31.5	31.7	49.8
	Medium physical activity	2616	27.6	27.8	77.6
	High physical activity	2108	22.2	22.4	100.0
	Sum	9405	99.2	100.0	.
Missing	.	74	.8	.	.
Total	.	9479	100.0	.	.

Table 8 - Smoking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	non-smoker	7797	82.3	82.3	82.3
	light-smoker	1055	11.1	11.1	93.4
	heavy-smoker	625	6.6	6.6	100.0
	Sum	9477	100.0	100.0	.
Missing	.	2	.0	.	.
Total	.	9479	100.0	.	.

4.2 Model 1 - Relation between SES and health

The first model is executed in order to explore the relation between health status and the SES-variables education and household income. Model 1 as a whole is significant, as shown in table 9. For both model 1 and 2, the reference categories of the independent variables for the ordinal regression are the middle ones, namely *medium education*, *medium income*, *medium physical activity* and *light smoker* respectively (table 10 & 12). The comparison category of the dependent variable health status in both models is *very well*.

Table 9 - Model 1 - Fitting Information

	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	13267.459			
Final	12747.864	519.595	14	.000

Table 10 shows the parameter estimates of model 1. Both the *low* (sig .000) and *high* (sig .004) income categories show significant outcomes. The category *low* has a lower probability to have a higher *health status* value than the category *medium income*, and the *high* income category has a higher probability to have a higher *health status* value than the category *medium income* (table 10). The negative effect of a lower income is substantially larger compared to the positive effect of a higher income (Wald 40,488 to 8,382 score).

When looking at the variable education, both a *low education* and a *high education* significantly differ from a *medium education*. A *low education* appears to decrease the odds to be in a higher health status category in comparison to a *middle education*, and a *high education* vice versa. As shown in table 10, the effect of both categories is comparable (Wald score of 10,178 and 8,628 respectively). These findings confirm the first hypothesis that *low education* significantly differ from *medium education*; a lower education seemingly has a lower change to be part of a higher self-assessed health status category as opposed to a medium education. This is in line with what Hu et al. (2016) found in an European context.

As for the test sample, male respondents and respondents that conducted the interview in Italian had a significant higher probability to rate their own health status higher than females and respondents that conducted their interview in French (table 10). Also, in comparing respondents from Central Switzerland with the other regions, Eastern Switzerland was the only region who showed a significant difference (sig .022). Respondents from Eastern Switzerland appear to have a higher probability to rate their health higher than respondents from Central Switzerland.

Table 10 - Model 1 - Parameter Estimates

							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold								
Health Status	Not very well / not well at all	-4.865	.154	998.913	1	.000	-5.167	-4.563
	So so (average)	-2.680	.136	388.850	1	.000	-2.947	-2.414
	Well	.653	.132	24.589	1	.000	.395	.911
Location								
Age		-.020	.001	238.824	1	.000**	-.023	-.018
Education	Low education	-.242	.076	10.178	1	.001**	-.390	-.093
	High education	.145	.049	8.628	1	.003**	.048	.242
	Medium education	0a	.	.	0	.	.	.
Yearly household Income Nett	Low income - < 70.000	-.387	.061	40.488	1	.000**	-.506	-.268
	High income - > 165.000	.168	.058	8.382	1	.004**	.054	.282
	Medium income - 70.000 to 165.000	0a	.	.	0	.	.	.
Sex	Male	.173	.045	14.808	1	.000**	.085	.262
	Female	0a	.	.	0	.	.	.
Partnership	Yes	.058	.056	1.070	1	.301	-.052	.167
	No	0a	.	.	0	.	.	.
Region	Lake Geneva	.107	.116	.850	1	.357	-.120	.334
	Middleland	.014	.087	.027	1	.869	-.157	.186
	North-west Switzerland	-.076	.092	.690	1	.406	-.256	.104
	Zurich	-.118	.089	1.757	1	.185	-.293	.057
	East Switzerland	.210	.092	5.209	1	.022*	.030	.391
	Central Switzerland	0a	.	.	0	.	.	.
Interview Language	Italian	-.474	.136	12.142	1	.000**	-.741	-.208
	German	.136	.081	2.784	1	.095	-.024	.295
	French	0a	.	.	0	.	.	.

a This parameter is set to zero because it is redundant.
* significance at 95% interval, ** significance at 99% interval

4.3 Model 2 - Mediating health behaviours

In the second model, the two health behaviour variables *physical activity* and *smoking* have been added in order to examine the mediating effect of these variables on the relationship between SES and self-assessed health status (the first model). The second model as a whole is significant, with a significance value of .000 (table 11).

Table 11 - Model 2 - Fitting Information

	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	12155.125			
Final	11779.354	375.771	18	.000

In table 12, the parameter estimates of the second model are shown. All categories of the independent SES- and health behaviour variables are significant. The results show that a *high* education increases the probability to be in a higher health status category compared to *medium* education. A *low* education has lower odds to have a higher health status value compared to *medium* education. Both the variables yearly household income and smoking show similar outcomes. The categories *low income* and *non-smoker* appear to have a smaller probability to have a higher self-assessed health status than their compared counterparts, *medium income* and *light smoker* respectively. This relationship is the other way around when comparing the categories *high income* and *heavy smoker* with *medium income* and *light smoker*. These results confirm the second hypothesis that both a non-smoking habit and a heavy smoking habit significantly differ from light smoking in predicting self-assessment of health (sig .026 and .022, table 12).

The categories of the variable physical activity all show significant results (table 12). Respondents with a *high physical activity* are more likely to have an higher self-assessed health status compared to respondents who practice *medium physical activity.* As for the categories *no physical activity* and *low physical activity* this relationship is the other way around. This relation is especially strong for the category *no physical activity*, which has the strongest estimate (-.677) and the highest Wald score (92.399) of the independent SES- and health behaviour variables. These results are in line with the notion that physical activity influences health (Stringhini et al., 2010 & Due et al., 2011). Though it is important to note that in assessment of the results of physical activity, especially with regard to the category *no physical activity,* the presence or possibility of reverse causation cannot be falsified (Wade et al., 2018). A low physical activity will generally result in a lower health status, although a (very) low health status could simultaneously decrease the amount of physical activity, or terminate the possibility to practice physical activities altogether.

Table 12 - Model 2 - Parameter Estimates

							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold								
	Not very well / not well at all	-5.010	.170	871.014	1	.000	-5.343	-4.677
	So so (average)	-2.817	.153	337.547	1	.000	-3.118	-2.517
	Well	.575	.149	14.867	1	.000	.283	.867
Location								
Age	Age	-.021	.001	235.670	1	.000**	-.023	-.018
Education	Low education	-.257	.077	11.275	1	.001**	-.407	-.107
	High education	.103	.050	4.228	1	.040*	.005	.200
	Medium education	0a	.	.	0	.	.	.
Yearly household Income Nett	Low income - < 70.000	-.352	.061	32.839	1	.000**	-.472	-.232
	High income - > 165.000	.136	.059	5.374	1	.020*	.021	.251
	Medium income- 70.000 to 165.000	0a	.	.	0	.	.	.
Physical activity	No physical activity	-.677	.070	92.399	1	.000**	-.815	-.539
	Low physical activity	-.150	.058	6.729	1	.009**	-.263	-.037
	High physical activity	.131	.063	4.264	1	.039*	.007	.255
	Medium physical activity	0a	.	.	0	.	.	.
Smoking	Non-smoker	.161	.072	4.958	1	.026*	.019	.302
	Heavy smoker	-.251	.109	5.282	1	.022*	-.466	-.037
	Light smoker	0a	.	.	0	.	.	.
Sex	Male	.194	.046	18.089	1	.000*	.104	.283
	Female	0a	.	.	0	.	.	.
Partnership	Yes	.042	.056	.564	1	.453	-.068	.152
	No	0a	.	.	0	.	.	.
Region	Lake Geneva	.128	.116	1.201	1	.273	-.101	.356
	Middleland	.019	.088	.048	1	.827	-.153	.192
	North-west Switzerland	-.048	.092	.266	1	.606	-.229	.133
	Zurich	-.096	.090	1.132	1	.287	-.272	.081
	East Switzerland	.221	.093	5.693	1	.017*	.040	.403
	Central Switzerland	0a	.	.	0	.	.	.
Interview Language	Italian	-.355	.137	6.708	1	.010**	-.624	-.086
	German	.037	.082	.205	1	.651	-.124	.199
	French	0a	.	.	0	.	.	.

a This parameter is set to zero because it is redundant.

* significance at 95% interval, ** significance at 99% interval

4.3.1 Influence of health behaviour on relation SES and self-assessed health

The addition of the mediating health behaviour variables *physical activity* and *smoking* didn't result in substantial changes in the relation between the SES variables and the self-assessment of health. The predictive ability of independent variables on self-assessed health rose with a small amount; the pseudo R square estimate *Nagelkerke* increased from .061 in the first model to .089 in the second. This is in line with Stringhini et al. (2010) and Mackenbach et al. (2008) their findings that health behaviour is an important factor in predicting health inequalities. Though the Akaike's Information Criterion (AIC) scores of the models (AIC model 1 = 12762 & AIC model 2 = 14850) indicate that the first model is the ''better'' model of the two (Burnham & Anderson, 2002). All four categories *low & high education* and *low & high income* remained significant after the inclusion of the health behaviour variables, though high income and high education changed from significance at 99% interval to a 95% interval (sig .004 to sig .020 and sig .003 to sig .040 respectively). Furthermore, the estimates of the SES variables experienced only very marginal changes.

This entails that the inclusion of the health influencers smoking and physical activity do not rule out that SES has an effect on self-assessed health status, but neither can be said that health behaviour strengthens the relationship between SES and self-assessed health based on the results. More specifically, the first model shows a distinct relationship between SES and self-assessed health (path C in the conceptual model, see figure 1). The addition of the health behaviour variables in the second model illustrated that health behaviour significantly influences the self-assessment of health also (path B in the conceptual model). Though based on the results of the second model, the relationship between SES and self-assessed health through the mediating health behaviour variables (pathway A and B subsequently) has not meaningfully influenced the direct relation between SES and self-assessed health status (pathway C).

4.4 Reflection on results

In the case of both the models the *test of parallel lines*, which tests the assumption of proportional odds, was significant, meaning that proportional odds are present in both models. This is not a bottleneck as the variables in play are distinctively different and do not have a structural relationship with one another. Nevertheless this rises extra caution in interpreting the predictive and scientific relevance of the models.

5 - Conclusion

5.1 Findings & research conclusions

The results illustrate that the SES is an important factor in predicting self-assessed health. The first regression model showed that both low education and low income, so subsequently a low SES, appeared to have a lower probability to have a higher self-assessed health rating than middle education and income (a medium SES) in a Swiss context. These findings are similar to Mackenbach et al. (2008), who state that a poorer self-assessment of health status is considerably higher in lower SES-classes. The second regression model indicated that inclusion of the health behaviour variables physical activity and smoking did not have a considerable effect on the relation between SES and self-assessed health. Thus, based on the data, a distinct relationship between SES and self-assessed health is observed which is mostly not the result of a mediation through health behaviours.

Overall, the two regressions are in line with the prediction that lower SES groups among the Swiss population would remain more prone to lifestyle related diseases and health in the upcoming decades by Galobardes et al. (2003). This thesis supports the relevance of SES as fundamental causes in predicting and influencing inequalities in self-assessed health status as put forward by Link and Phelan (1995).

5.2 Limitations

The aforementioned conclusions and its relevance in relation to Switzerland as a whole must be interpreted with caution. First, there are certain flaws in the dataset that limit the predictive value transfer from the sample to the Swiss population. The data consists solely of private households, meaning that collective households and dwellings such as old people's homes are excluded.

Second, a cross-sectional analysis was utilized in this thesis. Although a cross-sectional analysis has it perks, Stringhini et al. (2010) and Due et al. (2011) both emphasise that the application of a longitudinal approach is especially valuable when looking at the influence and development of health behaviour in relation to health over time.

5.3 Future research

Further research can be done in order to more extensively and accurately predict the role of SES in public health inequalities. This, for example, could be achieved through longitudinal data analysis of a larger sample of the Swiss population, as well as through the addition of variables such as occupation, diet and alcohol consumption.

6 - Literature

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7 - Appendix

7.1 Remainder Descriptives control variables

Table 13 - Age

N	Minimum	Maximum	Mean	Std. Deviation
9479	14	97	50.39	19.325

Table 14 - Interview Language

		Frequency	Percent
Valid	Italian	495	5.2
	German	6425	67.8
	French	2559	27.0
Total	.	9479	100.0

Table 15 - Partnership Status

		Frequency	Percent	Valid Percent
Valid	Yes	7007	73.9	74.0
	No	2464	26.0	26.0
	sum	9471	99.9	100.0
Missing	.	8	.1	.
Total	.	9479	100.0	.

Table 16 - Sex

		Frequency	Percent
Valid	Male	4349	45.9
	Female	5130	54.1
Total	.	9479	100.0

Table 17 - Region of residence

		Frequency	Percent
Valid	Lake Geneva	1770	18.7
	Middleland	2373	25.0
	North-west Switzerland	1309	13.8
	Zurich	1516	16.0
	East Switzerland	1595	16.8
	Central Switzerland	916	9.7
Total	.	9479	100.0

7.2 Case processing summaries

Table 18 - Model 1 - Case Processing Summary

		N	Marginal Percentage
Health Status	not very well / not well at all	173	2.0%
	so so (average)	1107	12.6%
	well	5771	65.6%
	very well	1751	19.9%
Education	Low education	1050	11.9%
	High education	3328	37.8%
	Medium Education	4424	50.3%
Yearly Household Income Nett	Low Income, < 70.000	1988	22.6%
	High income, > 165.000	1768	20.1%
	Medium Income, 70.000 - 165.000	5046	57.3%
Sex	Male	4091	46.5%
	Female	4711	53.5%
Partnership Status	Yes	6555	74.5%
	No	2247	25.5%
Region of residence	Lake Geneva	1594	18.1%
	Middleland	2247	25.5%
	North-west Switserland	1224	13.9%
	Zurich	1413	16.1%
	East switzerland	1449	16.5%
	Central zwitserland	875	9.9%
Interview Language	Italian	436	5.0%
	German	6029	68.5%
	French	2337	26.6%
Valid	.	8802	100.0%
Missing	.	677	.
Total	.	9479	.

Table 19 - Model 2 - Case Processing Summary

		N	Marginal Percentage
Health Status	Not very well / not well at all	173	2.0%
	So so (average)	1092	12.5%
	Well	5735	65.6%
	Very well	1739	19.9%
Education	Low education	1034	11.8%
	High education	3313	37.9%
	Medium Education	4392	50.3%
Yearly Household Income Nett	Low Income, < 70.000	1968	22.5%
	High income, > 165.000	1758	20.1%
	Medium Income, 70.000 - 165.000	5013	57.4%

Physical activity	No Physical activity	1553	17.8%
	Low Physical activity	2782	31.8%
	High Physical activity	1948	22.3%
	Medium Physical activity	2456	28.1%
Smoking	Non smoker	7194	82.3%
	Heavy smoker	588	6.7%
	light smoker	957	11.0%
Sex	Male	4065	46.5%
	Female	4674	53.5%
Partnership Status	Yes	6515	74.6%
	No	2224	25.4%
Region of residence	Lake Geneva	1581	18.1%
	Middleland	2229	25.5%
	North-west Switserland	1215	13.9%
	Zurich	1401	16.0%
	East switzerland	1443	16.5%
	Central zwitserland	870	10.0%
Interview Language	Italian	433	5.0%
	German	5993	68.6%
	French	2313	26.5%
Valid	.	8739	100.0%
Missing	.	740	.
Total	.	9479	.