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Association between nutrition, physical activity and socioeconomic status and intermediate risk factors of non-communicable diseases

Master thesis

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Abbreviations

ALPHA	Instruments for Assessing Levels of Physical Activity and Fitness
ANOVA	Analysis of Variances
AUDIT-C	Alcohol Use Disorders Identification Test-Consumption
BMI	Body-Mass-Index
CDRS	Connor-Davidson Resilience Scale
CI	Confidence interval (95%)
CMNN	communicable, maternal, neuronatal and nutritional
CVD	cardiovascular disease
DGE	German Nutrition Society
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
GBD	Global Burden of Disease
GBE	Gesundheitsberichterstattung des Bundes/German Health Report
GDP	gross domestic product
GEDA	Gesundheit in Deutschland aktuell
HAW	University of Applied Sciences Hamburg
HCU	HafenCity University
HRQOL	Health-related quality of life
ID	identification number
mm hg	millimetres mercury
n. d.	no date
NCD	Non communicable diseases

OECD	Organisation for Economic Co-operation and Development
OR	Odds Ratio
PSQI	Pittsburgh Sleep Quality Index
RKI	Robert-Koch-Institute
SD	Standard Deviation
SE	standard error
SES	Socioeconomic status
SF	Short Form
SPSS	Statistical Package for the Social
UI	Uncertainty interval
UKE	University Clinics Hamburg-Eppendorf
VIF	Variance Inflation Factor
WHO	World Health Organization

Abstract

Background: NCDs are causing a large number of death, globally, but also living with any chronic condition is also very expensive for the individual as well as for the health care systems. First indicators for NCDs are intermediate risk factors like hypertension or overweight and obesity. These factors are themselves influenced by modifiable behavioural risk factors like nutrition and physical activity. But also the influence of SES needs to be considered. An unhealthy diet, lack of physical activity and low SES are linked to a higher prevalence of overweight and hypertension.

Methods: The project ‘Health promotion and prevention in urban neighbourhoods’ in Hamburg aims to measure health status and behaviours in six statistical areas of different SES and improve it by participatory interventions. The data of primary data collection are used to test the influence of nutrition, physical activity and SES on BMI and hypertension. SES is measured by the social index of the neighbourhood as well as by the individual’s education and income. Influences on BMI are tested by linear regression, those on hypertension by binary logistic regression.

Results: BMI in women is influenced by individual SES (b=-0.34; CI: -0.66 - -0.01; p=0.041), very low social index of the living environment (b=4.70; CI: 1.33 – 8.08; p=0.007), and age (b=0.09; CI: 0.03 – 0.14; p=0.002). The effect of medium and low social index is mediated by individual SES. In men, individual SES has only an effect on BMI in areas with high social index (b=- 0.88 kg/m2; CI: -1.70 - -0.06; p=0.038), other influences could not be identified. Hypertension in women can be predicted by R^2=30.7% by age (OR=1.074; CI: 1.049 – 1.100; p<0.001) and physical activity (OR=0.410; CI: 0.191 – 0.879; p=0.022). Also very low SES in the living environment compared to the other statuses has an effect (OR=2.212; CI: 1.181 – 4.145; p=0.013). In men, only age had the same effect on occurrence of hypertension.

Discussion: The findings support the evidence that SES has an influence on BMI and hypertension whereas nutrition could not be identified as a risk factor and physical activity only had an influence on hypertension in women. Selection and information bias could not be excluded. Further research needs to address which indicators differ between socioeconomic groups so that public health actions can directly work on these specific results.

Keywords: overweight, hypertension, socioeconomic status, NCDs

1 Introduction

“At the broadest grouping of causes of death (Level 1), non-communicable diseases (NCDs) comprised the greatest fraction of deaths, contributing to 73.4% (95% uncertainty interval [UI] 72.5–74.1) of total deaths in 2017, while communicable, maternal, neonatal, and nutritional (CMNN) causes accounted for 18.6% (17.9–19.6), and injuries 8.0% (7.7–8.2). Total numbers of deaths from NCD causes increased from 2007 to 2017 by 22·7% (21·5–23·9), representing an additional 7.61 million (7·20–8·01) deaths estimated in 2017 versus 2007” (Roth et al., 2018, p. 1736).

These results of the Global Burden of Disease study 2017 (GBD) show a high increase of deaths because of NCDs. In contrast to infectious diseases that are preventable by spreading vaccinations or limiting exposure to sick people, the risk factors for NCDs include metabolic as well as modifiable behavioural factors. NCDs are known to cause rising costs because of their long lasting and expensive therapies (Reiner, Niermann, Jekauc, & Woll, 2013). As the World Health Organization (WHO) states, the main risk factors for NCDs are a lack of physical activity and healthy nutrition as well as the use of tobacco and alcohol (World Health Organization, 2019b). These factors are crucial to address in health promotion and prevention, but they also depend on the socioeconomic status (SES) of the individual and the living environment. SES is known to influence nutrition, physical activity and tobacco and alcohol consumption (Allen et al., 2017; Hoebel, Finger, Kuntz, & Lampert, 2016).

The aim of this thesis is to examine the influence of nutrition, physical activity and SES on the intermediate risk factors of NCDs, Body-Mass-Index (BMI) and hypertension. SES is measured on neighbourhood and also on individual level. Therefore, data of the project ‘Health promotion and prevention in urban neighbourhoods’ in Hamburg will be used. The project’s objective is to measure health status and behaviours in six statistical areas of different SES and improve it using participatory approaches.

2 Theoretical Background

In the following, the theoretical background for the analyses will be constituted. At first, it will be looked at NCDs, their public health relevance and metabolic as well as behavioural risk factors for NCDs. Regarding metabolic risk factors, the focus will be on overweight and hypertension. The behavioural risk factors nutrition and physical activity will be described in detail. At the end, SES will be considered as being an additional risk factor. Here it will be looked at two different levels of SES: on the one hand, the individual’s SES determined by education and income, on the other hand, the SES on the level of one’s neighbourhood. The relationship between modifiable behavioural risk factors and metabolic risk factors will also be explained.

2.1 Non-communicable Diseases

A NCD are defined as a medical condition that is neither transmissible nor infectious among people (H. C. Kim & Oh, 2013). For a long time, NCDs could only be found in high income countries, but with the reduction of CMNN causes in low and middle income countries the number of people affected by NCDs has grown in the last years. Only in the last ten years, the number of deaths by NCDs increased by 22.7% (H. C. Kim & Oh, 2013; Roth et al., 2018). Under the broad group of NCDs there are four major disease groups causing 82% of premature deaths by NCDs. Premature in this context means under the age of 70 years. These four major disease groups are the following: cardiovascular diseases (CVD), cancers, respiratory diseases and diabetes (World Health Organization, 2018a). In the European Union (EU) countries, the main causes of deaths in 2015 are due to circulatory diseases, cancers and respiratory diseases (OECD & European Union, 2018).

Besides the costs of premature deaths and in quality of life during the years a person is affected by a NCD, there is a high financial burden on people concerned which also include the families of diseased people. As NCD treatments are often expensive and needed for a long time span so that household resources get quickly drained (World Health Organization, 2018a). Germany’s health care costs equal 11.3% of its gross domestic product (GDP) that is the second highest in the EU (OECD & European Union, 2018). The German Health Report (GBE) of 2015 shows that NCDs are mostly responsible for the German sickness costs. The newest numbers of 2008 show a health expenditure of 254 billion euros of which 14.5% are due to cardiovascular diseases, 13.7% because of diseases of the digestive system, 11.3% due to mental health issues and 11.2% because of diseases of the musculoskeletal system (Robert-Koch-Institut, 2015).

2.2 Intermediate Risk Factors for NCDs

The probability of getting affected by NCDs rises with metabolic risk factors. The four main metabolic risk factors according to the WHO are high levels of lipids and glucose in the blood, high blood pressure and overweight respectively obesity (World Health Organization, 2018a). While studies show that the increase of obesity prevalence in adults and children leads to more mortality and morbidity due to CVDs (The GBD 2015 Obesity Collaborators, 2017) other studies state that the risk of obesity alone is not increasing the risk of CVDs but any combination with another metabolic risk factor is (Hamer & Stamatakis, 2012; Kuk, Rotondi, Sui, Blair, & Ardern, 2018). But it needs to be considered that obesity and hypertension are closely linked. The prevalence of hypertension is higher in obese people and complicates weight management programs (Cohen, 2017), so that it is likely that an obese person has also high blood pressure increasing his or her risk of CVDs. In the following, these two will be closer looked at because they can be self-assessed whereas hypertension can be diagnosed when measuring blood pressure at regular medical check-ups (AOK, n.d.).

2.2.1 Overweight and Obesity

Overweight and obesity are both defined by the BMI that can be calculated by dividing one’s weight by the squared height in metres. If the result is between 25 kg/m^2 but under 30 kg/m^2 the person is overweight while a result above 30 kg/m^2 is an indicator of obesity. While it is a common mean for each person to see if height and weight are in a healthy relation the BMI is often criticized for neglecting the fat proportion and distribution. Another problem is that self-reported height is often guessed higher whereas weight is guessed lower than it is, so that self-reported BMI is often lower than the actual (Lange & Finger, 2017).

In Germany, around 35.9% of all adults can be considered as being overweight and 18.1% as obese. Men are with 43.3% more often overweight than women with 28.8% while obesity is equally distributed over gender. The prevalence of both, obesity and overweight, increases with age and is getting higher every year (Lange & Finger, 2017). This stays in contrast to the WHO target of a halt of obesity between 2013 and 2020 because overweight and obesity are accountable for more deaths globally than undernutrition (World Health Organization, 2013) because it can lead to CVDs, cancers, diabetes, and respiratory diseases (H. C. Kim & Oh, 2013). Also gastrointestinal, dermatological, joint, muscular and psychological disorders are known as comorbidities caused by obesity. Additionally, affections of the central nervous system and the musculoskeletal system are frequent in obese people. Obesity and the comorbidities mentioned can lead to a reduction in life expectancy of five to ten years (Fruh, 2017). A more detailed overview is given in table 1 below.

The causes of obesity are widely ranged. The main problem is not the identification of factors that may have an independent influence on weight gain but to estimate the interaction effects of these risk factors that cause the global epidemic of overweight and obesity (Hruby & Hu, 2015). Each risk factor has an influence on energy intake or consumption of a person and if the intake is larger than the consumption weight gain is the consequence. Important factors are "*economic growth, growing availability of abundant, inexpensive, and often nutrient-poor food, industrialization, mechanized transportation, urbanization*" (Hruby & Hu, 2015, p. 673) and genetic, family historical and racial factors as well as socioeconomic and –cultural environments can have an influence. As it can be seen in table 1 below, the individual risk factors are mostly concerning nutrition and physical activity behaviour that also have synergistic and cumulative effects on the development of overweight. But it needs to be considered that there are some environmental factors that can have an influence on the people's individual behaviour as well. For example, if a neighbourhood is not pedestrian friendly it is not inviting its inhabitants to buy groceries by foot. Apart from that having a low individual SES is associated with a higher risk of overweight and obesity (Hruby & Hu, 2015; Lange & Finger, 2017).

The best way to reduce the risks of comorbidities is a moderate weight reduction by five to ten percent that can be reached in a reasonable period whereas a reduction of 20 to 30 percent is often unrealistic. A reduction between five to 15 percent can be achieved by structured lifestyle support that includes realistic goals in weight reduction, frequent checks and motivation as well as having a good environment and knowledge about heath promoting behaviours, and keeping a meal and physical activity diary (Fruh, 2017).

Table 1: Risk Factors, Comorbidities, and Sequelae of Obesity (Hruby & Hu, 2015)

Risk Factors (non-exhaustive)			**Comorbidities and Sequelae (non-exhaustive)**
Individual	**Socioeconomic**	**Environmental**	
• Energy intake in excess of energy needs • Calorie-dense, nutrient-poor food choices • Low physical activity • Sedentariness • Genetics • Pre- and perinatal exposures • Certain diseases • Psychological conditions • Specific drugs	• Low education • Poverty	• Lack of access to physical activity resources/low walkability neighbourhoods • Food deserts • Viruses • Microbiota • „Obesogens“ • Obese social ties	• Type 2 diabetes • Hypertension • Dyslipidaemia • Heart and vascular diseases • Osteoarthritis • Infertility • Certain cancers • Respiratory conditions/diseases • Liver diseases • Gallstones • Trauma treatment/survival • Infection • Psychological conditions • Physical disability • Years of life lost/early mortality • Absenteeism/loss of productivity • Higher medical costs

2.2.2 Hypertension

Hypertension is also known as high blood pressure which means that the blood runs through arteries and vessels with a pressure that is increased compared to normal. It is diagnosed if the systolic value is above 140 mm Hg (millimetres mercury) or higher or if the diastolic is above 90 mm Hg or higher in two or more readings in different medical appointments (National Heart, Lung, and Blood Institute (NHLBI), n.d.).

In Germany, 29.4% of men and 27.4% of women suffer from hypertension (Fehr, Lange, & Fuchs, 2017). Compared to the prevalence of the EU mean that is 20.2% for men and 21.7% for women, the prevalence in Germany is a lot higher. This can be due to demographic development in Germany, because the prevalence is increasing with age. The prevalence in women is below ten percent up to the age of 44, nearly reaches 30% in those between 45 and 64 years and increases to more than 55% at the age of 65 and older. In men the increase is not as steep as in women. Because the prevalence in younger ages is already higher, meaning that at the age between 30 and 44 years the prevalence already increases to around 15%, climbs up to more than 35% at between 45 and 64 and with 65 or older up to 55% (Fehr et al., 2017).

As mentioned above hypertension and obesity are closely linked, but hypertension can also have a multitude of causes that even people with normal body weight can suffer from hypertension and its consequences. Here are to name beside biological factors like age and sex as mentioned above, genetic disposition, disadvantageous dietary habits and living conditions, high salt and alcohol consumption, lack of physical activity and persistent stress (Neuhauser, Kuhnert, & Born, 2017a; World Health Organization, 2013). Again, low socioeconomic status is associated with a higher prevalence of hypertension (Neuhauser et al., 2017a).

The WHO sees a 'silent killer' and with that a large public health issue in hypertension because it is linked to 45% of deaths because of heart disease and 51% of deaths due to strokes globally. Combined with other risk factors like tobacco consumption, overweight and obesity, high cholesterol levels and diabetes, hypertension adds risk to the development of all major NCDs. In general, main organs like heart, brain and kidneys are likely affected due to hypertension (World Health Organization, 2013).

Mainly, treatment is done through antihypertensive medication that can lower the blood pressure but the possibilities are limited by unintended side-effects (Janhsen, Strube, & Starker, 2008). However, it is also possible to control the blood pressure modifying behaviours. The WHO recommends to stop alcohol and tobacco consumption, manage stress properly, increase physical activity, maintain a normal BMI and to follow a healthy diet. Dietary advice especially concerns reducing salt and fat intake and increasing fruit and vegetable consumption (World Health Organization, 2013).

2.3 Modifiable Behavioural Risk Factors

As it is explained above, modifiable behavioural risk factors are mainly responsible for the development of metabolic risk factors and also NCDs. Summarized, there are four main groups of unhealthy behaviours that increase that risk. These groups are drug consumption, dietary behaviours, physical activity and mental stress (World Health Organization, 2019b). Although resilience, tobacco and alcohol consumption are important factors, too, the focus of this thesis will be on nutrition and physical activity having a large influence on the development of hypertension and overweight.

2.3.1 Nutrition

When an unfavourable nutrition is discussed it is necessary to define a healthy nutrition. This topic is always present in the media and often the statements are contradictory and confusing while also often without any scientific evidence. Therefore, the WHO formulated its '5 keys to a healthy diet' which are the following:

"1. Breastfeed babies and young children,
2. Eat a variety of foods,
3. Eat plenty of vegetables and fruit,
4. Eat moderate amounts of fats and oils,
5. Eat less salt and sugar" (World Health Organization, 2019a).

The first one concerns breastfeeding which is essential to all children in the world as breast milk has all nutrients a baby is needing within the first six life months. After that it is recommended to continue breastfeeding up to the age of two years but with some safe and nutritious foods added. These foods shall not contain salt or industrial sugars. Breastfeeding protects babies and young children from getting infectious diseases or common childhood diseases. Another advantage is that children who got breastfed have a reduced risk of getting overweight in later child- or adulthood (World Health Organization, 2019a). In this thesis, because in the sample are only adults the topic of breastfeeding will not be further discussed.

Eating a variety of food is also one of the recommendations of the German Nutrition Society (DGE). This is crucial because a one-sided nutrition does not contain all nutrients needed (Deutsche Gesellschaft für Ernährung, 2017). The WHO points out that a combination of various unprocessed and fresh foods provides children and adults with all essential nutrients to maintain a healthy and active life. This includes grains and similar staple products, fruit and vegetables, legumes and animal products (World Health Organization, 2019a).

Especially regarding fruit and vegetables, it is better to consume various kinds than to limit the consumption to apples and bananas (Rabast, 2018, p. 232) which leads to the third key of the WHO that recommends eating a lot of vegetables and fruit. Beside macronutrients like carbohydrates, proteins and fats fruit and vegetables contain vitamins, minerals, dietary fibres, phytochemicals and antioxidants (Rabast, 2018, p.

154; World Health Organization, 2019a). These substances that can also be found in whole grains which are decreasing the risk of developing chronic diseases as well as metabolic risk factors (Liu, 2013; Rabast, 2018, p. 161; World Health Organization, 2019a). Whole grain products should always be preferred to white flour products (Deutsche Gesellschaft für Ernährung, 2017). Vegetables are also favourable because they are saturating without highly increasing the calorie intake, so they can be a healthy snack without added salt or sugar (World Health Organization, 2019a). Beans, lentils and peas are also part of that group (Deutsche Gesellschaft für Ernährung, 2017). They provide plant based protein so that they can substitute a part of animal products that should only complement a healthy diet according to the DGE (2017). They recommend to take five portions of fruit and vegetables per day that can be split into three portions equal to 400 grams of vegetables and two portions of fruit equal to 200 grams while one portion of fruit can be replaced by a 25 gram portion of nuts, seeds or dry fruit (Deutsche Gesellschaft für Ernährung, 2019b). It is recommended by the WHO and the DGE to gently heat fruit and vegetables to retain all of their nutrients (Deutsche Gesellschaft für Ernährung, 2017; World Health Organization, 2019a).

Fat intake is correlated with BMI, body fat percentage and waist circumference on a low level (Avitia, Loya Méndez, Portillo Reyes, Reyes Leal, & Capps Iv, 2018). Therefore, a moderate intake of oils and fats is also recommended because they are high in calories. Especially an overconsumption of saturated and trans-fats increases the risk of CVDs, diabetes and sudden cardiac death as well as the risk of metabolic syndrome components (Food and Agriculture Organization of the United Nations, 2010; Wolfram et al., 2015). Trans-fats can naturally be found in certain dairy and meat products and the industry uses hardened vegetable oil for processing, baking or frying foods and should be avoided (World Health Organization, 2019a). The daily intake of saturated fats should equal ten percent of the total energy consumption; the intake of trans-fats should be lower than one percent of total energy consumption. In contrast to this, six to 11 percent of the total energy intake should come from polyunsaturated fatty acids that can be found in oils from olives, sunflower, rapeseeds, soy and similar sources is recommended by the Food and Agricultural Organization of the United Nations (FAO) because it lowers the risk of the components of metabolic syndrome and diabetes (Food and Agriculture Organization of the United Nations, 2010; Wolfram et al., 2015). The remaining amount of the fat intake of 20 to 35 percent of the total energy intake should come from monounsaturated fatty acids appearing in plant oils (Food and Agriculture Organization of the United Nations, 2010). Palm and coconut oils are excepted because they contain a high amount of saturated fatty acids (World Health Organization, 2019a). It is often observed that people have an increased total fat and saturated fatty acid consumption while the intake of polyunsaturated fatty acids is often insufficient (Deutsche Gesellschaft für Ernährung, 2012; Skop-Lewandowska, Kolarzyk, Zając, Jaworska, & Załęska-Żyłka, 2016).

Fats can also come from animal products which provide mainly saturated fatty acids (Deutsche Gesellschaft für Ernährung, 2012). But the choices between different animal products can also have a benefit. According to the DGE (2017) and the WHO (2019a) it is better to choose white meat and fish than red meats because they contain less fat. Because of this milk and dairy products should also be preferred in low fat versions (World Health Organization, 2019a). Animal products are discussed a lot recently especially in terms of climate change as an omnivore diet consumes more resources than a vegetarian or vegan diet (Rosi et al., 2017). In Germany, around nine percent of all people follow a vegetarian diet (Statista, 2019). A balanced vegetarian diet is associated with lower BMI, higher consumption of carbohydrates and lower consumption of saturated fatty acids. These differences result in a lower risk of hypertension, overweight, arteriosclerosis, diabetes and metabolic syndrome components as well as coronary heart disease. As only animal products provide vitamin B_{12} an inappropriate vegetarian diet with very low animal product share leads to high levels of homocysteine in the blood that can have adverse effects on cardiovascular health, hormone levels and menstruation cycle. It is also questionable if a vegetarian diet is suitable for athletes. Similar effects can be found in the intake of calcium and B_2 (Herrmann, Schorr, Purschwitz, Rassoul, & Richter, 2001; Pilis, Stec, Zych, & Pilis, 2014). The DGE recommends a daily intake of milk and dairy products because of their proteins, vitamin B_2 and calcium as well as eating fish once or twice a week as they are a good source of omega-three fatty acids. If meat is consumed it should not exceed the amount of 300 to 600 grams per week depending on energy demands. Processed meat should be limited because of its high fat and salt containment (World Health Organization, 2019a). If animal products are not or only a small part of the diet a supplementation of vitamin B_{12} must be considered (Deutsche Gesellschaft für Ernährung, 2019b).

The last topic that is covered in the dietary recommendations of the WHO is the intake of salt and sugars which should always be kept low. As mentioned above salt is known to increase the risk of hypertension as well as the development of CVDs and stroke. The best way is to reduce the amount of salt and high-sodium condiments like soy sauce when food is prepared. Processed food with high salt content should be avoided (World Health Organization, 2019a). A proper orientation value is a salt intake of six grams per day (Deutsche Gesellschaft für Ernährung, 2019a) while the WHO recommends only five grams per day (Rabast, 2018, p. 203).

In the WHO guideline for sugars intake it is strongly recommended "*a reduced intake of free sugars throughout the lifecourse* [sic!]" (World Health Organization, 2015, p. 4). Free sugars are defined as mono- and disaccharides added by the manufacturer, cook or consumer. Natural sugars can be found in honey, syrups, fruit juices or concentrates but should be as well considered as free sugars. Sugars in whole vegetables and fruit are not included (Mann, 2014). The amount of free sugars should be lower than ten percent of the total energy intake while actually an intake below five percent is desirable (World Health Organization, 2015), but recent data shows that the current consumption in the age of 15 to 80 is about 14 percent in women and 13 percent of the total energy intake. The three main sources of this amount are sweets, juices and nectars as well as lemonades (Deutsche Gesellschaft für Ernährung, 2018). Sugars are directly linked to overweight and obesity and therefore to other medical conditions that are associated with a high BMI like diabetes and CVDs (Deutsche Gesellschaft für Ernährung, 2018). Additionally, sugars have adverse effects on dental health. The development of caries increases with increasing sugar consumption. Studies show that the WHO defined threshold of less than ten percent of total energy intake decreases caries development but cannot eliminate it. Better is to consume sugars equal to less than five percent of the total energy intake (Moynihan, 2016).

To put it in a nutshell, a healthy diet is balanced, includes all macro- and micronutrients. It is not necessary to completely avoid animal products, fat, sugars or salt, but it is better to limit the intake of these components. The only foods that should be avoided are highly processed products. If fresh food is consumed and prepared it is easier to control energy intake and sugars and salt consumption. All in all, the recommendations of WHO and DGE are very similar, while the DGE includes the daily water intake of 1.5 litres in their recommendations to stay properly hydrated. Another point is to eat mindfully because the satiation feeling can only set on after 15 to 20 minutes so that overeating can be prevented. The last recommendation of the DGE is to keep track of the bodyweight and to be physical active for 30 to 60 minutes daily (Deutsche Gesellschaft für Ernährung, 2019b). This is the topic that will be looked at in the next chapter.

2.3.2 Physical Activity

To describe physical activity and its influence on health, it is necessary to define a few terms. The commonly used terms are 'physical activity', 'sports' and 'exercise'. "*Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure*" (Caspersen, Powell, & Christenson, 1985, p. 126). This can be divided in categories like sports, occupational, household etc. Sports is defined as a physical performance connected with competition and pleasure being physical active (Rütten, Abu-Omar, Lampert, & Ziese, 2005). Too, exercise is a category of physical activity that has an objective and a "*planned, structured and repetitive*" character (Caspersen et al., 1985, p. 126).

For adults between 18 and 64 years it is recommended to do weekly at least 150 minutes of aerobic physical activity on a moderate intensity level. Moderate intensity should feel like a five or six on the individual's capacity scale ranging from zero to ten. This moderate activity can be replaced by 75 minutes on a vigorous intensity level or a mix of these levels for an adequate timespan. A vigorous intensity level equal a seven or eight on the individual's capacity scale. Aerobic means to do an endurance activity to improve health of the cardiovascular system, so it needs to be considered that every unit of physical activity should be at least ten minutes long. To gain additional benefits it is recommended to double the weekly amount of time and to do muscle-strengthening activities at least twice a week (World Health Organization, 2010).

The Robert-Koch-Institute (RKI) found out that 65 percent of women 56.4 percent of men do not meet the recommendation of the WHO. Men are more likely to neglect physical activity when they are more than 30 years old while women are older than 65 years when they do that. Another finding shows that 34 percent of all participants have not been physical active during the last three months (Robert-Koch-Institut, 2015). These numbers show that German adults are above the global average of 23 percent of all adults being physical inactive. In adolescents the global numbers are even worse:

81 percent do not meet the recommended criteria of physical activity. The reduction of physical inactivity by ten percent is one of the key factors to be achieved in the Global Action Plan for the Prevention and Control of NCDs 2013-2020 of the WHO because physical activity can reduce the risks of CVDs including stroke, diabetes and also cancers (World Health Organization, 2018b). A systematic review by Samitz, Egger, & Zwahlen (2011) on domains of physical activity shows that leisure time activity, daily living activity, and occupational activity all lower the overall mortality risks. But leisure time activity implied the largest risk reduction (Samitz et al., 2011).

Physical activity plays also a large role in the prevention of hypertension. Muscle strengthening training and aerobic training, both show a decrease in blood pressure. Nevertheless, one considerable factor is the sedentary behaviour that is known to increase the risk of hypertension. In this case, physical activity in the leisure time cannot reverse this effect (Diaz & Shimbo, 2013). Sedentary behaviours like watching television are also linked to diabetes type 2 and obesity, but already moderate activity can reduce that risk (Hu, Li, Colditz, Willett, & Manson, 2003).

Researchers of the RKI found out that physical activity differs significantly among socioeconomic status groups: whereas physical activity – defined as getting out of breath or begin to sweat equal or more than 2.5 hours per week – is more prevalent in low socioeconomic status and declines with increasing status, athletic activity for more than two hours a week increased with higher socioeconomic status. These findings were consistent when looking at education, profession and income (Hoebel et al., 2016).

Regarding the correlation of physical activity and obesity, a systematic review investigating the long-term benefits of physical activity shows contradictory results. Although some studies found a negative correlation between physical activity and weight, another study found that men being physical active tend to be overweight after ten years (Reiner et al., 2013). In older adults, it was observed that overweight and obese participants having a high physical activity level had the same risk of CVDs like normal weight participants. For those with low activity levels, overweight and obesity results in a higher risk of CVD (Koolhaas et al., 2017). But in general, physical activity is a way to enhance the body’s energy consumption so that it can balance the ratio between energy intake and consumption to prevent weight gain. The risk of weight gain is higher in people with low activity levels compared to those with a high activity level. To treat obesity and overweight physical activity should be combined with a change in dietary behaviours to be effective, as evidence shows (Swift, Johannsen, Lavie, Earnest, & Church, 2014). The best way to summarize most of the studies is a headline of the WHO brochure on the 'global recommendations on physical activity for health': "*Doing some physical activity is better than doing nothing*" because every extra movement in everyday life and exercise can add health benefits as it interrupts sedentary behaviours (World Health Organization, 2011). But not everyone has the same possibilities to be physical active and to follow a healthy diet because the individual's socioeconomic status as well as the status of the living area are having an impact, too, and these are not easily modifiable. These different impacts will be described in the next chapter.

2.4 Influence of socioeconomic status on health

Investigations are often controlled for the effects of SES as it is a typical confounder. Income and education reflect different factors of someone's life. Income plays a large role in timely aspects and also life circumstances. Depending how many family members need to be fed a salary can be high or low. In contrast to that, education limits the decision ability of a person because of lacking information or understanding (J.-H. Kim & Park, 2015). But SES has also direct effects on health and the living environment. There are two levels of SES needed to be considered. One is the SES of a person or group, the other is the living environment's SES. Both are explained by their effects on health, but there are certain combinations of these effects. Another important factor in this context is the subjective perception as it is explained below.

2.4.1 Individual socioeconomic status

According to the American Psychological Association SES is defined as an individual's or group's social class or standing (American Psychological Association, 2019). It is often used as one of the individual's properties predicting possible health outcomes. But there is not only one way to measure it. Often education, income or social class are used for operationalization, may it be a combination of these three forming an index or just one of them because they interact with each other (Darin-Mattsson, Fors, & Kåreholt, 2017; Lampert, Kroll, Müters, & Stolzenberg, 2013). Mostly, the differences in education, access to adequate nutrition, sanitation and health care is due to income inequalities (Ferreira et al., 2018). Occupational complexity is an additional factor that may be included, but a composition of these factors is suggested for being a suitable predictor for health but it ignores the isolated effects of them and it cannot be found out which has the largest impact on individual’s health (Darin-Mattsson et al., 2017).

In several countries, groups having a low SES are more likely to smoke, drink alcohol, and to eat less fruit and vegetables as well as fibres and fish compared to high socioeconomic groups. The level of physical activity is influenced by an interaction between SES and living area. While the physically most inactive people in rural areas tend to have a high SES, in the cities, groups with a low SES are the physical inactive. One explanation for this are occupational activities in rural areas which are often done by low socioeconomic groups. In the cities, these activities are not necessary and the leisure time activity gains more importance, but this requires more time and money (Allen et al., 2017; Hoebel et al., 2016).

In Germany, data from the DEGS study indicated that lower SES is associated with a higher prevalence of diabetes, obesity, depressive symptoms, and inactivity. It is also likely that people with low economic status rate their health status as moderate or poor. These findings were quite consistent in men and women, but the prevalence of all outcomes was higher with increasing age (Lampert, Kroll, von der Lippe, Müters, & Stolzenberg, 2013).

A recent review of 2017 assessing the influence of SES on dietary factors, alcohol consumption, obesity, hypertension, and diabetes shows that income, education, and occupation have a large impact on health. Dietary factors are possible explanations for the association of disadvantage in SES and a higher prevalence of CVDs so that they are looked at from different perspectives. The results show that low SES is associated with a higher amount of potatoes, white flour products, and refined cereals. High SES groups are more likely to consume fruit and vegetables, wholegrain products which results in a higher intake of fibres and a lower average glycaemic index. Fish and meat consumption differs also, as high SES groups consume more lean meat, fish, and sea fruit while low SES groups consume more canned or fried meat as well as fish products. Low-fat dairy products are more frequently consumed in high SES. Butter, sugary desserts, and sweetened beverages are more likely consumed in groups with low SES. Food choices and diet quality are often explained by the income available. Low income groups often favour dry package food containing a high amount of sugar, starch, salt, and saturated fats. A healthy diet including lean meat, fish, fruit, and vegetables costs more money that often means a barrier for the disadvantaged. Another explanatory factor also included in the SES is an individual's education. People with a higher educational degree tend to eat healthier than those who did not complete high school. But it needs to be considered that highly educated people often work in more stressful occupations resulting in a less healthy nutrition due to time causes (Psaltopoulou et al., 2017).

The role of SES on alcohol consumption remains ambiguous. Whereas low SES groups drink more beer, those with a high SES are more likely to drink wine so it is quite balanced. The differentiating fact is the awareness of possible consequences of alcohol consumption that is more prevalent in higher educated groups (Psaltopoulou et al., 2017).

As mentioned above, low income and education are main predictors of obesity when socioeconomic factors are looked at. Up to the 1980s, SES was positively correlated with obesity prevalence, but today the correlation in developed countries turns to be negative. Healthy diet and finances to effort physical activity is more accessible for people with more socioeconomic power, but this correlation can only be found in women. In men, the correlation could not be found (Psaltopoulou et al., 2017). Data of the RKI indicates that having a low individual socioeconomic status is associated with a higher risk of overweight and obesity in men and in women (Schienkiewitz, Mesink, Kuhnert, & Lange, 2017). The increase of obesity and overweight in low SES groups connected with a lack of physical activity in those groups leads to an increase in diabetes. Considerable factors in this context are also access to health care, knowledge about diabetes, unhealthy behaviours, smoking, attitudes, and beliefs. Dietary behaviours are mainly influenced by availability. In areas with low SES, mainly food with high energy dense is the only available or affordable (Psaltopoulou et al., 2017). As sodium intake is a main cause of hypertension that can result in severe CVDs, it is important to look at the association between this and the SES. People with lower SES are more likely to consume salt and saturated fats leading to a higher prevalence of hypertension (Psaltopoulou et al., 2017).

2.4.2 Socioeconomic status of neighbourhoods

Another possibility to rate someone's SES is by the social index of an individual's neighbourhood. In Hamburg, this index consists of data collected and analysed by the social monitoring of the city of Hamburg. The 'Framework Programme Integrated City Development' aims to improve the quality of life in districts with development needs. These are identified by the social monitoring that also has the objective to assess social-spatial differences and developments. By the social index as well as the dynamic index the districts are comparable. 846 of total 941 statistical areas having more than 300 inhabitants are included. To form the status index, the following data is collected and compared to the overall mean of the city:

- Children and adolescents with migration background
- Single parented children
- Proportion of school leavers without degree
- Basic insurance for job seekers according to Volume II of the Social Code Book (SGB II) and the Asylum Seekers Benefit Act (AsylbLG)
- Number of unemployed people according to SGB II and SGB III
- Children in minimum benefit system according to SGB II
- Elderly in minimum benefit system according to SGB XII.

These values are grouped in the four categories high, medium, low, and very low. The dynamic index indicates the development over the last three years categorized in positive, stable or negative. This is used to gain information where interventions may be needed (Görlach, n.d.).

Geographically, a higher prevalence of obesity can be found in low income areas and countries (Psaltopoulou et al., 2017). Also a life expectancy lowered by two to three years has been observed in areas with low SES. These two consequences act independently from the individual's income (Mohnen & Schneider, 2014, pp. 32–33). This shows that the SES of neighbourhoods is also affecting individual's health. It is found that people living in socioeconomic deprived neighbourhoods have a lower health-related quality of life (HRQOL) which is a self-rated construct. This mainly concentrates on physical health (Rocha, Ribeiro, Severo, Barros, & Fraga, 2017).

In Germany, areas with high unemployment rate and measures of overcrowding, as typical indicators for a low SES, were positively correlated with hypertension prevalence. A reason for this is that the neighbourhood is also influencing dietary habits as areas with low SES are often known as 'food deserts' because supermarkets and grocery stores providing healthy choices are missing (Psaltopoulou et al., 2017). This is also confirmed by studies investigating the food and addictive substances supply. Disadvantaged areas tend to have a bigger supply of fast food and addictive substances, that are mainly tobacco and alcohol. Also the advertising density for these drugs increases with lower SES. Socioeconomic factors of neighbourhoods are influencing structures relevant for health. As the population density of high socioeconomic neighbourhoods is lower the facilities for health promotion like green spaces are easier to implement in the space. Important physical factors are the presence of nature, building density, physical and chemical environmental burdens. For example, lawns and cycle paths need space and an adequate infrastructure to be built, but they have a motivational impact on physical activity behaviours. Additionally, medical care is more accessible in areas with high SES (Mohnen & Schneider, 2014, p. 32).

Besides the economic factors, social factors need to be considered in neighbourhoods because social nets are also important for health. This is not only reduced on neighbours who interact personally with each other, but also includes neighbours in physical proximity. If the people collaborate and interact in a positive and friendly manner the neighbourhoods are called cohesive. Many studies on this topic found positive or no correlations between cohesive neighbourhoods and health, but it is important to consider that none of them found a negative correlation. Cohesive neighbourhoods can form a unity influencing decisions of politics and urban planning about the living environment and health care supply. Disadvantaged neighbourhoods often do not have the sense of cohesion, so that they are not organized enough to influence those decisions because often the time and financial resources are not given in these neighbourhoods. Social contacts also have mental effects that can again positively affect physical health. People tend to adapt social standards, so if the majority of the neighbourhood has health promoting habits and values, behaviours that do not fit into these standards will be disapproved. These relations are able to impact each individual in adopting health promoting behaviours and in refusing risk behaviours (Mohnen & Schneider, 2014, pp. 33–35).

Another social factor is criminality that is known to influence health as with lower criminality rates BMI is lower and the prevalence of bicycle usage is higher. In this context, the subjective sense of safety was more important than objective values. This is also important in the rating of the living environment's walkability. Inhabitants who do not rate their living environment as activity-friendly tend to have a higher BMI and be less physical active although objective measures would rate the environment as activity-friendly. This is one reason for missing the objective of promoting physical activity by improving environmental factors (Mohnen & Schneider, 2014, pp. 34–36).

To sum up, it is important to recognize that living environments can have a large impact on the individual's health because the access to healthy food, good social connections and physical activity facilities have direct effects on health behaviours. Effects of the living environment like these are moderated by demographics, consciousness, personality, personal involvement and the according behaviours. An exemplary direct effect is the air pollution of a living environment having a direct impact on respiratory health. However, it is to be noted that many objective measures cannot replace the subjective perception of the living environment because this can motivate or prevent risk and health behaviours (Mohnen & Schneider, 2014, pp. 34–39).

2.4.3 Subjective perception of SES

In the last few years, a discussion arose if the objective SES is still a suitable predictor as it does not include the subjective rating of an individual's social class. An objective value cannot predict if someone feels as being part of a social class apart from income or education. These inequalities in feeling vulnerable are a considerable factor for health disparities (Ferreira et al., 2018). This discussion is comparable to the professional assessment of someone's health and the self-rated HRQOL. The self-assessment is known to measure the disease burden and wellness status of person in a more adequate way because it is influenced by all the risks and resources. In a Korean study, HRQOL was more influenced by the subjective social class than by the objective predictors education or income (J.-H. Kim & Park, 2015).

2.5 Research Objective

Based on the theoretical background presented, the **objective of this master thesis is to investigate the influence of nutrition, physical activity, and SES on BMI and hypertension as intermediate the risk factors for NCDs.** Furthermore, it will be assessed if the individual SES or the social index of the neighbourhood is decisive for the development of these risk factors and healthy behaviours. An analysis on possible moderating or mediating effects of the predictors is also included.

3 Methods

This chapter provides a detailed description of the methods applied in this thesis. At first, the project 'Health Promotion and Prevention in Urban Neighbourhoods' is presented including the primary data collection. After that the instruments assessing the variables nutrition, physical activity, BMI, hypertension, and SES on neighbourhood as well as on individual level are described. Furthermore, the statistical analyses are explained from descriptive univariate over bivariate ending in multivariate analyses.

3.1 Project 'Health Promotion and Prevention in Urban Neighbourhoods'

The project 'Health Promotion and Prevention in Urban Neighbourhoods' is realized by the interdisciplinary research joint of the University of Applied Sciences Hamburg (HAW), the University Medical Centre Hamburg-Eppendorf (UKE), HafenCity University (HCU) and the Otto-von-Guericke-University Magdeburg and started in 2017. It aims to assess health status and health influencing behavioural patterns in six statistical areas in Hamburg (Jeorgakopulos & Westenhöfer, 2018). In two of these neighbourhoods, interventions to improve health and healthy lifestyles will be developed by means of a participatory approach. The other four neighbourhoods serve as controls. The two intervention neighbourhoods have one a low and one a very low social index. Besides two control neighbourhoods with the same social patterns, there is one control with a medium social index and one with a high. The statistical areas investigated were randomly selected using the following criteria:

- a population of more than 2000 inhabitants
- a stable dynamic index
- no health promotion programme finding place in that area that exceeds a yearly budget of 10.000€
- intervention and control areas should not be neighbouring to prevent spill over effects (Eichner, 2018b).

The statistical areas selected are in Sasel with a high social index, in Stellingen with a medium social index, in Hamm and Lohbrügge having a low social index, as well as in

Rahlstedt and Wilhelmsburg having a very low social index (Eichner, 2018c). The areas selected are visualized in figure 1.

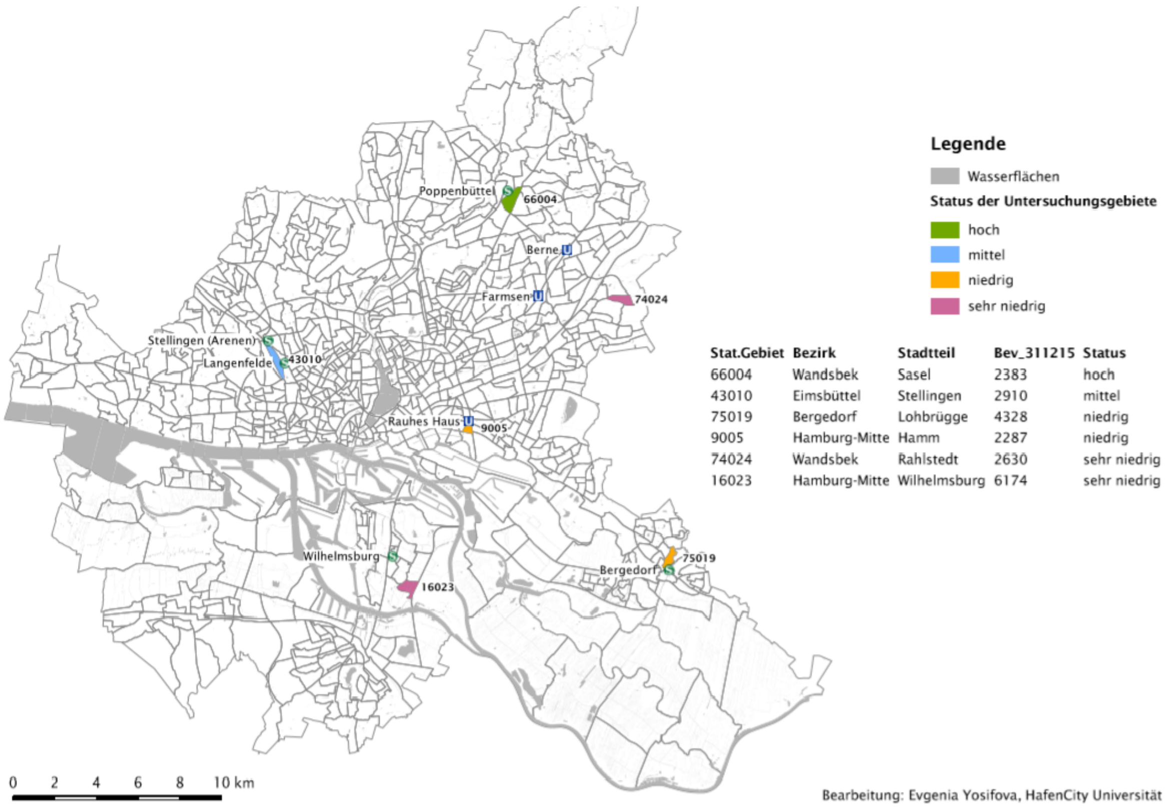

Figure 1: Selected Statistical Area (Data Source: Socialmonitoring Hamburg 2017)

3.2 Data Collection and Instrument

Data is collected by structured interviews in which the questionnaire will be answered. To gather more diverse data, the questionnaire was translated into Turkish and Polish representing the largest groups with migration background in the neighbourhoods. Trained interviewers were sent into each of the statistical areas on one day per week with an information booth. There the participants which were randomly selected through a preselected list of the residents' registration office were invited to fil out the questionnaire (Buchcik, Borutta, & Westenhöfer, 2018). Participants gained ten euros if they joined a 30-minute interview (Eichner, 2018d). They were also offered the opportunity to fil out the questionnaire at home by themselves and give it back another day or send it via mail to the office at the HAW in Bergedorf. The aim is to reach 150 participants per neighbourhood (Eichner, 2018a). The instrument contains the following topics, some measured by standardized instruments provided in brackets:

- living environment,
- walkability (ALPHA-10),
- NCDs (GEDA),
- health-related quality of life (SF-12),
- life satisfaction,
- resilience (CDRS-10),
- health competence (eHealth),
- sense of community (Community Index),
- physical activity (GEDA),
- nutrition,
- height and weight,
- alcohol consumption (AUDIT-C),
- tobacco usage,
- sleep behaviour (parts of PSQI)
- sociodemographic data including SES.

In the following, instruments relevant for this thesis are described precisely. The whole questionnaire is available in the appendix I.

3.2.1 NCDs

The acquisition of data on NCDs is oriented at the Gesundheit in Deutschland aktuell (GEDA) 2012 study of the RKI. The question is if each disease group has ever been diagnosed by a doctor. In the GEDA questionnaire, individual diseases are checked, but to shorten the questionnaire these diseases are grouped to categories. The disease groups are chronic respiratory diseases, CVDs, hypertension/high blood pressure, diabetes, any type of cancers, and mental diseases (Robert-Koch-Institut, 2014).

3.2.2 BMI

BMI is measured by dividing the self-reported weight by the squared self-reported height. The variable will be mainly used as a metric one, but also in the four categories underweight (BMI below 18.5 kg/m^2), normal weight (BMI of 18.5 kg/m^2 and below 25 kg/m^2), overweight (BMI of 25 kg/m^2 or above), and obesity (BMI of 30 kg/m^2 or above) for a better overview of prevalences (Deutsche Gesellschaft für Ernährung, 2006).

3.2.3 Nutrition

For measuring healthy nutrition, a questionnaire was developed and assessed on psychometric properties. The results of this assessment showed that seven items have good values for objectivity and reliability (Cronbach's alpha of α=0.723). The seven items are the following:

1. My diet is balanced and contains a variety of foods.
2. I daily consume healthy fats (e. g. from plant oils or nuts)
3. I drink a minimum of 1.5 litres of water or unsweetened tea per day.
4. How many portions of fruit do you eat regularly? (A portion equals e. g. an apple or a handful of berries)
5. How many portions of salads and/or leaf vegetables do you eat regularly? (A portion equals a handful of salad)
6. How many portions of other vegetables do you eat regularly? (A portion equals e. g. one tomato or a handful of broccoli)
7. How many portions of whole-grain bread do you eat regularly? (A portion equals one slice)

The answer format of the first three questions was a four-point Likert-scale ranging from 'I disagree' to 'I agree'. The other questions could be answered on a scale of frequencies beginning with 'once a month or less' to 'five per day or more'. A score is allocated to all items, so that the answers with the least fit to the recommendations of the DGE get only one point and those with the best fit get four points. For the first three items, the score gets higher the more the participant agrees to the statements. The scoring of the last four questions is visualized in table 2. Then all scores are summed up to a total nutrition score ranging from seven to 28 achievable points whereas a higher score indicates a better nutrition. It is important to consider that during the assessment of psychometric properties of the questionnaire, construct validity could not be obtained because the score did not correlate with BMI and it could not be found any difference in nutrition score between BMI categories.

Table 2: Scoring of the Nutrition Questionnaire

<table>
<tr><th>Item Number</th><th>1 per month or less</th><th>2-3 per month</th><th>1 per week</th><th>2-3 per week</th><th>4-6 per week</th><th>1 per day</th><th>2 per day</th><th>3-4 per day</th><th>5 or more per day</th></tr>
<tr><td>4</td><td colspan="4">1</td><td colspan="2">2</td><td>3</td><td colspan="2">4</td></tr>
<tr><td>5</td><td colspan="4">1</td><td>2</td><td>3</td><td colspan="3">4</td></tr>
<tr><td>6</td><td colspan="4">1</td><td colspan="2">2</td><td>3</td><td colspan="2">4</td></tr>
<tr><td>7</td><td colspan="4">1</td><td colspan="2">2</td><td>3</td><td colspan="2">4</td></tr>
</table>

3.2.4 Physical activity

Physical activity is also measured by items taken from the GEDA 2012 study. It is asked how many days the participant is physically active. This activity shall include sweating and/or getting out of breath. After that the average duration of the physical activity is recorded in categories. The third question concerns the weekly average time spent with doing sports. In the GEDA 2012 study, three categories were used to classify the data which are ‘less than 2.5 hours per week physically active’, ‘more than 2.5 hours per week physically active on less than five days’, and ‘at least five times per week for at least 30 minutes physically active’, but these categories were only calculated by the first two questions (Robert-Koch-Institut, 2014). To consider all questions, the weekly time being physically active is calculated by multiplying the days with the average active time per day and adding the weekly average time spent doing sports. For each category including a timespan the median will be used as a reference for calculation. The answer category of the second question ‘less than ten minutes’ will be transformed to five minutes and ‘more than 60 minutes’ to 75 minutes. In the third question, ‘less than 1 hour per week’ will be taken as 30 minutes; ‘more than 4 hours per week’ taken as 270 minutes. Because there is no indication over how many days the sport activity is distributed only two categories are used. The classifying threshold for these is the WHO recommended minimum time being physically active of 30 minutes on five days per week that equals a total time of 150 minutes per week (World Health Organization, 2010).

3.2.5 Individual SES

Individual SES is assessed by education and income. As vocational education and occupation are not considered, a modification of the scoring system of Lampert, Kroll, Müters, & Stolzenberg (2013) will be used. For education, only the highest school or university degree can be considered. The points in the scoring system differ with vocational education. So for each two original values the average is calculated. Detailed information is provided in table 3. To maintain clarity, the German terms of school degrees are used.

Table 3: Scoring System Education

Degree	w/o vocational education	score according to Lampert et al. (2013)	Average Score
No school degree	without	1	**2**
	with	3	
Hauptschul-abschluss	without	1,7	**2,35**
	with	3	
Realschulabschluss	without	2,8	**3,2**
	with	3,6	
Abitur	without	3,7	**4,25**
	with	4,8	
Bachelor's degree	without Master's degree	6,1	**6,55**
	with Master's degree	7	

Income is assessed by the participant's household income in categories. The categories' medians are then divided by the weighted number of household members. For the lowest category 'under 1000 euros' an income of 750 euros, for the highest category 'over 3500 euros' an income of 3750 euros is applied. To calculate the weighted household members, it is necessary how many people are living in a household and how old these people are. For the head of household one point is the baseline value, for every other person older than 14 years 0.5 points, and for every child under 14 years 0.3 points are added. So if a couple has a four-year-old child the weighted number of household members will be: 1.0 + 0.5 + 0.3=1.8. For the results, the scoring system will be used as it is presented in table 4. After scoring both variables the values will be summed up to have a total score for SES ranging from three to 13.55 achievable points. Higher scores indicate a higher SES.

Table 4: Scoring System Income (Lampert et al., 2013)

EQUALIZED NET INCOME IN €	SCORE
<=655	1.0
656 – 815	1.5
816-935	2.0
936-1065	2.5
1066-1185	3.0
1186-1290	3.5
1291-1395	4.0
1396-1545	4.5
1546-1665	5.0
1666-1895	5.5
1896-2165	6.0
2166-2665	6.5
>= 2666	7.0

3.2.6 SES on neighbourhood level

The SES of an individual's living environment is measured by the social monitoring in Hamburg explained in the theoretical background. As it was the starting year the values from 2017 were used as the indicators of social index. To prevent missing values, the statistical area can be retrieved from the identification number (ID). The list from the resident's registration office included 800 participants from each statistical area ordered by the number of the area which were consecutively numbered. The statistical areas selected can be seen in table 5 as well as in figure 1 above.

Table 5: Participating neighbourhoods of the project

Statistical area	District	Neighbourhood	Inhabitants	Status index	Group
9005	Hamburg-Mitte	Hamm	2287	Low	Control
16023	Hamburg-Mitte	Wilhelmsburg	6174	Very low	Control
43010	Eimsbüttel	Stellingen	2910	Middle	Control
66004	Wandsbek	Sasel	2383	High	Control
74024	Wandsbek	Rahlstedt	2630	Very low	Intervention
75019	Bergedorf	Lohbrügge	4328	Low	Intervention

3.3 Statistical Analysis

The following chapters describe the steps of statistical analysis in detail. All statistical analyses are conducted using IBM Statistical Package for the Social Sciences (SPSS) Version 25. The desired level of significance is 95 percent. Data only includes questionnaires registered at the HAW in Bergedorf up to the end of February 2019. As gender is often known to have a distorting effect on results, all statistical analyses will be split by gender, unless the results do not show large differences. To replicate the analysis, the commented SPSS syntax is provided in appendix II.

3.3.1 Descriptive Analysis

At first the sample will be described by age, gender, and migrant background. Migrant background is categorized in three groups: no migrant background, one parent born in another country, and both parents born in another country. Also the representation of neighbourhoods will be looked at and with that their SES. NCDs including hypertension will be described by their prevalence observed in the sample. Nutrition, individual SES, and BMI will be described by the measures of central tendency and measures of variation as well as the distribution. To gain a better insight into the sample, BMI will also be described in the four categories mentioned above. To describe physical activity, it will be shown how many participants fulfil the WHO recommendation of 2.5 hours per week. For further analyses, metric variables, namely age, BMI, individual

SES, and nutrition, are also tested with the Kolmogorov-Smirnov test for normal distribution (Field, 2018, p. 249).

3.3.2 Bivariate Analysis

For all bivariate analyses, pairwise exclusion is selected to maintain a larger sample size. All tests are two-tailed to be able to observe effects in any direction. Normally distributed metric variables will be correlated with Pearson's correlation coefficient (r). If one variable is ordinal (neighbourhood's SES) or not normally distributed, Spearman's rho (r_s) is used (Field, 2018, p. 344). Associations between dichotomous and metric or ordinal variables are also analysed by correlations with Spearman's rho.

To see if dichotomous variables are associated, chi-square test (X^2) are conducted. The effect size is determined by the odds ratio (OR) with a 95% confidence interval (CI), as this is also the effect size of binary logistic regressions and because it does not specify which one of the variables is outcome or predictor. To test the effect of hypertension and BMI on NCDs, the group is dichotomized by having ever been diagnosed with an NCD or not. For the association with BMI a correlation and with hypertension a chi-square will be used.

3.3.3 Regression Analyses

Two regression models are being used for the purpose of identifying the influencing factors on BMI and hypertension as intermediate risk factors for NCDs. For the outcome BMI, a linear regression will be conducted. As hypertension is a dichotomous variable a binary logistic regression will be used. The possible influencing factors are the following, presented with their level of data:

- Nutrition (interval scale)
- Physical activity (dichotomous: less than 150 minutes/week, equal or more than 150 minutes/week)
- SES on individual level (interval scale)
- SES on neighbourhood level (dummy coded ordinal scale; reference group: high SES)
- Age (interval scale) will be tested as a potential confounder.

To prevent suppressor effects, new predictors will be included in the model by the enter method following the hierarchical order (Field, 2018, pp. 398, 400) provided by their correlation with the outcome. Cases are excluded per listwise exclusion to prevent absurdities in the results because pairwise exclusion changes the sample and with that the variance of the outcome variable with every predictor included in the model. This can result in a negative value of explained variance (Field, 2018, p. 408).

At first, the sample included in the regression analysis is described by the predictors in the model and compared to the total sample. To assess the influence of the predictors in linear regression, primary, the goodness of fit shown by R^2 is looked at, but predictors will be maintained until all predictors are entered to observe indications on possible mediator and moderator effects. Adjusted R^2 is also considered to estimate in how far the model can be generalized. F-statistics will show if the variables improve the prediction of the outcome rather than the mean (Field, 2018, p. 411). The effect size of the predictors on the outcome will be given by the unstandardized coefficient (b) and its 95% CI indicating the increase of the outcome by a one unit change of the predictor. Significance is given by the p-values of the T-statistics. To compare influences of several predictors, the standardized coefficient (β) is used showing how many standard deviations (SD) the outcome increases if the predictor increases by one SD (Field, 2018, p. 415). To consider multicollinearity, besides that the correlations between the predictors should be below $r=0.9$ the variance inflation factor (VIF) and the tolerance statistic are regarded. VIF values above VIF=10 and tolerance values below $r=0.2$ indicate a problematic multicollinearity (Field, 2018, pp. 402, 409).

In binary logistic regression, the fit of the model is given by Nagelkerke's R^2 indicating the reduction of errors while predicting the outcome (Field, 2018, p. 903). If the addition of a predictor to the model results in a significantly better prediction of the outcome, is determined by the chi-square of the omnibus test for each block (Field, 2018, p. 897). The exponential of b shows the effect size, that can be interpreted like an OR (Field, 2018, p. 904). Significance is given by the Wald statistics' p-values (Field, 2018, p. 902). To test on multicollinearity in binary logistic regression, a linear regression with same outcome and all suspected predictors is run, while only VIF tolerance values will be looked at (Field, 2018, pp. 913–914).

3.3.4 Moderator and mediator effects

Moderator variables are affecting the relationship between predictor and outcome (Field, 2018, p. 484). Different stages of the moderator variable result in different effects of the predictor. If moderation occurs, the interaction of the predictor and the moderator variable is significant in the regression analysis (Field, 2018, p. 497). For the purpose of better interpretable coefficients metric variables should be centred. This is done by subtracting the mean from all values (Field, 2018, p. 487).

The most interesting variables in this case are both indicators of the SES because they are different ways to measure a similar construct, but depending on the results the other variables will also tested on mediator and moderator effects. It is important to see if the SES indicators act independently or only combined. To test the regression analysis results for moderation, the interaction is built by multiplying the dummy coded SES on neighbourhood level with the centred individual SES. If any effects occur, simple regression slopes will be used to visualize them.

Another possibility is mediation meaning that an effect of a predictor is only obtained through a third variable. *"Mediation is said to have occurred if the strength of the relationship between the predictor and outcome is reduced by including the mediator"* (Field, 2018, p. 497). To test on mediation, it is necessary to test the significance of the three influences in regression models in table 6, in which the assumption is that the SES on neighbourhood level is the mediator, but it can also be that it is the individual SES. Both possibilities will be tested and also the other variables may be included if it is indicated by previous analyses.

Assuming that model no.1 and no.2 show significant influences, mediation exists if the influence of the predictor in the last model is lower than in the first model or no longer significant and the mediator instead has an influence on the outcome. The indirect effect of the predictor through the mediator on the outcome can be calculated by multiplying the b coefficients from model no.2 and the mediator effect on the outcome from model no.3. To see if the indirect effect differs significantly from the direct effect, a Sobel test is conducted using the online tool 'Calculation for the Sobel Test' (available at http://quantpsy.org/sobel/sobel.htm).

Table 6: Models for testing mediation of SES on neighbourhood level (Field, 2018, p.499)

NO.	MODEL	PREDICTOR(S)	OUTCOME
1	The predictor having a significant influence on the outcome	Individual SES	BMI/hypertension
2	The predictor having a significant influence on the mediator	Individual SES	SES on neighbourhood level
3	The predictor and mediator influencing the outcome	Individual SES SES on neighbourhood level	BMI/hypertension

4 Results

In the following, the results of the analyses will be described in detail. At first, the sample and the distribution of variables will be described. After this the bivariate relationships between the variables will be shown. Based on these results, the regression analyses will be observed while it may be that the procedure concerning moderator and mediator analyses differs from the methods because the results do not indicate a presence of moderating or mediating variables. For further insight into the multivariate analyses, model summaries and tables with coefficients are provided in the appendix for any step in the regression analyses, that has a significant result in the ANOVA and shows new effects, while the first analysis is always provided.

4.1 Sample description

The sample includes n=502 participants of which 207 (41.2%) are male and 288 (57.4%) are female. Two participants (0.4%) did not assign themselves to be male or female and for five participants (1%) data for gender is missing. For purpose of clarity, the following analyses will only include those 495 participants being male or female.

Table 7: Frequencies of neighbourhoods and social indices represented in the sample

NEIGHBOURHOOD	SOCIAL INDEX	MALE		FEMALE	
		n	%	n	%
WILHELMSBURG	very low	21	10,14	43	14,93
RAHLSTEDT	very low	41	19,81	50	17,36
HAMM	low	48	23,19	55	19,10
LOHBRÜGGE	low	33	15,94	43	14,93
STELLINGEN	medium	41	19,81	63	21,88
SASEL	high	24	11,59	34	11,81

The statistical areas are differently represented in the sample like it is shown in table 7. But looking at the status indices, that very low status accounts for around 30% of male and 32% in female participants, low status index has a share of 39% in men and

34% in women, medium ranges at 20% and around 12% have a high social index in both groups. So each SES on neighbourhood level is represented in the sample.

59.12% of women do not have any migrant background, and so do 62.81% of men. Of those with migrant background, the majority (female: 34.31%; male: 30.65%) has parents who were both born in another country. The others have their migrant background because of only one parent. But it needs to be considered that data is only available for 274 female and 207 male participants.

Table 8: Frequencies of NCD occurrence

	FEMALE (N=260)	**MALE (N=189)**
	n yes (%)	n yes (%)
CHRONIC RESPIRATORY DISEASES	41 (15.8)	20 (10.6)
CVDS	22 (8.5)	17 (9.0)
HYPERTENSION/HIGH BLOOD PRESSURE	62 (23.8)	45 (23.8)
DIABETES (WITHOUT GESTATIONAL DIABETES)	23 (8.8)	15 (7.9)
CANCERS	7 (2.7)	6 (3.2)
MENTAL DISEASES	38 (14.6)	22 (11.6)

Table 8 shows that 23.8% of males and females are suffering from hypertension. This is the most frequent chronic condition in the sample. More than one in ten people has a chronic respiratory or mental disease, while women are more affected than men.

Table 9 gives an overview about the distribution of the metric variables. The mean age of males and females is rounded $\bar{x}$=46 years with standard deviations (SD) of SD=16.61 years in women and SD=16.35 years in men. Regarding the range of age, it is conspicuous that the oldest woman is 96 years old compared to the oldest man with 79 years.

Table 9: Descriptive statistics of metric variables

		N	MEAN	SD	SE	VAR	MIN	MAX
AGE	**female**	268	46.41	16.61	1.01	275.78	18	96
	male	192	45.78	16.35	1.18	267.19	18	79
BMI	**female**	231	25.85	6.15	0.40	37.78	14.45	57.81
	male	191	26.64	5.02	0.36	25.20	16.98	44.98
NUTRITION	**female**	274	17.87	4.06	0.25	16.48	7	28
	male	204	17.15	4.23	0.30	17.88	7	28
INDIVIDUAL SES	**female**	189	7.58	3.06	0.22	9.37	3	13.55
	male	155	7.96	2.92	0.23	8.53	3	13.05

The individual SES is equally distributed in men and women. Both means show an SES in the middle of the possible range from three to 13.55 points. It is important to consider, that data for individual SES is only available in 344 of all cases. Having less missing values, in nutrition, similar data is observed. The mean is located in the middle of the scale and distribution (female: $\bar{x}$=17.87 points; SD=4.06 points; male: $\bar{x}$=17.15 points; SD=4.23 points). BMI shows means that can be categorized as being overweight. The average BMI of women is $\bar{x}$=25.85 kg/m^2 (SD=6.15 kg/m^2) and for men it is $\bar{x}$=26.64 kg/m^2 (SD=5.02 kg/m^2). Because of the wide range in BMI, it is necessary to see the distribution in weight categories provided in figure 2. Most of the participants have a normal weight (females: 50%; male: 44%). Around one fifth of the sample is obese. Underweight is more often in men than in women while overweight shows the opposite. Additionally, it can be observed that only 142 (56.1%) of 253 women and 125 (66.1%) of 189 men fulfil the recommendation of the WHO to be at least 2.5 hours per week physically active.

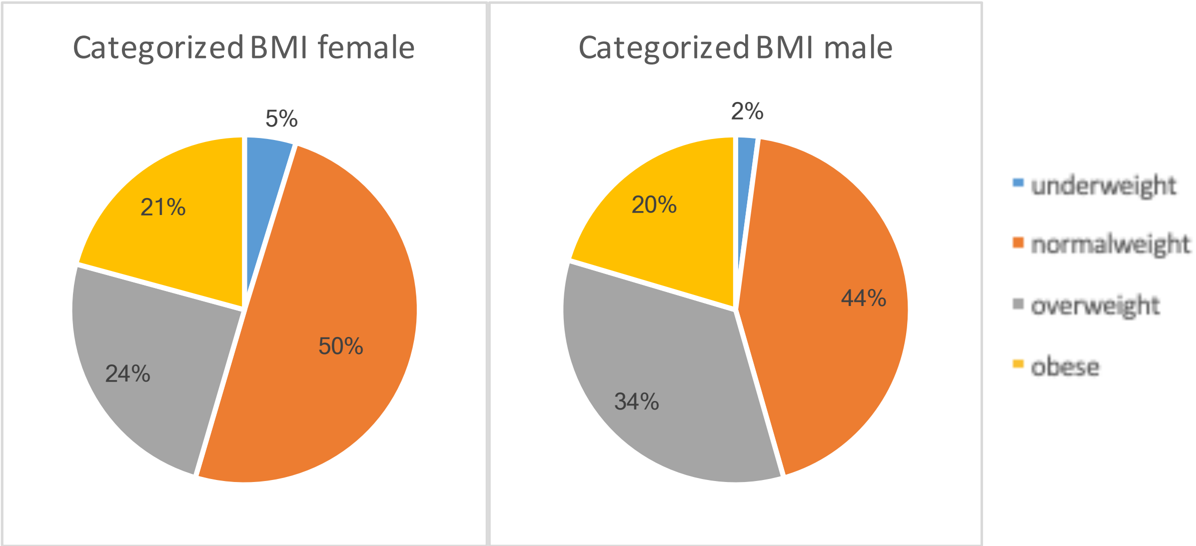

Figure 2: BMI by categories

The Kolmogorov-Smirnov test for normal distribution shows only significant results in age (females: D(268)=0.081; p<0.001; males: D(192)=0.078; p=0.006), BMI (females: D(231)=0.140; p<0.001; males: D(191)=0.119; p<0.001), individual SES (females: D(189)=0.079; p=0.005; males: D(155)=0.088; p=0.005), and nutrition (females: D(274)=0.064; p=0.009; males: D(204)=0.077; p=0.005). This means that all variables are not normally distributed. Figures 3 to 6 provide the histograms of all metric variables to gain better insight into their distribution.

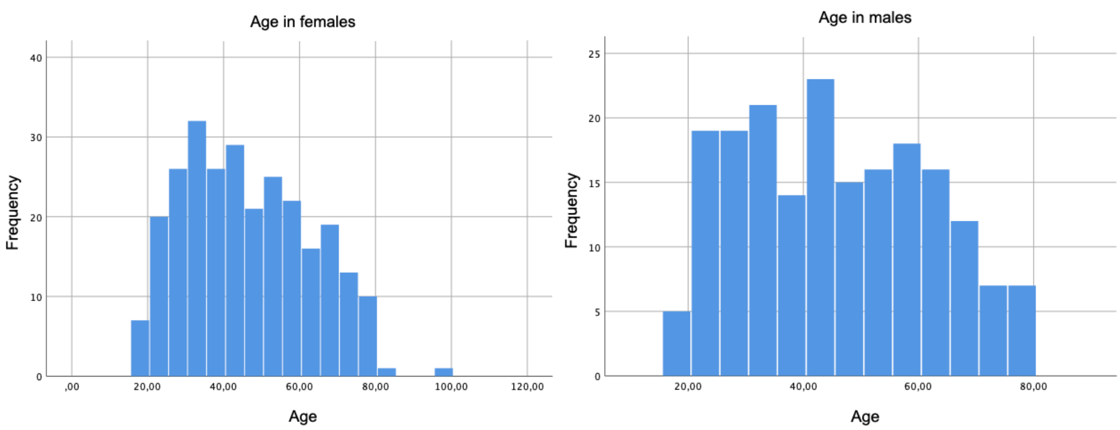

Figure 3: Distribution of age in males and females

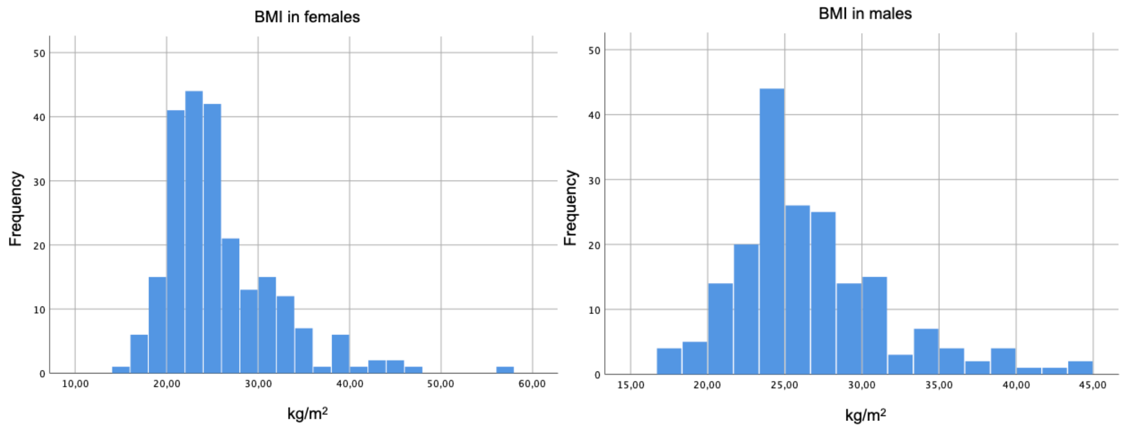

Figure 4: Distribution of BMI in males and females

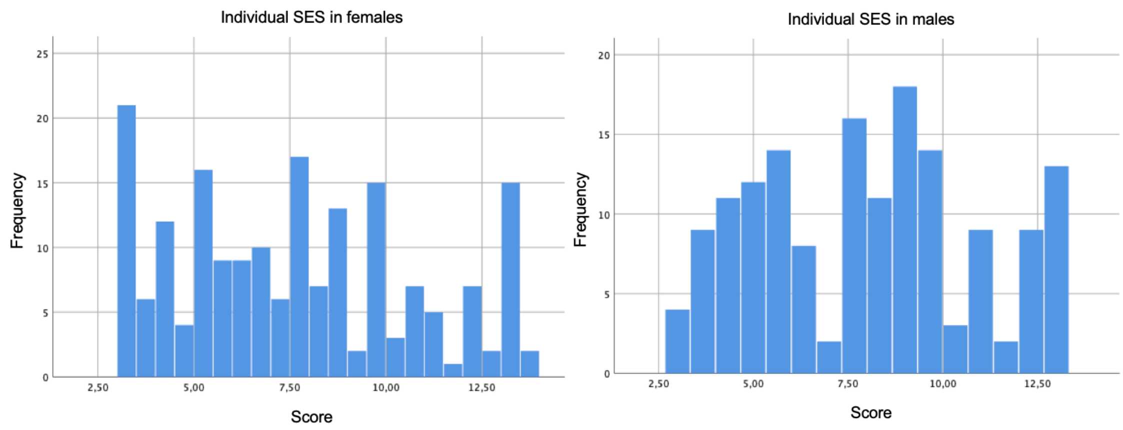

Figure 5: Distribution of individual SES score in males and females

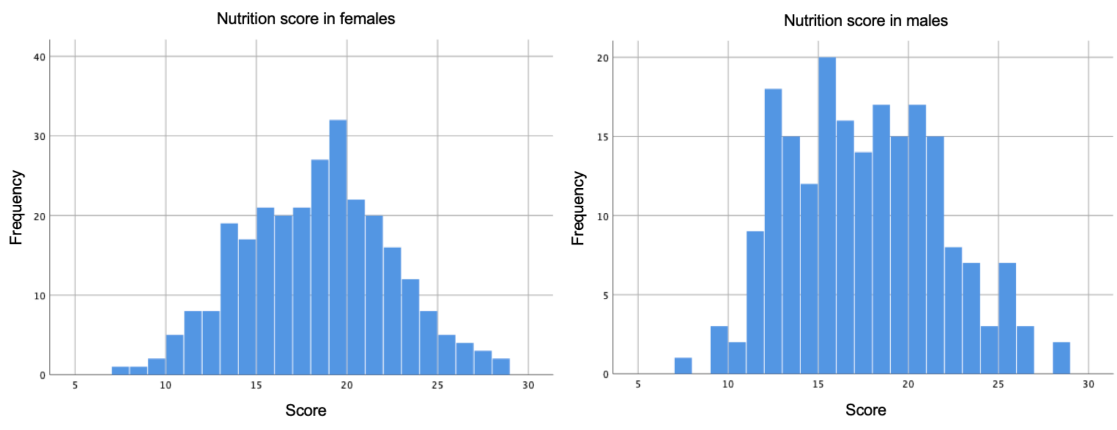

Figure 6: Distribution of nutrition score in males and females

4.2 Bivariate analysis

Because the metric variables are not normally distributed, all correlation coefficients are determined by Spearman's rho. As it is visible in table 10, the individual SES is significantly associated with nutrition in women and with the fulfilment of the physical activity recommendation in men on a low level. So with higher SES the nutrition is healthier in women, and men with higher SES tend to fulfil the physical activity recommendation. It is also negatively associated with BMI in both genders. This correlation is significant, but the correlation is also on a low level. A significant moderate association can be found between individual SES and the social index of the neighbourhood. With higher individual SES, BMI decreases and SES of the neighbourhood increases. Physical activity is significantly correlated with nutrition in both genders with $r_s=0.18$ ($p=0.004$), so the nutrition is healthier if the recommendation for physical activity is fulfilled. A similar but negative effect is found between the SES on neighbourhood level and the outcomes, BMI and hypertension, while this is only observable in females. So the higher the social index of the neighbourhood, the more BMI and the probability to suffer from hypertension increases. In both genders, both outcomes are significantly correlated with each other on a low level (females: $r_s=0.27$; $p<0.001$; males: $r_s=0.28$; $p<0.001$), meaning that with higher BMI the hypertension prevalence increases. It is to consider, that there are certain missing values across the correlation matrix.

A significant correlation is found between BMI and the occurrence of an NCD in men ($r_s=0.22$; $p=0.004$; $n=175$) and in women ($r_s=0.25$; $p<0.001$; $n=213$). In women, the OR shows a higher risk for those who suffer from hypertension to have also another chronic condition of OR=3.64 (CI: 2.01 – 6.59; $X^2(1)=19.33$; $p<0.001$; $n=260$). In men, it is even higher with OR=5.43 (CI: 2.65 – 11.13; $X^2(1)=23.54$; $p<0.001$; $n=189$).

Table 10: Correlation matrix (significant correlations are printed in bold type)

Gender			PA	Nutrition	Status Index Neigh-bourhood	BMI	Hyper-tension
female	SES	r_s	0.07	**0.20**	**0.43**	**-0.24**	-0.04
		n	176	184	189	166	178
	PA	r_s		**0.18**	0.12	-0.12	*Deter-mined by OR*
		n		247	253	215	
	Nutrition	r_s			0.05	-0.11	0,02
		n			274	227	250
	Status Index Neighbour-hood	r_s				**-0.17**	**-0.12**
		n				231	260
	BMI	r_s					**0.27**
		n					213
male	SES	r_s	**0.19**	0.15	**0.45**	**-0.24**	-0.03
		n	145	155	155	148	142
	PA	r_s		**0.18**	0.04	-0.11	*Deter-mined by OR*
		n		187	189	178	
	Nutrition	r_s			**0.14**	0.10	**-0.07**
		n			204	190	187
	Status Index Neighbour-hood	r_s				-0.08	-0.08
		n				191	189
	BMI	r_s					**0.28**
		n					175

4.3 Linear regression on BMI

Variables were included in the order based on correlation coefficients to examine the influence on BMI. Therefore, regression analyses are split by gender, because the order of inclusion of variables differs. At first, the results of female participants are reported in the following, the regression results of male participants are subsequently following. Supplement tables for the linear regression analyses on BMI are provided in appendix III for women and in appendix IV for men.

4.3.1 Linear regression results for female participants

The analysis includes 153 women having valid values across all variables included. Average BMI of $\bar{x}$=26 kg/m^2 (SD=5.94) does not differ to that of the total sample. Similar is the individual SES showing an average of $\bar{x}$=7.55 points (SD=3.21). 90 (58.8%) women fulfil the recommendation on physical activity. 24.8% have a very low, 41.2% a low, 18.3% a medium and 15.7% a high SES on neighbourhood level. So this is a different distribution compared to the total sample.

The model summary in table 11 shows that the individual SES accounts for R^2=7.3% of the variance in BMI in the sample. But the adjusted R^2=6.7% shows that this is not transferrable to the population. If physical activity is included R^2 does only change by 0.001, but in the population the adjusted R^2 increases to R^2(adjusted)=7.7%, so an additional percent of the variance in the population gets explained. While including nutrition leads to an R^2=10.8% the adjusted R^2 lowers by 0.6%. As the significance of F-statistics only shows values lower than p=0.05, any model predicts the outcome better than only assigning the mean.

Regarding the effect sizes, the only significant influence is found in the individual SES. Per each point increase in individual SES the BMI lowers by b=-0.51 kg/m^2 (CI: -0.81 - -0.22; p=0.001) in the first model, but it lowers with each predictor added in the model until it is no longer significant in the last (b=-0.34 kg/m^2; CI: -0.69 – 0.01; p=0.053). This may be due to the significant associations of SES with nutrition and the SES on neighbourhood level shown in the bivariate analysis, but considering the VIF and tolerance values does not show a serious problem of multicollinearity.

Table 11: Model summary for regression on BMI in females

MODEL	PREDICTORS	R^2	ADJUSTED R^2	SE	CHANGE IN R^2	P (ANOVA)
1	individual SES	0.073	0.067	5.73	0.073	0.001
2	individual SES Social index neighbourhood	0.106	0.067	5.69	0.033	0.002
3	individual SES Social index neighbourhood physical activity	0.107	0.077	5.70	0.001	0.005
4	individual SES Social index neighbourhood physical activity nutrition	0.108	0.071	5.72	0.001	0.010

To explain the results, it was observed if moderating variables can be found in the model. Therefore, interactions between individual SES and the other variables were computed. All metric variables have been centred for this. None of these interactions had a significant influence on BMI if it was included besides the main predictors.

To test on mediation, at first the predictors' influences on BMI were tested in raw models. Nutrition ($F(1,225)=2.095$; $p=0.149$) and physical activity ($F(1,213)=1.786$; $p=0.183$) did not show significant results in the ANOVA. Only SES on neighbourhood level had a significant result of $F(3,227)=4.243$ ($p=0.006$) with an explained variance of $R^2=5.3\%$. The coefficients only show significant results for very low SES ($b=4.06$ kg/m^2; CI: 1.51 – 6.61; $p=0.002$) and medium SES ($b=3.00$ kg/m^2; CI: 0.30 – 5.70; $p=0.029$) compared to high SES indicated by the constant in this model was a BMI of 23.52 kg/m^2 (CI: 21.42 – 25.62). Low SES on neighbourhood level did not affect BMI.

The second model for testing on mediation is used to examine if the predictor, SES on neighbourhood level, is influencing the suspected mediator. It was observed that the SES on neighbourhood level was predicting the individual SES by $R^2=29\%$ and is significantly better predicting the SES rather than the allocation of the mean ($F(3,185)=25.22$; $p<0.001$). The coefficients show that compared to high SES people living in a neighbourhood with very low SES have a lower individual SES by b=-5.25 points (CI: -6.46 - -4.04; $p<0.001$) and people living in an area with medium social index have a lower individual SES by b=-3.90 points (CI: -5.18 - -2.61; $p<0.001$). Low SES of the neighbourhood also influences the individual SES. As it does not have any direct effect on BMI it is not further considered, but for integrity still maintained in the mediation analysis. At last a model including the predictor and mediator has been computed and the effects of the SES on neighbourhood level is no longer significant, but the effect of the individual SES still shows significant results (b=-0.36 kg/m^2; CI: -0.69 - -0.03; p=0.032). SES is a mediator for SES on neighbourhood level if it shows a very low (Sobel z=2.18; p=0.029; b=1.91) or medium social index (Sobel z=2.11; p=0.034; b=1.41). The outputs for the Sobel tests are also provided with the supplement of these analyses in appendix III.

To see why the effect of individual SES on BMI gets lower if SES on neighbourhood level is included, the regression is split by the social index and only individual SES is included for predicting the BMI. The regression shows only significant result in low social index of the neighbourhood ($F(1,66)=5.87$; p=0.018) that accounts for R^2=8.2% of the variance. The effect of individual SES in this subgroup is b=-0.506 kg/m^2 (CI: -0.92 - -0.09; p=0.018). In contrast to the first four models in this analyses, the effect of individual SES on BMI is not affected by including the nutrition score.

To sum up the influences on BMI in women, it is observed that neither physical activity nor nutrition has any influence on BMI. Individual SES has only significant influence if the individual's living environment has a low SES, but works as a mediator for the other levels of social index of the living environment. The inclusion of age at the end of the analysis accounts for additional explanation of the variance by R^2=6.1%, while the influence of individual SES remains significant with a similar effect size (b=-0.34; CI: -0.66 - -0.01; p=0.041). The effect of very low SES on neighbourhood level got significant (b=4.70; CI: 1.33 – 8.08; p=0.007). With every year the BMI gets higher by b=0.09 kg/m^2 (CI: 0.03 – 0.14; p=0.002). Comparing these three effects by their standardized coefficient, it is found that living in an area with very low SES has the largest effect of β=0.33, followed by age with an effect of β=0.25 and SES with β=–0.18.

4.3.2 Linear regression results for male participants

The analysis of influences on BMI in men includes 139 participants having a mean BMI of $\bar{x}$=26.85 kg/m^2 (SD=5.18). The mean SES is $\bar{x}$=8.23 points (SD=2.84) which is a little higher than in the total sample. The average nutrition score of $\bar{x}$=17.43 points (SD=4.24) is comparable to the total sample. 68.4% of men included in the analysis fulfils the physical activity recommendation. The distribution of SES on neighbourhood level shows the following: 24.5% have a very low, 44.5% a low, 16.6% a medium and 14.4% a high SES in their living area. These shares are different compared to the total sample.

Table 12: Model summary for regression on BMI in males

MODEL	PREDICTORS	R^2	ADJUSTED R^2	SE	CHANGE IN R^2	P (ANOVA)
1	individual SES	0.054	0.047	5.73	0.054	0.006
2	individual SES physical activity	0.057	0.043	5.69	0.002	0.019
3	individual SES physical activity nutrition	0.061	0.040	5.70	0.004	0.036
4	individual SES physical activity nutrition Social index neighbourhood	0.064	0.021	5.72	0.003	0.182

At first, the individual SES was included to predict the BMI. It explains R^2=5.4% of the variance in BMI. It can be observed that the first three models show significant results in the ANOVA, but the last one does not show a significant difference to the allocation of the mean ($F(6,132)=1.504$; $p=0.182$). While the fit of model increases by very small amounts between R^2(change)=0.002 and R^2(change)=0.004, the adjusted R^2 decreases with every factor included in the model. This is an indicator that the other variables do not have any influence on BMI, which is confirmed by the coefficients in the models. It also provides the information that the generalization possibility of the results to the population is getting lower with every predictor included.

Only individual SES shows a significant influence of b=-0.42 kg/m^2 (CI: -0.72 – 0.13; p=0.006) if it is the only predictor. It shows that with each point increase in individual SES BMI decreases. This effect remains constant during the inclusion of physical activity and nutrition, but lowers to b=-0.39 kg/m^2 (CI: -0.76 - -0.02; p=0.041) if the SES on neighbourhood level is added to the model. Tolerance and VIF values do not show any severe limitation due to multicollinearity. Because of the decrease in effect size of individual SES, interactions between the centred individual SES and the dummy coded SES on neighbourhood level have been computed, but none of them showed a significant influence.

To examine possible mediator effects in the variables measuring the SES, at first it is looked at the influence of SES on neighbourhood level in a raw model. This model does not show a significant result (F(3,187)=0.682; p=0.564) and none of the dummy variables has significant effects.

Another possible reason, why the effect of the individual SES lowers through adding the SES on neighbourhood level, is that the individual SES has different effects according to the social index of the living environment. So the influence of individual SES on BMI is tested in every category. The result shows only one significant model that is in high SES of the neighbourhood (F(1,19)=4.988; p=0.038) and individual SES explains R^2=20.8% of the total variance. With every point SES increases BMI decreases by b=-0.88 kg/m^2 (CI: -1.70 - -0.06; p=0.038). In the other social index groups, it does not have any influence on BMI.

To summarize the results, individual SES could be identified as being a predictor for BMI, but the further analysis showed that this is only observable in areas with a high social index. Nutrition, physical activity and neighbourhood SES do not have any influence on BMI. To test if age affects the results, it was also included besides the individual SES. It neither has any influence on BMI nor on the effect of individual SES.

4.4 Binary logistic regression on hypertension

Maintaining the method of entering variables into the linear regression models, also in these binary logistic regression analyses are entered following the given order by their correlation coefficient with the outcome. Considering that the effect of physical activity on hypertension is determined by an OR, it will be the first predictor included in the model. Here again, the order of including variables differs among gender, so the analyses are again split, beginning with the females followed by the males. Supplement tables for the binary logistic regression analyses on hypertension are provided in appendix V for women and in appendix VI for men.

4.4.1 Binary logistic regression results for female participants

The regression on hypertension includes 163 women of which 38 (23.3%) suffer from hypertension. This is similar to the total female sample. Also the mean of the nutrition score is similar with $\bar{x}$=18.20 points (SD=3.96). 99 (60.7%) women fulfil the recommendation on physical activity which is less than in the total sample, but average individual SES of $\bar{x}$=7.55 points (SD=3.11) is equally distributed. 27.6% live in an area with very low, 40.5% in one with a low, 16.6% in one with a medium and 15.3% in an area with a high social index, so this distribution differs because it shows a higher representation of low and high social index.

Looking at the model summaries in table 13, it can be observed that the only significant block is the first, ($X^2(1)=5.22$; p=0.022) reducing the error rate in prediction by R^2=4.8%. After that the error rate is reduced, too, but further blocks do not help predicting the occurrence of hypertension significantly better. If the WHO recommendation on physical activity is fulfilled the chance to suffer from hypertension is reduced by 57.5% (OR=0.425; CI: 0.203 – 0.888; p=0.023). Although the other predictors are included in the model, the effect of physical activity stays nearly the same, so that in the last block, the effect is OR=0.410 (CI: 0.191 – 0.879; p=0.022).

To test if any effect of the other predictors is suppressed by another, raw models are being run. Neither nutrition nor SES shows a significant difference, so there is no possible mediator or moderator effect. If all three dummy variables are included to predict the occurrence of hypertension, it is also not significant, but it is indicated, that living in an area with very low social index compared to a high social index has an effect by the significant chi-square of variables not in the equation ($X^2(1)=4.77$; $p=0.029$). If only this dummy is included in the regression, the effect shows an increase of hypertension probability. Compared to the other social indices of the neighbourhood, very low social index nearly doubles the chance of suffering from hypertension (OR=1.926; CI: 1.064 – 3.487; p=0.030). If then physical activity is also included, the effect of the very low social index in the neighbourhood increases to OR=2.212 (CI: 1.181 – 4.145; p=0.013) while the effect of physical activity is the same as before. Interactions between physical activity and social index do not show any significant results, so there is not any moderating effect in these results. Tolerance and VIF values did not show any problem of multicollinearity in the predictors.

Table 13: Model summary for regression on hypertension in females

			OMNIBUS TEST	
BLOCK	**PREDICTORS**	**NAGELKERKE'S R^2**	**CHI-SQUARE (df)**	**P-VALUE**
1	Physical activity	0.048	5.22 (1)	0.022
2	physical activity Social index neighbourhood	0.090	4.79 (3)	0.188
3	physical activity Social index neighbourhood individual SES	0.094	0.51 (1)	0.477
4	physical activity Social index neighbourhood individual SES nutrition	0.103	1.00 (1)	0.317

If the age is included as an additional predictor, the effect of physical activity is maintained, but with an increase by one year of age the OR to suffer from increases to OR=1.074 (CI: 1.049 – 1.100; p<0.001). This seems to be a quite small effect, but if the age differs by 20 years the OR increases to $OR=e^{0.071*20}=4.137$. Also the error rate of prediction decreases significantly ($X^2(2)=51.13$; $p<0.001$) by $R^2=30.7\%$. So the addition of age adds an explanation of variance of $R^2(\text{change})=25.9\%$.

4.4.2 Binary logistic regression results for male participants

The regression analysis on hypertension in male participants includes n=134 men, of which 34 (23%) suffer from hypertension. The percentage share is as high as in the total sample. 88 participants (60.7%) fulfil the recommendation on physical activity which is lower than in the total sample. Average SES of $\bar{x}=7.55$ points (SD=3.11) is a bit lower than in the total sample, but the SD is larger. The mean of nutrition score is $\bar{x}=17.05$ (SD=4.21) similar to the total sample. 20.9% live in an area with very low, 45.5% with low, 18.7% with medium and 15% with high social index. So compared to the total sample, very low social index is underrepresented while low and high status indices are a bit overrepresented.

Table 14: Model summary for regression on hypertension in males

			OMNIBUS TEST	
BLOCK	**PREDICTORS**	**NAGELKERKE'S R^2**	**CHI-SQUARE (df)**	**P-VALUE**
1	Physical activity	0.010	0.93 (1)	0.335
2	physical activity Social index neighbourhood	0.025	1.37 (3)	0.714
3	physical activity Social index neighbourhood nutrition	0.028	0.29 (1)	0.592
4	physical activity Social index neighbourhood Nutrition individual SES	0.028	0.01 (1)	0.946

As it can be observed in table 14, none of the blocks leads to a significant improvement in predicting the occurrence of hypertension in men. To see if any variable's influence is suppressed by another, raw models were conducted, but it could not be found any effect. Multicollinearity in VIF or tolerance values could not be observed in the linear regression.

At last, age is tested to have an influence on the occurrence of hypertension, and it has the same effect like in women. Age reduces the error rate of prediction by R^2=27.4% significantly ($X^2(1)=86.08$; $p<0.001$) and an increase by one year of age leads to an effect of OR=1.073 (CI: 1.055 – 1.092). An increase by 20 years would lead to an OR=4.137.

5 Discussion

To compare the results to recent evidence presented in the theoretical background, it has been clearly observed that SES is associated with many factors. The individual SES is associated with physical activity and nutrition as well as with social index of the neighbourhood if it is looked at the bivariate analysis, though there are some differences between genders. These findings support the results of the systematic review of Psaltopoulou et al. (2017) and the results of the DEGS study by Lampert et al. (2013). With higher SES the nutrition is healthier and the more likely the recommendation on physical activity is fulfilled. As the individual SES is a combination of education, income and occupation, these are also three explanatory factors for the socioeconomic discrepancies in physical activity and nutrition. Often physical activity and nutrition require a certain financial wealth to afford healthy food and e.g. a membership in a gym. A lack of education can also concern health knowledge about a healthy diet and an adequate physical activity, so this may lead to unhealthy decisions. Also the correlation between individual SES and the metabolic risk factors for NCDs, BMI and hypertension, was found in the sample like it is also stated by Hruby & Hu (2015) and by Schienkiewitz et al. (2017). The higher the individual SES, the lower is the BMI and the prevalence of hypertension.

Also the social index of the living environment shows small positive effects on nutrition. This may be due to different food offer in these areas that includes a larger supply of fast food and a lack of healthy food provision found by Psaltopoulou et al. (2017).

The regression analyses on BMI show effects of SES on individual as well as on neighbourhood level, while the individual SES is mediating the effect of the neighbourhood in women. So living in an area with lower social index is not always a risk in itself, but if it is combined with a low individual SES it can lead to an increase of BMI. This may be rooted in better financial and time resources to lead a healthier behaviour because buying food in another part of the city or being a member of a gym becomes affordable. The estimated effect of physical activity and healthy nutrition being associated with lower BMI could not be confirmed in the regression analyses. It needs to be considered that the national prevalence of overweight is higher than in the sample. In women, the prevalence differs by four percent and by around nine percent in men, but the prevalence of obesity is higher in women by three percent and by two percent in men.

A large effect of age increasing the hypertension occurrence is found in both genders that was also stated by Fehr et al. (2017) before, while the prevalence 23.8% in the sample is lower than the nation-wide average of 29.4% in men and 27.4% in women. Female participants show a reduction in the development of hypertension by physical activity. This supports the statement of the WHO (2013) that a lack of physical activity causes hypertension and adequate physical activity can prevent or treat hypertension as well.

Also the linkage of hypertension and BMI found by Cohen (2017) has been observed in the sample, so the higher the BMI the more likely a person suffers from hypertension. According to the WHO (2013) the combination of overweight and hypertension is leading to a highly increased risk to develop one of the major NCDs and affection of main organs.

5.1 Limitations

The most obvious limitation is the prevalence of missing values. Already in the bivariate analysis, it can be recognized that in some correlations only 166 of 288 women respectively 142 of 207 men could be observed. The largest part of missing values is coming from individual SES as many people did not give any information on their income and/or education. In the regression analyses these samples are further reduced by listwise case exclusion to 153 females and 139 males in linear regression analyses on BMI and 163 females and 130 males included in binary logistic regression on hypertension. While most variables including the outcomes are similar to the total sample, the distribution on the different social indices of neighbourhoods differs a lot. High social index is more and lower social index is less represented.

Missing values in single variables can be due to misunderstanding or social desirability. If people are physically active, eat healthy, have normal weight and do not suffer from any diseases, it is more likely to share these data, while a person with the opposite characteristics may feel ashamed or afraid to get judged. Participants may also feel affected in their privacy so that they withhold information on health and lifestyle.

These factors can also be influenced by the way data was collected, but this was not analysed. It may lead to different results depending on if a participant answered in an interview or via paper-pencil and the questionnaire was only handed to another person or sent back to the office. In the last case, it is also not traceable if the participant answered the questionnaire alone or with the help of a friend or family member. The worst case would be if the participant his or herself was not involved at all. Without the help of an interviewer it is also difficult to prevent misunderstandings. For example, information on income was gathered by the household income including social welfare benefits, which was, according to an interviewer, often misunderstood in the interviews as well, but in this case, it could be resolved.

This misunderstanding leads to another limiting factor that is the measurement of the indicators. Regarding the outcomes, it is likely that a person over- or underestimates his or her weight, like it was recognized by Lange & Finger (2017), especially, if the more time has passed since he or she was weighed. Also questionable is the way information on chronic diseases including hypertension was gathered. As the question is if one has ever been diagnosed with e.g. hypertension it may be that the participant has already overcome that disease or is successfully treating it at the moment. So it only gives information on the occurrence during one’s life, but not on the present status.

The questions concerning physical activity do not include the intensity of the activity that needs to be considered according to the WHO (2010). Because only information on time is given the threshold of 150 minutes per week is applied to dichotomizing the variable into (not-)fulfilment of the WHO recommendation. But if one is physically active on a vigorous intensity level for only 75 minutes per week the participant would be labelled as not fulfilling the recommendation even if he or she would according to the WHO (2010).

Like already mentioned in the methods, the nutrition questionnaire could not be validated by an association with BMI. Nutrition is often measured by food frequency lists or food diaries, but their length exceeded the possibilities of the interviews because there was only limited time for the questionnaire. It is likely that these seven items give a brief overview about the nutrition status of a person, but do not reflect it comprehensively.

Individual SES was only measured by highest school degree and equalized net income. Occupation could not be considered because information was not on an analysable level. Data on education was mainly unambiguous, but data on income was needed to be adjusted a lot. The biggest issue was the calculation of the weighted household members. At first the housing situation was asked in the categories 'alone', 'with my partner', and 'with other persons'. After that the total number of people living in the household was recorded. That number should be divided in age categories of 'over 18 years old', 'between 14 and 17 years old', and 'under 14 years old'. Often the sum of the age categories differed from the total number. Sometimes it was clear that the participants excluded his or herself because none of the persons was older than 18 years, but in other cases the discrepancy could not be resolved this easy. If education or income was missing it was not replaced by the other because these variables are not always correlated, so that it would result in misleading values.

SES on neighbourhood level was the only variable in the analyses not needed to be answered by the participant so that there are no missing values, but the different representation of the areas needs to be considered. While in Hamm and in Stellingen more than 100 people have already participated in the study, in Sasel and Wilhelmsburg less than 70 people were interviewed. To compare these groups, it is necessary to have similar sample sizes in the areas.

Also the cross-sectional study design limits the causality, because only associations and no cause-effect relationships can be shown. For example, physical inactivity may lead to an increased weight, but also an increased weight may complicate physical activity. It is unlikely that SES is influenced by the other factors, while these effects cannot be completely disproved.

5.2 Recommendation for action

Based on these results, the focus of interventions should be on socioeconomic factors. Although it is difficult to address, it can be tried to increase knowledge on health promoting behaviours by free course offers, so that a high income is not required. This is thought to balance out any lack of education. The content of these courses can be on a healthy but not cost intensive diet as well as physical activity that does not require a lot of equipment, time or money. The participatory approach chosen in the project

‘Health Promotion and Prevention in Urban Neighbourhoods’ gives an adequate framework to start with ideas like that, while this may give another opportunity to ask the inhabitants of the intervention areas what would have the largest impact to improve their health concerning lifestyle. The collaboration of the people involved in the interventions provide an opportunity to strengthen the neighbourhood’s community. This can result in more thoughtfulness actions and in caring about the living environment. Also health promoting behaviours are likely to be adapted from social contacts. For the individual, it also raises social and psychological resources to cope with stressors in one’s life.

Also institutions of urban planning like the HCU and government agencies can be involved to improve the attractiveness of the living environment to encourage people to be physically active and to spend time outside. Blue and green spaces as well as bicycle trails are factors that are quite obvious regarding this topic, but also the subjective feeling of security needs to be addressed. Higher criminality is often a factor influencing physical activity because the feeling of insecurity demotivates people to do short trips of everyday life by foot or by bike. This can be achieved by an increased police and security personal presence, but also by installing additional street lights. The other factor influencing the motivation to be physically active is the walkability of the area mentioned by Mohnen and Schneider (2014). If the conditions for health promoting behaviours are met it is easier for the individual to adapt these behaviours.

5.3 Outlook for further research

The project aims to collect data from 900 participants. At the end of February 2019, questionnaires from 502 participants were collected. This is a percentage share of 55.8%. So after the planned sample size is achieved, the analysis should be repeated to gain more knowledge. With a larger total sample, it is expected that also the samples includable in the regression analyses are larger. This also enhances the possibility to observe small effects.

The representation of genders is also unequally distributed. If it is looked at the sample, men pose only 41.9% of the sample. So it needs to be decided if the sample should have a 50% share for each gender or if the sample should represent the distribution of the research areas requiring the raw shares of the areas. This different sample sizes regarding gender could be the reason why results in women showed more influencing factor than in men.

At the moment, the institute of medical sociology at the UKE is working on the categorization of occupations so that these can be included in the measurement of individual SES which leads to an improvement in data quality. If only one of the data on income, education or occupation is missing it also can be considered to replace one missing value by the average of the two others, to increase the analysable sample size.

As many other indicators for health and behaviours are measured in the questionnaire, it is important to investigate if other factors have an influence on the outcomes. For example, resilience as a measure of psychological capability can have an impact on overweight and motivation for weight reduction as Fruh (2017) already stated.

Apart from the current data collection and questionnaire, it is a topic of interest if the subjective perception of social class is higher associated with the health issues regarded in this thesis as it is a good indicator for HRQOL, that is also self-rated (Kim & Park, 2015). So more research needs to be done if this indicator of SES is predicting objective health measures like the suffering from chronic conditions or overweight. If this is confirmed the focus of health interventions would shift from only objective measures to the perception of subjective experienced health status and issues.

6 Conclusions

The aim of this thesis was to investigate the association between nutrition, physical activity and SES and intermediate risk factors on NCDs. As risk factors hypertension and increase of BMI were chosen. The result could not state any influence from nutrition, but the influence of physical activity on hypertension was found in women. Age was an important factor predicting the occurrence of hypertension as well as BMI in women. The main influence came from the SES measures, while the individual SES was more likely to influence the outcomes. It needs to be considered that data collection and the measurement of the constructs may be influenced by selection and information bias.

It requires additional research to investigate the behavioural differences in the different status groups. This can already be addressed in the participatory interventions in the selected areas. Further research should also address the subjective rating of social class to find out if this is an influencing factor on health behaviours.

7 Literature

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APPENDICES

Content

APPENDIX I: Relevant extracts of the German survey

Teilnehmer/in - Nr. ☐☐☐☐

Interviewleitfaden und Fragebogen

Guten Tag, mein Name ist ... Ich komme im Auftrag der Hochschule für Angewandte Wissenschaften Hamburg. Wir führen eine Befragung im Rahmen des Projektes „Gesunde Quartiere" durch. Vielleicht erinnern Sie sich, dass wir Ihnen hierzu vor ein paar Tagen schon ein Informationsschreiben zugeschickt haben.

➲ *Interviewer zeigen Sie bitte Ihren Interviewer-Ausweis zur Legitimation vor.*

In dem Projekt „Gesunde Quartiere" entwickelt ein Forschungsverbund aus Hochschule für Angewandte Wissenschaften Hamburg, Universitätsklinikum Hamburg-Eppendorf, HafenCity Universität Hamburg und Universität Magdeburg Maßnahmen, mit denen die Gesundheit und Lebensqualität in ausgewählten Wohngebieten verbessert werden kann.

➲ *Wenn der/die Angesprochene bereit ist das Gespräch zu beginnen,* ***legen Sie ihm/ihr zunächst das Informationsschreiben vor,*** *besprechen Sie die Inhalte und klären eventuelle Fragen. (Hinweis: das Informationsschreiben wurde den potentiellen Teilnehmern bereits im Vorfeld zugeschickt. Die Inhalte sind daher eventuell, aber nicht zwangsläufig bereits bekannt)*

➲ *Wenn der/die Angesprochene zu der Teilnahme an der Befragung bereit ist, bitten Sie um die Unterschrift für die* ***Teilnahme- und Datenschutzerklärung****.*

➲ *Lassen Sie das Informationsblatt und eine Kopie der Teilnahme- und Datenschutzerklärung zum Verbleib bei dem/der Studienteilnehmer_in*

➲ *Dann kann das eigentliche Interview beginnen.*

Wie gesagt, alle Ihre Angaben sind freiwillig: wenn Sie eine Frage nicht beantworten mögen, hat das keine Konsequenzen für Sie.

Aber natürlich freuen wir uns über jede Information und ich bedanke mich schon jetzt für Ihre Mithilfe!

Nichtübertragbare Krankheiten

19. Hatten Sie in den letzten 12 Monaten eine der folgenden Krankheiten? (Mehrfachantworten möglich)

☐ Chronische Atemwegserkrankungen

Hierzu zählen: Asthma, chronische Bronchitis, chronisch obstruktive Lungenerkrankung, Lungenemphysem

☐ Herz-Kreislauf-Erkrankungen

Hierzu zählen: Herzinfarkt, chronische Beschwerden in Folge eines Herzinfarktes, koronare Herzerkrankung oder Angina Pectoris, Schlaganfall, chronische Beschwerden in Folge eines Schlaganfalls, Herzmuskelschwäche/Herzinsuffizienz

☐ Bluthochdruck/Hypertonie

☐ Diabetes/Zuckerkrankheit *Kein Schwangerschaftsdiabetes*

☐ Krebserkrankungen

☐ Psychische Erkrankungen

Hierzu zählen: Depression, Angst und Panikstörungen sowie Suchterkrankungen (Spielsucht, Alkohol, etc.)

☐ Keine dieser Erkrankungen

☐ Keine Angabe

Bewegung - körperliche Aktivität und Sport/Anstrengung[7]

Wir sind daran interessiert herauszufinden, wie viel körperliche Aktivitäten Sie vollziehen. Die folgenden Fragen beziehen sich auf Ihre körperlichen Aktivitäten in den letzten drei Monaten.

61. An wie vielen Tagen in der Woche sind Sie körperlich so aktiv, dass Sie ins Schwitzen oder außer Atem geraten?

> Es geht um eine durchschnittliche Woche.

Anzahl der Tage _____________ ➲ weiter mit Frage 62

☐ An keinem Tag ➲ weiter mit Frage 63

☐ Keine Angabe ➲ weiter mit Frage 65

62. Und wie lange sind Sie an diesen Tagen, an denen Sie durch Ihre körperliche Aktivität ins Schwitzen oder außer Atem geraten, durchschnittlich körperlich aktiv?

Weniger als 10 Minuten	☐
10 bis unter 30 Minuten	☐
30 bis unter 60 Minuten	☐
Mehr als 60 Minuten	☐
Keine Angabe	☐

63. Wie oft treiben Sie Sport?

Keine sportliche Betätigung	☐
Weniger als 1 Stunde in der Woche	☐
Regelmäßig, 1–2 Stunden in der Woche	☐
Regelmäßig, 2–4 Stunden in der Woche	☐
Regelmäßig, mehr als 4 Stunden in der Woche	☐
Keine Angabe	☐

[7] Fragen der GEDA Studie (Lampert et al., 2013)

Ernährung

Der folgende Teil handelt von Ihren Ernährungsgewohnheiten. Beim ersten Frageblock geht es um Aussagen und ich bitte Sie, sich zwischen folgenden Antwortmöglichkeiten zu entscheiden: „trifft zu“, „trifft eher zu“, „trifft eher nicht zu“ und „trifft nicht zu“.

	trifft nicht zu	trifft eher nicht zu	trifft eher zu	trifft zu	keine Angabe
65. Ich ernähre mich ausgewogen und abwechslungsreich.	☐	☐	☐	☐	☐
66. Ich nehme täglich gesunde Fette zu mir (z.B. aus pflanzlichen Ölen oder Nüssen).	☐	☐	☐	☐	☐
67. Ich trinke mindestens 1,5 Liter Wasser oder ungesüßten Tee am Tag.	☐	☐	☐	☐	☐

Bei den folgenden Fragen bitte ich Sie, mir zu sagen, wie oft Sie diese Dinge essen bzw. trinken. Sie können hier Angaben machen, wie „1 mal pro Monat oder weniger", „2-3 mal pro Monat", „1 mal pro Woche", „2 mal pro Tag" etc. *(Bei Angaben, die nicht zur Auswahl stehen, immer aufrunden. Beispiel: „3-4x pro Woche", aufrunden auf „4-6x pro Woche")*

	1 pro Monat oder weniger	2-3 pro Monat	1 pro Woche	2-3 pro Woche	4-6 pro Woche	1 pro Tag	2 pro Tag	3-4 pro Tag	5 pro Tag oder mehr	keine Angabe
68. Wie viele Portionen Obst essen Sie normalerweise? (Eine Portion entspricht z.B. einem Apfel oder einer Handvoll Beeren)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
69. Wie viele Portionen Salat und/oder Blattgemüse essen Sie normalerweise? (Eine Portion entspricht einer Handvoll Salat)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
70. Wie viele Portionen anderes Gemüse essen Sie normalerweise? (Eine Portion entspricht z.B. einer Tomate oder einer Handvoll Brokkoli)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
71. Wie viele Portionen Vollkornbrot essen Sie normalerweise? (Eine Portion entspricht einer Scheibe)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

72. Wie groß sind Sie?

_______ Zentimeter ☐ Keine Angabe

73. Wie viel wiegen Sie?

_______ Kilogramm ☐ Keine Angabe

Soziodemografische Daten

Ich möchte Sie nun um ein paar persönliche Angaben bitten – auch hier gilt natürlich, dass die Daten vertraulich behandelt werden und Sie anonym bleiben.

> Interviewanweisung: nach dem Geschlecht bitte nicht fragen, nur ankreuzen!

Geschlecht weiblich ☐
männlich ☐
anderes ☐

81. Seit wann wohnen Sie schon hier in der Wohngegend?

Monat: ______________

Jahr: ______________ keine Angabe ☐

82. In welchem Jahr wurden Sie geboren?

Geburtsjahr: |__|__|__|__| keine Angabe ☐

83. In welchem Land sind Ihre Eltern geboren?

Mutter

In Deutschland ☐

In einem anderen Land ☐

Welches? ______________________

Keine Angabe ☐

Vater

In Deutschland ☐

In einem anderen Land ☐

Welches? ______________________

Keine Angabe ☐

90. Wie ist Ihre Wohnsituation? Leben Sie…

…allein .... ☐
…mit Ihrer Partnerin/Ihrem Partner.... ☐
…mit anderen Personen, nämlich: ____

Mit Ihnen sind es insgesamt _____ Personen *(Zahl angeben),*
davon Personen unter 14 Jahren _____,
zwischen 14 und 17 Jahren _____,
ab 18 Jahren _____ *(Zahl angeben)*

Keine Angabe ☐

94. Welchen höchsten Schulabschluss bzw. Hochschulabschluss haben Sie?

> Interviewanweisung: offen antworten lassen, ggf. genauer nachfragen

Noch in der Schule	☐
Ohne Schulabschluss abgegangen	☐
Sonderschule/Förderschule	☐
Haupt-/Volksschulabschluss	☐
Realschulabschluss/Mittlere Reife	☐
Abschluss der Polytechnischen Oberschule 10.Klasse (vor 1965: 8.Klasse)	☐
Fachhochschulreife	☐
Erweiterte Oberschule/Allgemeine/fachgebundene Hochschulreife/Abitur	☐
Fachhochschulabschluss/Hochschulabschluss	☐
Einen anderen Schulabschluss, und zwar:	____________________________
Keine Angabe	☐

99. Wie hoch etwa ist das monatliche Haushaltsnettoeinkommen, d.h. das Nettoeinkommen, das Sie (alle zusammen) nach Abzug der Steuern und Sozialabgaben haben? Gemeint sind Einkünfte zum Beispiel aus Arbeit, Rente, Sozialhilfe, Vermietung und anderen Quellen.

☐ Unter 1.000 €	K
☐ 1.000 € bis unter 1.500 €	D
☐ 1.500 € bis unter 2.000 €	S
☐ 2.000 € bis unter 2.500 €	N
☐ 2.500 € bis unter 3.000 €	A
☐ 3.000 € bis unter 3.500 €	Z
☐ 3.500 € oder mehr	W
☐ Weiß nicht	T
☐ Keine Angabe	E

Social index of neighbourhood level is included by the participant's identification number, that is filled out on the first page of the questionnaire.

APPENDIX II: SPSS syntax for all analysis steps

```
**SAMPLE DESCRIPTION.
**Frequencies gender, Split file in males and females.

Missing values Geschlecht (-99).
Frequencies Geschlecht.
Recode Geschlecht (3=-99) (EISE=COPY).
FREQUENCIES Geschlecht.
Sort cases by Geschlecht.
Split file by Geschlecht.

**Age distribution.

Compute Alter=2018-Geburtsjahr82.
If (Geburtsjahr82=-99) Alter=-99.
Missing values Alter (-99).
Execute.

EXAMINE VARIABLES=Alter
  /PLOT BOXPLOT HISTOGRAM NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

**Social index of the neighbourhood.

Recode Quartier (1=2) (2=1) (3=3) (4=4) (5=1) (6=2) into StatusindexQ.
Execute.

FREQUENCIES StatusindexQ.

**Migration background.

COMPUTE Migrationshintergrund=HerkunftM83+HerkunftV83.

Recode Migrationshintergrund (2=0) (3=1) (4=2) (ELSE=SYSMIS).

Value Labels Migrationshintergrund
0 'kein Migrationshintergund'
1 'ein Elternteil nicht in D geboren'
2 'beide Elternteile nicht in D geboren'.

FREQUENCIES Migrationshintergrund.

**DESCRIPTIVE ANALYSES.

**Frequencies of NCDs including hypertension.

FREQUENCIES Krankheiten19_1 to Krankheiten 19_6.

**Description of BMI (metric and categorized)

COMPUTE BMI=Gewicht73 / ((Größe72 / 100) *( Größe72/100)).
EXECUTE.

EXAMINE VARIABLES=BMI
  /PLOT BOXPLOT HISTOGRAM NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

Compute bmi_cat=-99.
if (bmi<18.5) bmi_cat=1.
if (bmi>=18.5 AND bmi<25) bmi_cat=2.
if (bmi>=25 AND bmi<30) bmi_cat=3.
if (bmi>=30) bmi_cat=4.
Missing values bmi_cat (-99).

Value labels bmi_cat
```

```
1 'Untergewicht'
2 'Normalgewicht'
3 'Übergewicht'
4 'Adipositas'.
EXECUTE.

Frequencies bmi_cat.

**Physical activity dichotomization and frequencies.

RECODE Bewegung62 (1=5) (2=20) (3=45) (4=75) (-77=-99) (ELSE=COPY) into PA_Minuten.
RECODE Bewegung63 (1=0) (2=30) (3=90) (4=180) (5=270) (-77=-99) (ELSE=COPY) into Sport_Minuten.
RECODE Bewegung61  (ELSE=COPY) into PA_Tage.
MISSING VALUES PA_Minuten PA_Tage Sport_Minuten (-99).
EXECUTE.

COMPUTE PA_Woche=PA_Tage*PA_Minuten.
COMPUTE PA_Gesamt=SUM(PA_Woche,Sport_Minuten).
EXECUTE.
IF (PA_Minuten=-99 OR PA_Tage=-99) PA_Gesamt=Sport_Minuten.
IF (Sport_Minuten=-99) PA_Gesamt=PA_Woche.
IF (PA_Woche=-99 AND Sport_Minuten=-99) PA_Gesamt=-99.
Execute.
MISSING VALUES PA_Gesamt (-99).
EXECUTE.

COMPUTE PA_Recommendation=-99.
IF (PA_Gesamt<150) PA_Recommendation=0.
IF (PA_Gesamt>=150) PA_Recommendation=1.
VALUE LABELS PA_Recommendation
1 ‘fulfilled’
2 ‘not fulfilled’.
EXECUTE.
MISSING VALUES PA_Recommendation (-99).
EXECUTE.

FREQUENCIES PA_Recommendation.

**Nutrition Scoring, replacement of missing values and description

RECODE Ernährung68 (1,2,3,4=1) (5,6=2) (7=3) (8,9=4) (ELSE=COPY) into S01.
RECODE Ernährung69 (1,2,3,4=1) (5=2) (6=3) (7,8,9=4) (ELSE=COPY) into S02.
RECODE Ernährung70 (1,2,3,4=1) (5,6=2) (7=3) (8,9=4) (ELSE=COPY) into S03.
RECODE Ernährung71 (1,2,3,4=1) (5,6=2) (7=3) (8,9=4) (ELSE=COPY) into S04.
EXECUTE.

MISSING VALUES S01 S02 S03 S04 (-99).
EXECUTE.

COMPUTE ErnährungScore=SUM(Ernährung65,Ernährung66,Ernährung67,S01,S02,S03,S04).
COMPUTE ErnährungMV=NMISS(Ernährung65,Ernährung66,Ernährung67,S01,S02,S03,S04).
EXECUTE.

COMPUTE Ernährung=-99.
IF (ErnährungMV=0) Ernährung=ErnährungScore.
IF (ErnährungMV>0 AND ErnährungMV<3) Ernährung=ErnährungScore+(ErnährungMV*(ErnährungScore/(7-ErnährungMV))).
IF (ErnährungMV>2) Ernährung=-99.
MISSING VALUES Ernährung (-99).
EXECUTE.

EXAMINE VARIABLES=Ernährung
  /PLOT BOXPLOT HISTOGRAM NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

**SES Scoring and description.

COMPUTE Weighted_Members=-99.
RECODE Wohnsituation90 (-99=0) (-77=0) (ELSE =COPY) into Wohnsituation.
RECODE Anzahlu14 (-99=0) (-77=0) (ELSE =COPY) into Anzahlu14_1.
RECODE Anzahlu18 (-99=0) (-77=0) (ELSE =COPY) into Anzahlu18_1.
RECODE Anzahlab18 (-99=0) (-77=0) (ELSE =COPY) into Anzahlab18_1.
RECODE AnzahlPersonen (-99=0) (-77=0) (ELSE =COPY) into AnzahlPersonen_1.
```

```
EXECUTE.
COMPUTE MinusPersonen=-SUM(Anzahlu14_1, Anzahlu18_1, Anzahlab18_1).
EXECUTE.

COMPUTE PersonenDifferenz=SUM(AnzahlPersonen_1,MinusPersonen).
DO IF PersonenDifferenz>=0.
COMPUTE Personenab14=SUM(Anzahlu18_1,Anzahlab18_1,PersonenDifferenz).
END IF.
EXECUTE.
DO IF PersonenDifferenz<0.
COMPUTE Personenab14=SUM(Anzahlu18_1,Anzahlab18_1).
END IF.
EXECUTE.
COMPUTE Personenu14=Anzahlu14_1.
COMPUTE PersonenGesamt=SUM(Personenab14,Personenu14).
Execute.
DO IF (Wohnsituation90=1) AND (PersonenGesamt>1).
COMPUTE Weighted_Members=10+(5*(Personenab14-1))+(3*Personenu14).
END IF.
Execute.
DO IF (Wohnsituation90=2) AND (PersonenGesamt>2).
COMPUTE Weighted_Members=10+(5*(Personenab14-1))+(3*Personenu14).
END IF.
Execute.
DO IF Wohnsituation90=3.
COMPUTE Weighted_Members=10+(5*(Personenab14-1))+(3*Personenu14).
END IF.
Execute.
DO IF Wohnsituation=0.
COMPUTE Weighted_Members=10+(5*(Personenab14-1))+(3*Personenu14).
END IF.
Execute.

DO IF (Wohnsituation=3 AND PersonenGesamt<2).
COMPUTE Weighted_Members=10+(5*(Personenab14))+(3*Personenu14).
END IF.
Execute.

IF (Wohnsituation90=1 AND PersonenGesamt<=1) Weighted_Members=10.
IF (Wohnsituation90=2 AND PersonenGesamt<=2) Weighted_Members=15.
Execute.

IF (Wohnsituation=0 AND Personenab14=0 AND Personenu14=0) Weighted_Members=-99.
IF (Wohnsituation=3 AND Personenab14=0 AND Personenu14=0) Weighted_Members=-99.
EXECUTE.
Frequencies Weighted_Members.

COMPUTE Weighted_Members10=Weighted_Members/10.
RECODE Einkommen99 (1=750) (2=1250) (3=1750) (4=2250) (5=2750) (6=3250) (7=3750) (ELSE=COPY) into Einkommen_met.
EXECUTE.
MISSING VALUES Einkommen_met (-99).
COMPUTE Income_Weighted=Einkommen_met/Weighted_Members10.
COMPUTE InSES=-99.
IF (Income_Weighted<=655) InSES=10.
IF (Income_Weighted>655 AND Income_Weighted<816) InSES=15.
IF (Income_Weighted>=816 AND Income_Weighted<936) InSES=20.
IF (Income_Weighted>=936 AND Income_Weighted<1066) InSES=25.
IF (Income_Weighted>=1066 AND Income_Weighted<1186) InSES=30.
IF (Income_Weighted>=1186 AND Income_Weighted<1291) InSES=35.
IF (Income_Weighted>=1291 AND Income_Weighted<1396) InSES=40.
IF (Income_Weighted>=1396 AND Income_Weighted<1546) InSES=45.
IF (Income_Weighted>=1546 AND Income_Weighted<1666) InSES=50.
IF (Income_Weighted>=1666 AND Income_Weighted<1896) InSES=55.
IF (Income_Weighted>=1896 AND Income_Weighted<2166) InSES=60.
IF (Income_Weighted>=2166 AND Income_Weighted<2666) InSES=65.
IF (Income_Weighted>=2666) InSES=70.
EXECUTE.
MISSING VALUES InSES (-99).
COMPUTE Income_SES=InSES/10.
FREQUENCIES Income_SES.

COMPUTE EdSES=-99.
IF (Bildungsabschluss94=2) EdSES=200.
IF (Bildungsabschluss94=4) EdSES=235.
IF (Bildungsabschluss94=5) EdSES=320.
IF (Bildungsabschluss94=6) EdSES=320.
```

```
IF (Bildungsabschluss94=7) EdSES=425.
IF (Bildungsabschluss94=8) EdSES=425.
IF (Bildungsabschluss94=9) EdSES=655.
EXECUTE.
MISSING VALUES EdSES (-99).
COMPUTE Education_SES=EdSES/100.
EXECUTE.
FREQUENCIES Education_SES.

COMPUTE SES=Income_SES+Education_SES.
EXECUTE.

EXAMINE VARIABLES=Ernährung
  /PLOT BOXPLOT HISTOGRAM NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

**BIVARIATE ANALYSES.
**correlations between metric/dichotomous variables

NONPAR CORR
  /VARIABLES=SES PA_Recommendation Ernährung StatusindexQ BMI Krankheiten19_3
  /PRINT=SPEARMAN TWOTAIL NOSIG
  /MISSING=PAIRWISE.

**Association between physical activity and hypertension.

CROSSTABS
  /TABLES=PA_Recommendation BY Krankheiten19_3
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ RISK
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.

**Association between outcomes and NCD occurrence.

RECODE Krankheiten19_1 (1=1) (0=0) (-99=-99) into NCD.
IF (Krankheiten19_2=1) NCD=1.
IF (Krankheiten19_4=1) NCD=1.
IF (Krankheiten19_5=1) NCD=1.
IF (Krankheiten19_6=1) NCD=1.
IF (Krankheiten19_7=1) NCD=0.
EXECUTE.
MISSING VALUES NCD (-99).
EXECUTE.

NONPAR CORR
  /VARIABLES=BMI NCD
  /PRINT=SPEARMAN TWOTAIL NOSIG
  /MISSING=PAIRWISE.

CROSSTABS
  /TABLES=Krankheiten19_3 BY NCD
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ RISK
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.

**MULTIVARIATE ANALYSES.
**DUMMY CODING Social Index Neighbourhood'**

Compute verylowSI=-99.
If (StatusindexQ=1) verylowSI=1.
If (StatusindexQ>1) verylowSI=0.
EXECUTE.

Compute lowSI=-99.
If (StatusindexQ=2) lowSI=1.
If (StatusindexQ>2) lowSI=0.
If (StatusindexQ<2) lowSI=0.
EXECUTE.

Compute mediumSI=-99.
```

```
If (StatusindexQ=3) mediumSI=1.
If (StatusindexQ>3) mediumSI=0.
If (StatusindexQ<3) mediumSI=0.
EXECUTE.

**Linear Regression on BMI in females.

SPLIT FILE OFF.
REGRESSION
  /SELECT=Geschlecht EQ 1
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES
  /METHOD=ENTER SES verylowSI lowSI mediumSI
  /METHOD=ENTER SES verylowSI lowSI mediumSI PA_Recommendation
  /METHOD=ENTER SES verylowSI lowSI mediumSI PA_Recommendation Ernährung.


**Compute Centred SES and interactions

DO IF Geschlecht=1.
COMPUTE CentredSES=SES-7.58.
COMPUTE CentredNut=Ernährung-17.87.
COMPUTE CentredSESverylowSI=CentredSES*verylowSI.
COMPUTE CentredSESlowSI=CentredSES*lowSI.
COMPUTE CentredSESmediumSI=CentredSES*mediumSI.
COMPUTE IntSESNut=CentredSES*CentredNut.
COMPUTE IntSESPA=CentredSES*PA_Recommendation.
END IF.
EXECUTE.

**Test on moderator effects.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER CentredSES
  /METHOD=ENTER CentredSES verylowSI lowSI mediumSI
  /METHOD=ENTER CentredSES verylowSI lowSI mediumSI CentredSESverylowSI CentredSESlowSI CentredSESmediumSI.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER CentredSES
  /METHOD=ENTER CentredSES PA_Recommendation
  /METHOD=ENTER CentredSES PA_Recommendation IntSESPA.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER CentredSES
  /METHOD=ENTER CentredSES CentredNut
  /METHOD=ENTER CentredSES CentredNut IntSESNut.

**Raw models to test on mediation.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
```

```
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER verylowSI lowSI mediumSI.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER PA_Recommendation.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER Ernährung.

**Influence of predictor on mediator.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT SES
  /METHOD=ENTER verylowSI lowSI mediumSI.

**Model with predictor and mediator on BMI.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES verylowSI lowSI mediumSI.

**Influence of SES on BMI in different social index.

Sort cases by StatusindexQ.
Split file by StatusindexQ.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES.

Split file off.

**Influence of age on BMI.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES verylowSI lowSI mediumSI Alter.

**Linear regression on BMI in males.

REGRESSION
  /SELECT=Geschlecht EQ 2
```

```
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES
  /METHOD=ENTER SES PA_Recommendation
  /METHOD=ENTER SES PA_Recommendation Ernährung
  /METHOD=ENTER SES PA_Recommendation Ernährung verylowSI lowSI mediumSI.

**Compute Centred SES and interactions

DO IF Geschlecht=2.
COMPUTE CentredSES=SES-7.58.
COMPUTE CentredNut=Ernährung-17.87.
COMPUTE CentredSESverylowSI=CentredSES*verylowSI.
COMPUTE CentredSESlowSI=CentredSES*lowSI.
COMPUTE CentredSESmediumSI=CentredSES*mediumSI.
COMPUTE IntSESNut=CentredSES*CentredNut.
COMPUTE IntSESPA=CentredSES*PA_Recommendation.
END IF.
EXECUTE.

**Test on influence from interaction between SES and neighbourhood social index on BMI.

REGRESSION
  /SELECT=Geschlecht EQ 2
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER CentredSES
  /METHOD=ENTER CentredSES verylowSI lowSI mediumSI
  /METHOD=ENTER CentredSES verylowSI lowSI mediumSI CentredSESverylowSI CentredSESlowSI CentredSESmediumSI.

**Raw model with SES on neighbourhood level on BMI.

REGRESSION
  /SELECT=Geschlecht EQ 2
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER verylowSI lowSI mediumSI.

**Test influence of individual SES in social index categories.

Sort cases by StatusindexQ.
Split file by StatusindexQ.

REGRESSION
  /SELECT=Geschlecht EQ 2
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES.

Split file off.

**Influence of age on BMI.

REGRESSION
  /SELECT=Geschlecht EQ 2
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT BMI
  /METHOD=ENTER SES Alter.

**Sample description of sample included in the logistic regression analyses split by gender.
```

```
EXAMINE VARIABLES=Krankheiten19_3 Ernährung PA_Recommendation SES verylowSI lowSI mediumSI BY
    Geschlecht
  /PLOT BOXPLOT STEMLEAF HISTOGRAM
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

**Binary logistic regression on hypertension in females.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER PA_Recommendation
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI SES
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI SES Ernährung
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Raw models on BMI.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER Ernährung
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER verylowSI lowSI mediumSI
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER SES
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Prediction of hypertension by Physical activity and very low social index.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER PA_Recommendation
 /METHOD=ENTER PA_Recommendation verylowSI
 /METHOD=ENTER PA_Recommendation verylowSI Alter
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 1
 /METHOD=ENTER PA_Recommendation
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI PA_Recommendation*verylowSI
PA_Recommendation*lowSI PA_Recommendation*mediumSI
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Test on multicollinearity.

REGRESSION
  /SELECT=Geschlecht EQ 1
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Krankheiten19_3
  /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI SES Ernährung.

**Binary logistic regression on hypertension in males.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 2
 /METHOD=ENTER PA_Recommendation
```

```
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI Ernährung
 /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI Ernährung SES
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Raw models for predictting hypertension.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 2
 /METHOD=ENTER verylowSI lowSI mediumSI
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 2
 /METHOD=ENTER Ernährung
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 2
 /METHOD=ENTER SES
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Influence of age on hypertension.

LOGISTIC REGRESSION VARIABLES Krankheiten19_3
 /SELECT=Geschlecht EQ 2
 /METHOD=ENTER Alter
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

**Test on multicollinearity.

REGRESSION
  /SELECT=Geschlecht EQ 2
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Krankheiten19_3
  /METHOD=ENTER PA_Recommendation verylowSI lowSI mediumSI SES Ernährung.
```

APPENDIX III: Supplement tables of linear regression analyses on BMI in females

Model Summary

Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	,270[a]	,073	,067	5,73348	,073	11,903	1	151	,001
2	,325[b]	,106	,082	5,68826	,033	1,804	3	148	,149
3	,327[c]	,107	,077	5,70371	,001	,199	1	147	,656
4	,329[d]	,108	,071	5,71960	,001	,184	1	146	,668

a. Predictors: (Constant), SES

b. Predictors: (Constant), SES, mediumSI, lowSI, verylowSI

c. Predictors: (Constant), SES, mediumSI, lowSI, verylowSI, PA_Recommendation

d. Predictors: (Constant), SES, mediumSI, lowSI, verylowSI, PA_Recommendation, Nutrition

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B: Lower Bound	Upper Bound	Collinearity Statistics: Tolerance	VIF
1	(Constant)	29,878	1,217		24,550	,000	27,473	32,283		
	SES	-,514	,149	-,270	-3,450	,001	-,808	-,220	1,000	1,000
2	(Constant)	27,731	2,177		12,735	,000	23,428	32,034		
	SES	-,355	,173	-,187	-2,057	,041	-,697	-,014	,731	1,367
	verylowSI	2,977	1,731	,217	1,720	,087	-,443	6,397	,378	2,644
	lowSI	,253	1,453	,021	,174	,862	-2,619	3,125	,413	2,419
	mediumSI	,581	1,691	,038	,344	,732	-2,760	3,923	,495	2,021
3	(Constant)	27,920	2,224		12,553	,000	23,525	32,316		
	SES	-,350	,174	-,184	-2,017	,046	-,694	-,007	,728	1,374
	verylowSI	2,980	1,735	,218	1,717	,088	-,449	6,410	,378	2,644
	lowSI	,283	1,459	,024	,194	,847	-2,600	3,166	,413	2,424
	mediumSI	,609	1,697	,040	,359	,720	-2,744	3,962	,494	2,024
	PA_Recommendation	-,420	,942	-,035	-,446	,656	-2,281	1,441	,990	1,010
4	(Constant)	28,823	3,065		9,404	,000	22,766	34,880		
	SES	-,342	,175	-,180	-1,949	,053	-,688	,005	,719	1,391
	verylowSI	2,966	1,740	,217	1,704	,090	-,474	6,406	,378	2,645
	lowSI	,265	1,463	,022	,181	,857	-2,628	3,157	,412	2,426
	mediumSI	,569	1,704	,037	,334	,739	-2,799	3,937	,493	2,030
	PA_Recommendation	-,367	,953	-,030	-,385	,701	-2,249	1,516	,973	1,028
	Nutrition	-,054	,125	-,034	-,429	,668	-,301	,193	,957	1,045

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = female

Model Summary

Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	,230[a]	,053	,041	6,02075	,053	4,243	3	227	,006

a. Predictors: (Constant), mediumSI, verylowSI, lowSI

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B: Lower Bound	Upper Bound	Collinearity Statistics: Tolerance	VIF
1	(Constant)	23,520	1,064		22,099	,000	21,423	25,618		
	verylowSI	4,059	1,294	,300	3,137	,002	1,510	6,608	,455	2,196
	lowSI	1,442	1,253	,113	1,151	,251	-1,026	3,911	,434	2,302
	mediumSI	2,999	1,368	,200	2,192	,029	,303	5,696	,501	1,994

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = female

Model Summary

Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	,539[a]	,290	,279	2,59935	,290	25,221	3	185	,000

a. Predictors: (Constant), mediumSI, verylowSI, lowSI

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	Upper Bound	Collinearity Statistics Tolerance	VIF
1	(Constant)	10,929	,491		22,247	,000	9,959	11,898		
	verylowSI	-5,248	,614	-,758	-8,553	,000	-6,458	-4,037	,488	2,049
	lowSI	-3,068	,577	-,491	-5,320	,000	-4,206	-1,931	,451	2,217
	mediumSI	-3,897	,651	-,507	-5,986	,000	-5,182	-2,613	,536	1,867

a. Dependent Variable: SES

b. Selecting only cases for which Gender = female

Model Summary

Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	,328[a]	,107	,085	5,61936	,107	4,844	4	161	,001

a. Predictors: (Constant), mediumSI, SES, lowSI, verylowSI

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	Upper Bound	Collinearity Statistics Tolerance	VIF
1	(Constant)	27,624	2,119		13,034	,000	23,439	31,810		
	SES	-,363	,167	-,192	-2,167	,032	-,693	-,032	,705	1,418
	verylowSI	2,927	1,672	,212	1,751	,082	-,375	6,229	,379	2,641
	lowSI	,265	1,379	,022	,192	,848	-2,459	2,989	,413	2,419
	mediumSI	,252	1,591	,017	,158	,875	-2,890	3,393	,483	2,070

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = female

Model Summary

StatusindexQ	Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1,00	1	,121[a]	,015	-,012	7,68916	,015	,553	1	37	,462
2,00	1	,286[a]	,082	,068	4,94388	,082	5,870	1	66	,018
3,00	1	,015[a]	,000	-,033	5,65531	,000	,007	1	30	,934
4,00	1	,182[a]	,033	-,006	3,38110	,033	,856	1	25	,364

a. Predictors: (Constant), SES

Coefficients[a,b]

StatusindexQ	Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	Upper Bound	Collinearity Statistics Tolerance	VIF
1,00	1	(Constant)	30,668	3,091		9,920	,000	24,404	36,932		
		SES	-,384	,516	-,121	-,744	,462	-1,430	,662	1,000	1,000
2,00	1	(Constant)	29,008	1,735		16,720	,000	25,544	32,472		
		SES	-,506	,209	-,286	-2,423	,018	-,924	-,089	1,000	1,000
3,00	1	(Constant)	25,475	2,853		8,929	,000	19,648	31,301		
		SES	-,031	,369	-,015	-,084	,934	-,785	,723	1,000	1,000
4,00	1	(Constant)	26,912	3,559		7,561	,000	19,582	34,243		
		SES	-,297	,321	-,182	-,925	,364	-,959	,365	1,000	1,000

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = female

Model Summary

Model	R Geschlecht = weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	,410[a]	,168	,142	5,43835	,168	6,313	5	156	,000

a. Predictors: (Constant), Age, lowSI, SES, mediumSI, verylowSI

Coefficients[a,b]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	95,0% Confidence Interval for B Upper Bound	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	22,322	2,679		8,333	,000	17,031	27,613		
	SES	-,337	,164	-,178	-2,056	,041	-,661	-,013	,714	1,400
	verylowSI	4,703	1,707	,334	2,755	,007	1,331	8,076	,362	2,760
	lowSI	1,447	1,391	,122	1,041	,300	-1,300	4,194	,388	2,580
	mediumSI	1,845	1,615	,124	1,142	,255	-1,346	5,035	,452	2,211
	Age	,085	,026	,248	3,199	,002	,032	,137	,884	1,131

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = female

Input:			Test statistic:	Std. Error:	*p*-value:
a	-5.248	Sobel test:	2.10659883	0.90431266	0.03515237
b	-0.363	Aroian test:	2.09318598	0.91010737	0.03633256
s_a	0.614	Goodman test:	2.12027288	0.89848058	0.03398304
s_b	0.167	Reset all	Calculate		

Result of the Sobel test (predictor: verylowSI; mediator: SES)

Input:			Test statistic:	Std. Error:	*p*-value:
a	-3.897	Sobel test:	2.04312829	0.69237502	0.04103974
b	-0.363	Aroian test:	2.0183976	0.70085844	0.04354987
s_a	0.651	Goodman test:	2.0687909	0.68378636	0.03856571
s_b	0.167	Reset all	Calculate		

Result of the Sobel test (predictor: mediumSI; mediator: SES)

APPENDIX IV: Supplement tables of linear regression analyses on BMI in males

Model Summary

Model	R Geschlecht = männlich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,233[a]	,054	,047	5,05337	,054	7,858	1	137	,006
2	,238[b]	,057	,043	5,06526	,002	,357	1	136	,551
3	,247[c]	,061	,040	5,07190	,004	,644	1	135	,424
4	,253[d]	,064	,021	5,12166	,003	,130	3	132	,942

a. Predictors: (Constant), SES

b. Predictors: (Constant), SES, PA_Recommendation

c. Predictors: (Constant), SES, PA_Recommendation, Nutrition

d. Predictors: (Constant), SES, PA_Recommendation, Nutrition, lowSI, mediumSI, verylowSI

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	30,348	1,318		23,027	,000	27,741	32,954		
	SES	-,424	,151	-,233	-2,803	,006	-,724	-,125	1,000	1,000
2	(Constant)	30,591	1,382		22,131	,000	27,857	33,324		
	SES	-,407	,154	-,224	-2,637	,009	-,713	-,102	,966	1,036
	PA_Recommendation	-,562	,940	-,051	-,598	,551	-2,421	1,297	,966	1,036
3	(Constant)	29,355	2,070		14,180	,000	25,261	33,449		
	SES	-,424	,156	-,233	-2,719	,007	-,733	-,116	,948	1,055
	PA_Recommendation	-,695	,956	-,063	-,728	,468	-2,586	1,195	,936	1,068
	Nutrition	,084	,105	,069	,803	,424	-,123	,292	,942	1,061
4	(Constant)	28,493	3,066		9,293	,000	22,428	34,557		
	SES	-,388	,188	-,213	-2,061	,041	-,760	-,016	,665	1,504
	PA_Recommendation	-,739	,973	-,067	-,760	,449	-2,663	1,185	,922	1,085
	Nutrition	,088	,107	,072	,824	,411	-,123	,300	,924	1,082
	verylowSI	,623	1,750	,052	,356	,723	-2,839	4,085	,333	2,999
	lowSI	,759	1,475	,073	,515	,608	-2,159	3,678	,351	2,850
	mediumSI	,194	1,724	,014	,113	,910	-3,217	3,605	,460	2,176

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = male

Model Summary

StatusindexQ	Model	R Geschlecht = männlich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
1,00	1	,067[a]	,005	-,022	5,64187	,005	,169	1	37	,684
2,00	1	,173[a]	,030	,014	5,23440	,030	1,883	1	61	,175
3,00	1	,315[a]	,099	,060	5,44576	,099	2,529	1	23	,125
4,00	1	,456[a]	,208	,166	2,81440	,208	4,988	1	19	,038

a. Predictors: (Constant), SES

Coefficients[a,b]

StatusindexQ	Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	95,0% Confidence Interval for B Upper Bound	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1,00	1	(Constant)	28,697	2,636		10,885	,000	23,355	34,038		
		SES	-,164	,399	-,067	-,411	,684	-,972	,644	1,000	1,000
2,00	1	(Constant)	30,195	2,331		12,954	,000	25,534	34,855		
		SES	-,377	,274	-,173	-1,372	,175	-,926	,172	1,000	1,000
3,00	1	(Constant)	31,651	3,048		10,385	,000	25,346	37,956		
		SES	-,591	,372	-,315	-1,590	,125	-1,360	,178	1,000	1,000
4,00	1	(Constant)	35,314	4,639		7,612	,000	25,604	45,024		
		SES	-,876	,392	-,456	-2,233	,038	-1,696	-,055	1,000	1,000

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = male

Model Summary

Model	R Geschlecht = männlich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	,259[a]	,067	,054	5,16011	,067	4,967	2	138	,008

a. Predictors: (Constant), Age, SES

Coefficients[a,b]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	95,0% Confidence Interval for B Upper Bound	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	29,754	1,745		17,054	,000	26,304	33,204		
	SES	-,476	,153	-,257	-3,107	,002	-,779	-,173	,987	1,014
	Age	,024	,027	,073	,886	,377	-,030	,077	,987	1,014

a. Dependent Variable: BMI

b. Selecting only cases for which Gender = male

APPENDIX V: Supplement tables of binary logistic regression analyses on hypertension in females

First four models predicting hypertension, predictors entered by hierarchical method

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	171,806[a]	,032	,048

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,857	,377	5,174	1	,023	,425	,203	,888
	Constant	-,717	,266	7,247	1	,007	,488		

a. Variable(s) entered on step 1: PA_Recommendation.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	167,021[a]	,060	,090

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,829	,383	4,684	1	,030	,437	,206	,925
	verylowSI	,781	,598	1,702	1	,192	2,183	,676	7,051
	lowSI	,012	,596	,000	1	,984	1,012	,315	3,259
	mediumSI	-,346	,746	,215	1	,643	,707	,164	3,055
	Constant	-,939	,539	3,028	1	,082	,391		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	166,516[a]	,062	,094

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	PA_Recommendation	-,851	,385	4,873	1	,027	,427	,201	,909
	verylowSI	1,051	,711	2,190	1	,139	2,862	,711	11,520
	lowSI	,165	,633	,068	1	,795	1,179	,341	4,074
	mediumSI	-,164	,789	,043	1	,836	,849	,181	3,985
	SES	,053	,074	,507	1	,476	1,054	,912	1,218
	Constant	-1,494	,951	2,471	1	,116	,224		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI, SES.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	165,516[a]	,068	,103

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	PA_Recommendation	-,891	,389	5,249	1	,022	,410	,191	,879
	verylowSI	1,045	,709	2,169	1	,141	2,842	,708	11,412
	lowSI	,147	,632	,054	1	,816	1,159	,336	4,001
	mediumSI	-,142	,790	,032	1	,857	,868	,184	4,080
	SES	,040	,075	,288	1	,592	1,041	,899	1,205
	Nutrition	,051	,051	,992	1	,319	1,052	,952	1,162
	Constant	-2,299	1,249	3,386	1	,066	,100		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI, SES, Nutrition.

Model predicting hypertension by physical activity and very low social index

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	235,034[a]	,044	,066

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	PA_Recommendation	-,636	,323	3,881	1	,049	,529	,281	,997
	verylowSI	,763	,333	5,259	1	,022	2,144	1,117	4,116
	Constant	-1,086	,266	16,673	1	,000	,338		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI.

Model predicting hypertension by physical activity, age, and very low social index

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	181,893[a]	,246	,370

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,695	,374	3,460	1	,063	,499	,240	1,038
	verylowSI	1,392	,411	11,478	1	,001	4,024	1,798	9,005
	Alter	,082	,013	37,082	1	,000	1,085	1,057	1,115
	Constant	-5,567	,853	42,616	1	,000	,004		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, Alter.

APPENDIX VI: Supplement tables of binary logistic regression analyses on hypertension in males

First four models predicting hypertension, predictors entered by hierarchical method

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	150,863[a]	,007	,010

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,397	,409	,942	1	,332	,672	,302	1,499
	Constant	-,827	,320	6,656	1	,010	,438		

a. Variable(s) entered on step 1: PA_Recommendation.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	149,498[a]	,017	,025

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,395	,413	,916	1	,338	,673	,300	1,513
	verylowSI	,599	,693	,747	1	,387	1,821	,468	7,087
	lowSI	,315	,633	,248	1	,618	1,371	,396	4,742
	mediumSI	-,062	,755	,007	1	,935	,940	,214	4,130
	Constant	-1,099	,632	3,025	1	,082	,333		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	149,212[a]	,019	,028

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PA_Recommendation	-,357	,419	,723	1	,395	,700	,308	1,593
	verylowSI	,496	,720	,473	1	,491	1,642	,400	6,738
	lowSI	,265	,641	,171	1	,679	1,303	,371	4,577
	mediumSI	-,125	,765	,027	1	,870	,882	,197	3,952
	Nutrition	-,027	,051	,284	1	,594	,973	,881	1,075
	Constant	-,609	1,110	,301	1	,583	,544		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI, Nutrition.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	149,207[a]	,019	,028

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Step 1[a]	PA_Recommendation	-,363	,431	,710	1	,399	,695	,299	1,618
	verylowSI	,522	,823	,403	1	,525	1,686	,336	8,456
	lowSI	,284	,702	,164	1	,685	1,329	,336	5,260
	mediumSI	-,103	,832	,015	1	,901	,902	,177	4,606
	Nutrition	-,027	,051	,287	1	,592	,973	,881	1,075
	SES	,006	,088	,005	1	,946	1,006	,846	1,196
	Constant	-,670	1,432	,219	1	,640	,512		

a. Variable(s) entered on step 1: PA_Recommendation, verylowSI, lowSI, mediumSI, Nutrition, SES.

Model predicting hypertension by age

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	165,514[a]	,185	,275

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than ,001.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Step 1[a]	Age	,072	,014	28,305	1	,000	1,075	1,047	1,104
	Constant	-4,723	,754	39,225	1	,000	,009		

a. Variable(s) entered on step 1: Age.

Declaration of academic honesty

Hereby, I declare that I have composed the presented master thesis independently on my own and without any other resource than the ones indicated. All thoughts taken directly or indirectly from external sources are properly denoted as such.

Hamburg, 15th April 2019

Svenja Mertens