Poverty and health behaviour

Comparing socioeconomic status and a combined poverty indicator
as a determinant of health behaviour

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Abstract

Studies in the area of health economics and public health have shown that low socioeconomic status (SES) and poverty are related to lower levels of health. Attempts to explain these differences have often made reference to the observation that poor health behaviours cluster in low SES respectively poverty groups. However, relatively little attention has been paid to the defining concept of SES and its appropriate measurement.

Therefore data from the German Socio-Economic Panel are used to analyse the relationship between two multidimensional measurements to describe a) poverty respectively b) a low SES and health behaviour, including dietary behaviour, weight status and health behaviour in general.

This study shows that both multidimensional indicators allow identifying an inverse relationship between low SES respectively poverty and several types of health behaviour. However, comparing both indicators it is evident that individuals may be affected by poverty in different ways which has various effects on their health behaviour. Additionally, future research should focus not only on multidimensional poverty measurements but also on dynamic effects.

1. Introduction

Poverty is still present in developed countries like Germany. While most poor individuals are not affected by physical deprivation or hunger, the definition of relative poverty mostly referring to income in comparison to average wealth still concerns several persons to this day. In addition, poverty is not static but dynamic regarding duration and continuity.

Studies in the area of health economics and public health have shown that low socio-economic status (SES) and poverty are related to lower levels of health. For example rates of premature mortality are higher among those with lower levels of education, occupational status or income. Additionally, rates of morbidity are also higher. Altogether, inequality in the so-called "healthy life expectancy" can be observed (1; 2). Attempts to explain these differences have often made reference to the observation that poor health behaviours, such as unhealthy dietary behaviour, smoking or physical inactivity, cluster in low SES respectively poverty groups (3; 4; 5). As an example, studies have shown that a lower SES is associated with poor dietary habits (6; 7) and obesity (8; 9). Furthermore evidence suggests that the health impact increases in magnitude if two or more advertent behavioural patterns are present in combination (6; 8).

The SES is often used in social epidemiology. However, relatively little attention has been paid to the defining concept of SES and its appropriate measurement: there is neither consensus on a definition of SES nor a widely accepted SES measurement tool (10). Traditional components of SES are income, education and occupation (11). These indicators are often used interchangeably even though they are only moderately correlated with one another (1; 12; 13). In Germany, a SES measure was created by Winkler and Stolzenberg (1999), which includes the above mentioned dimensions. The measure is often used in German epidemiological studies (14). Additionally, a new combined poverty index by Groh-Samberg (2008) is introduced which considers several deprivation dimensions next to income to describe nuances of poverty (15).

Against this background the objectives of this study are twofold. The first aim is to analyse the relationship between poverty and unhealthy/ healthy dietary behaviour and the weight status as well as health behaviour in general in the German population in 2008 using data of the German Socio-Economic Panel. The second aim of this study is to test multidimensional poverty measurements in their relation to risky health behaviour. It will be clarified whether these measurements are useful in identifying poverty risk groups who are affected by unhealthy behaviour and weight status which can be seen as central risk factor for health (16).

2. Background

The presented empirical results can be underlined by two theoretical approaches: The "model of explaining health inequality" by Elkeles and Mielck (1997) and the "explanation of health inequality" by Mackenbach (2006) (1; 17). Both approaches consider health behaviour as mediator between social inequality/ a low socio-economic status and health inequality. They show that health behaviour is influenced by socio-economic parameters directly as well as indirectly via the living conditions which is quiet similar to Mackenbach (2006).

However, social inequality can be not only a result of a low SES but also of poverty. Poverty is related to extreme inequality, especially regarding material aspects, which is immediately related to a lack of material resources (19).

Figure 1: Model of explaining health inequality
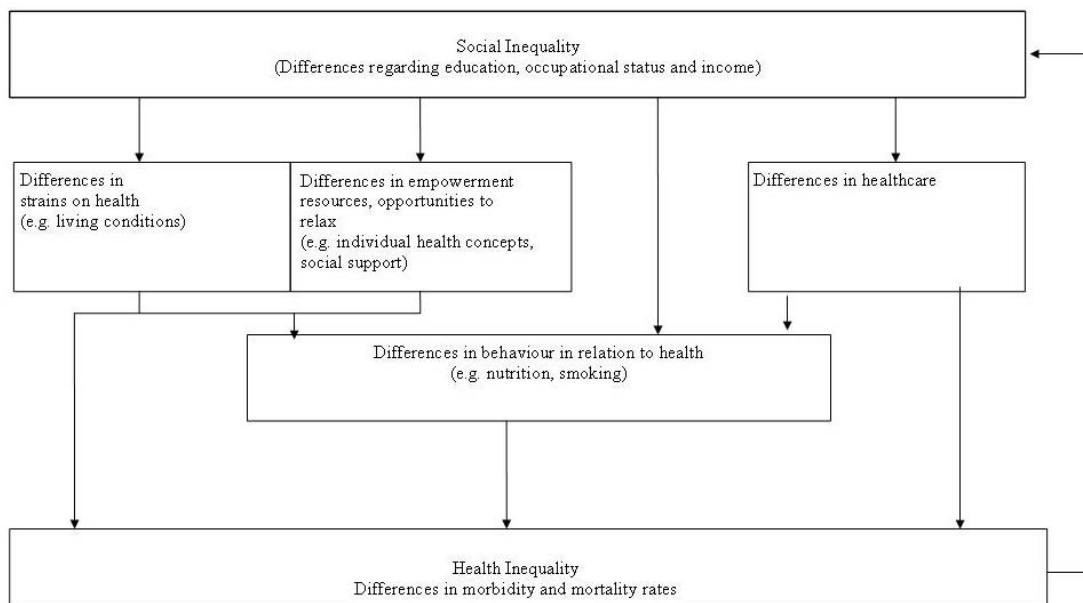
Source: 18 (modified, based on 17)

Mielck and Elkeles (**see figure 1**)show that social inequalities causes differences in strains on health, inadequate empowerment strategies, differences in health care as well as health behaviour. Those factors affect not only health behaviour but also health. The increased morbidity has repercussions on their social situation (20).

Also Mackenbach (2006) assumes that the causal effect on health is likely to be largely indirect (**see figure 2**). Specific health determinants are seen as the main explanation of health inequality. The group of material factors include financial aspects, especially the income situation which influences psychosocial aspects like stress, subsequent risk-taking health behaviour as well as the access to health-promoting facilities and products. Further material factors are health risks related to occupation and to housing. Second psycho-social factors

have to be considered: negative life-events, daily hassles, effort-reward imbalance and a combination of high demands and low control. Both factors influence health either through biological pathways or through behavioural pathways. The latter pathway will be focussed within this study because health outcomes can be influenced via long-term behavioural effects.

Figure 2: Explanation of health inequality
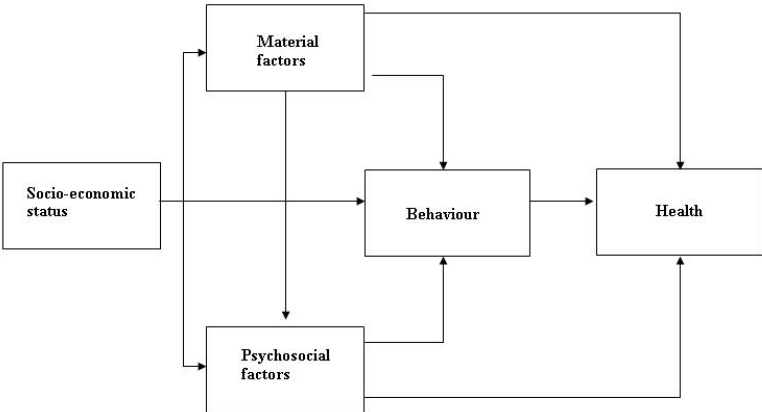
Source: 1

Several definitions and approaches to define poverty in developed countries exist. However, there is no universally valid approach.

In order to analyse study objectives, a definition of poverty is also needed. In industrialized countries, especially Germany, the measure of absolute poverty has become obsolete because only few people are in that condition today. It is supposed that general standard of living requirements related to food, clothing, accommodation and health exists, which is equal and constant across countries and time (21) According to the definition of the Organisation for Economic Co-operation and Development (OECD) absolute poverty threshold consider people to be living in poverty if their income is not sufficient to cover costs of a given basket of goods in a particular year (22). I. e. absolute poverty is oriented on a physical subsistence minimum (23).

However, this study focuses on approaches of relative poverty which has been established in European research (15). The definition of relative poverty, however, is difficult and in general is based on normative criteria (19). The relative poverty concept is based on the idea that an individual or a family is poor or in a state of deprivation, if they have so few materials, social and cultural resources that they are excluded from the lifestyle or standard of living that is the minimum acceptable in the member state in which they live (15). This definition of standard

of living goes back to the British sociologist Peter Townsend, who was the first researcher who provided a definition based on concepts of deprivation and social exclusion (24).

For example, in the European Union the at-risk-poverty-rate as one of the so-called Laeken indicators is defined to be 60% of median net equivalence income (25): a person living in a household with a net equivalent income of less than 60% of national median income is regarded as poor. It is assumed that on such an income s/he is at risk of deprivation and social exclusion (15). Also the German report on Poverty and Wealth is based on this concept (21).

Additionally, it is also calculated at 40%, 50% and 70% for comparison (25). So it is a measure of income poverty implemented in most poverty surveillance studies.

Next to the income-based definition further relative measurements exist. The standard of living and other life domains can be aggregated by the definition of deprivation. Townsend described deprivation 1979 as follows:

"Deprivation takes many different forms in society. People can be said to be deprived if they lack the types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary, or at least widely encouraged and approved in the societies to which they belong" (24).

Peter Townsend created the approach of standard of living by surveying whether essential items, namely goods or practices of everyday life, are missing due to financial restrictions. Further researchers have refined this approach with the last years (cf.: 26- 29). A deprivation in the area of standards of living is existent if a defined amount of items is missing. Nevertheless it is possible that individuals don't need these items although the financial resources are available (19).

Another approach is concentrating on life domains such as quality of dwelling, education, health status, dissatisfaction and sorrows or occupational disadvantages. It was created by Otto Neurath (1931). This approach considers not only material but also immaterial aspects which are not obligatory income-related. Examples are health status, education, and isolation at work. Moreover it can cause income poverty. The term of cumulative deprivation is central to this approach: the more areas are affected the more is a person likely to be classified as poor according to this definition. This approach shows parallels to the capability approach by Amartya Sen. Unfortunately, it is problematically regarding the empirical realisation because there is no consensus which aspects have to be taken into account.

Life domains which are very often used due to availability in data are income and financial reserves, housing, education, occupation, diet, networks and health status. As already mentioned, it is important to differentiate between poverty and social inequality (19).

In conclusion, information on income is not sufficient to determine the degree to which a person is at risk of deprivation. For instance, some households are able to maintain a standard of living that is acceptable in society although they are on a low level of income either because income poverty is only temporary or persons have other resources like savings or gifts. Thus, it has been argued in the European literature to supplement the measurement of income poverty with direct measurements of standard of living (30).

Therefore, this study aims to overcome disadvantages of single measures and applies two multidimensional measurements which consider not only income but also additional aspects of deprivation.

The social status scaling by Winkler and Stolzenberg (1999) includes next to household income the level of education and occupational qualification as well as the highest occupational status within the household (14). SES by Winkler and Stolzenberg is based on an index to describe social prestige and social levels by Scheuch (31). Individual education and occupational qualification describe the "cultural level" and indicate the preference for behaviour. The occupational status of the main earner of a household reflects the impact of the social environment. Additionally, the household income describes the economic situation and indicates which capabilities and restrictions an individual has (14). All three components of this index are defined as life domains (2). Using this index it is possible to examine the relationship between social inequality and health behaviour like it is described in the models of Mielck and Elkeles as well as of Mackenbach.

In contrast Groh-Samberg (2008) focuses on poverty directly. As already mentioned poverty can be result of social inequality but it is no must.

Also Groh-Samberg assumes that describing poverty by income is not sufficient. Therefore the index combines income poverty with four life domains dimensions, namely: housing, consumption, financial reserves and unemployment (15). Minimum standards are defined for income as well as for the four additional life domains. Individuals and households are regarded as poor if they fall below these standards (15). Groh-Samberg takes only life domains into account which are causally related to income as well as variable in time. For this reason education, migration background and health status or similar aspects are not considered by this index.

In conclusion, Groh-Samberg considers aspects of standard of living by Townsend as well as the approach of life domains to describe poverty respectively a low SES using the presented measurements. Referring to the models Mielck and Elkeles as well as Mackenbach the relationship between the combined poverty indicator and health behaviour is examined.

3. Data and estimation

This section is divided into three parts. First, data of the German Socio-Economic Panel are introduced (3.1). Second, the method of the multivariate analyses is presented. Third, dependent (3.3) and independent variables (3.4) of the computed models are described.

3.1 Data description

For the analysis we use the German Socio-Economic Panel (GSOEP) as **data set**. This survey is an ongoing household panel survey of households and individuals conducted annually since 1984, representing the resident population of Germany. Representativeness of the panel is assured by using a weighting-procedure and a multi-step random-sampling process of subsamples for West-German, East-German, foreigners and immigrants and high income sample. This analysis uses the wave in 2008, including 16,188 individuals aged between 17 and 65 years (49.09% male, 51.01% female) in 7,983 households. Further details about the sample can be found in source no. 32. The GSOEP covers topics such as demography, labour market and employment, income, social security, health, education/ qualification and participation (32). Social selectivity has to be assumed: Like the majority of empirical surveys GSOEP is not able to consider homeless persons, illegal immigrants, addicts or persons who are highly deprived because these persons are hardly reachable. In contrast individuals/ households who are aware to control their finances and their living conditions agree more often to take part in surveys like GSOEP. This issue has to be taken into account when interpreting the results of the following analysis (22).

3.2 Multivariate analysis

Dietary behaviour (a), weight status (b) and health behaviour (c) as dependent variables are analysed using SES (I) and the combined poverty indicator (II) within 36 logistic regression. The models are computed for the total population (general model) and by sex as well as without (1) and with (2) adjusting for further independent variables.

$$Logit\ (Y_{1/0}) = b_0 + b_1X_1 + b_2X_2 + ... b_kX_k \tag{1}$$

To interpret the results we use odds ratios (OR). An odds ratio is calculated by dividing the odds in group 1 by the odds in group 2.

$$OR = \frac{Odds_{group1}}{Odds_{group2}} = \frac{P(Y_1=1)}{1-P(Y_1=1)} \Big/ \frac{P(Y_2=1)}{1-P(Y_2=1)} \tag{2}$$

P= probability; Y_1 and Y_2=dependent variable

For additional information about logistic regression the interested reader is referred to source no. 33.

Since health related behaviour varies by sex analysis are computed for the total population as well as separated by sex (34).

3.3 Dependent variables

3.3.1 Dietary behaviour

SOEP as a survey with focus on socio-economics offers no food frequency questionnaire or another detailed measurement to survey dietary behaviour. However, dietary behaviour is measured by the question: "To what extent do you follow a health-conscious diet?" Answers are: "very strong" (=1), strong" (=2), "a little" (=3) and "not at all" (=4). Since it can be suggested that there is a direct association between self-reported healthfulness of diet and dietary quality this question shall represent the dietary behaviour within the German population (c.f. 35). For the following analyses answers are aggregated to a binary variable: healthy diet (=1, includes answers 1 and 2) and no healthy diet (=0; includes answers 3 and 4).

3.3.2 Weight status

Weight status is represented by the body mass index (BMI): Obesity can be seen as a central risk factor for health. Furthermore, being overweight has the same negative consequences as smoking or problem drinking (16).

$$BMI = \frac{weight(kg)}{height^2(m^2)} \qquad (3)$$

Within the SOEP only self-reported height and weight are requested, the BMI is computed for each individual. BMI is classified by four categories based on the definition of the World Health Organization (WHO) (36).

Table 1: Classifying weight status by BMI

Category	Weight Status	BMI
1	Underweight	<= 19,9
2	Normal weight	>=20 - <=25
3	Overweight	>=25,1 - <=30
4	Obesity	>30,1

Source: 36

Furthermore, a binary variable "normal weight" (=1) and overweight (=0, includes category 3 and 4) is constructed. Due to the small number of cases the group of underweight individuals is excluded. BMI values are age-independent for adults and are valid for both sexes (36). Additionally, BMI correlates to 95% with the fat mass and is the best indirect measurement to survey the body fat mass. However, BMI is influenced by muscle mass and constitution so that individual with a high muscle mass may be incorrectly classified as overweight (37).

3.3.3 Health behaviour

Next to eating behaviour and weight status three other categories of health-related behaviours, namely smoking, alcohol consumption and physical activity are considered using an index following Grünheid (38). Smoking is considered by counting the amount of cigarettes/ day (pipes/ cigars are counted as two cigarettes) (cf. 39). It is summarized as dichotomous variable indicating whether the respondent smokes more than 20 cigarettes/ day or not. Above this threshold the risk of cardiovascular diseases increases dramatically (16). Frequency of alcohol drinking is measured by four categories "regularly", "occasionally", "seldom" and "never". Due to the anticipated J-shape of alcohol consumption on health it is focussed on the highest category of drinking: the variable alcohol takes the value 1 if at least one of the following beverages is regularly consumed: beer, wine/ champagne, spirits and mixed drinks (c.f. 16). Physical activity is defined as sufficient if the respondent does sport min once/ week or more often which is near to the recommendations of Robert Koch-Institut (central federal institution responsible for disease control and prevention in Germany) and the Physical Activity Guidelines for Americans (40; 41). For each category of health behaviour one point is assigned if an individual does not show a healthy behaviour (**see table 2**).

Table 2: Index of health behaviour following Grünheid

Binary variable: health behaviour	Point values	Category
Health-conscious behaviour	0	Very healthy lifestyle
	1	Still healthy lifestyle
No health-conscious behaviour	2	Unhealthy lifestyle
	≥ 3	Very unhealthy lifestyle

Source: modified, based on 38

An individual behaves health-conscious if s/he shows a point value of 0 or 1.

3.4 Independent variables

Firstly, SES variables based on the idea of Winkler and Stolzenberg (2.4.1) and the combined poverty indicator by Groh-Samberg (2.4.2) are constructed. Additionally, further independent variables are presented (2.4.3).

3.4.1 Approach based on Winkler and Stolzenberg

Winkler and Stolzenberg consider the following variables on a scale of 1 to 7 to describe the socio-economic status (SES): education and occupational qualification, occupational status as well as income (14). All three dimensions are summed up: The SES is described on a scale of 3 to 21. Three groups can be identified: low SES (score max 8), medium (score 9 – 14) and high SES (15-21). **Table 3** shows in detail the construction of SES by Winkler and Stolzenberg.

If only one variable is missing the value is imputed by the mean of the two other variables. The same procedure is used if the occupational status is "pensioner", "not employed" or "unemployed". (2).

Table 3: Dimensions of the socio-economic status according to Winkler and Stolzenberg

Education		Occupational qualification	Household income	Occupational status	Point Value
no school degree yet dropout, no school degree secondary school degree Intermediate School Degree 10th school degree (East) Technical School Degree	and	no vocational degree other training apprenticeship, not graduated yet	<1,249 Euro	in education apprentice, trainee industry technology apprentice, trainee trainee, intern untrained worker	1
dropout, no school degree secondary school degree other degree	and	apprenticeship vocational school technical school	1,250 – 1,749 Euro	untrained worker semi-trained worker	2
intermediate school degree	and	apprenticeship vocational school technical school university, not graduated yet	1,750 – 2,249 Euro	foreman team leader help in family business employee with simple tasks low-level civil service	3
technical school degree 10th school degree (East)	and	apprenticeship vocational school technical school university, not graduated yet	2,250 – 2,999 Euro	qualified professional middle-level civil service	4
Abitur/ college entrance exam (East) (upper secondary degree)	and	no vocational degree apprenticeship vocational school technical school apprenticeship, not graduated yet, university, not graduated yet	3,000 – 3,999 Euro	self-employed farmer or other self-employed, no co-workers – 9 co-workers	5
Abitur/ college entrance exam (East) (upper secondary degree)	and	technical college	4,000 – 4,999 Euro	free-lance professional high qualified professional high-level civil service	6
Abitur/ college entrance exam (East) (upper secondary degree)		university	≥ 5,000 Euro	self-employed farmer and other self-employed > 9 co-workers managerial executive civil services	7

Source: modified; based on (2)

3.4.2 Combined poverty index by Groh-Samberg (

The described variables refer to household level. Different from the European definition of income poverty, Groh-Samberg uses the "old" OECD equivalence scale: This assigns a value of 1 to the first household member, of 0.7 to each additional adult and of 0.5 to each child. The factors commonly taken into account to assign these values are the size of the household and the age of its members (42).

The equivalent net household income (*ENI*) is computed as follows:

$$ENI = \frac{HHY}{1,0 + 0,7 * i + 0,5 * j} \qquad (4)$$

HHY = Household Income

i = additional adult member (14 years and older); *j* = number of children (younger than 14)

Instead of the median the mean is used which is a standard in previous poverty research. Groh-Samberg defines three income situations: "income poor", "low income" and "adequate income". **Table 4** shows the classification of this income definition.

Table 4: Classification of income within the combined poverty index

Classification	Description
Income Poor	<50% of mean
Low Income	50 – 75% of mean
Adequate Income	>75 of mean

Source: modified, based on 15

The four deprivation dimensions are housing, consumption, financial reserves and unemployment. Regarding housing deprivation includes insufficient room and a lack of basic equipment. Consumption is aggregated in a scale of commodities. This scale includes a large number of items such as owning a car or TV. The deprivation threshold of one standard deviation below the index mean is applied. It has to be considered that GSOEP surveys in years with even numbers only items without adjusting for preferences[1]. To determine deprivation in the area of financial reserves households are regarded as deprived if they have no assets and no significant savings at all. Finally unemployment is a state of deprivation too because it can be seen as one of the most important non-monetary dimensions of social exclusion and lowers life satisfaction substantially (15). Combining income poverty with deprivation measurements nine combinations can be observed altogether:

Table 5: Characteristics of the combined poverty index by Groh-Samberg

Income	Deprivation		
	Multiple deprivation (two or more out of four)	Single deprivation (one out of four)	No deprivation
Income poverty (<50% of mean)	Extreme poverty	Moderate poverty	One-sided poverty
Low income (50-75% of mean)	Moderate poverty	Vulnerability	Fragile prosperity
Adequate income (> 75% of mean)	One-sided poverty	Fragile prosperity	Secure prosperity

Source: (15)

3.4.3 Health and socio-demographic variables

Not only health behaviour affects health outcomes but also vice versa. Schulz and Northridge describe in the model of "Social Determinants of Health and Environmental Health Promotion" that health outcome as well as well-being influence health behaviour (43).

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[1] Participants are only asked whether they own an item or not. In years with uneven numbers they are also asked why they don't own these items: financial reason or another reason.

Therefore subjective health of the previous and of the recent year of the survey is considered. Self-rated health is measured by the international widely accepted scale: How would you evaluate your present health?" Is it "Very Good" (=1), "Good" (=2), "Fair" (=3), "Poor" (=4) and "Bad" (=5)?

Relationship between self-reported health and mortality has been confirmed for GSOEP (44). Additionally, the models consider whether a person is not able to work for more than six weeks/year (yes/no) as well as socio-demographic variables, namely age, marital status, migration background, region of residence (former East/ West Germany), number of persons in general and number of children, aged 0 -14 years, living in a household.

3. Results

4.1 Descriptive statistics

Table 6 shows frequencies of all variables which are used in the multivariate models. Generally, more individuals indicate an unhealthy behaviour than a favourable one. However, women state more often a health-conscious behaviour (all three dependent variables) than men.

Since most variables have been collected on household level, the percentages of the groups regarding poverty differ hardly by sex. The mean of SES is 10.7 (4.14) which is equivalent to the medium group of SES. 31.78% of the individuals are classified as having low SES, 48.65% medium SES and 18.95% as high SES.

Poverty by Groh-Samberg is divided into 9 groups. The majority of respondents (35.59%) belong to the group living in prosperity. In contrast 9.00% are affected by extreme poverty. Also further 22.77% show either an adequate income and a single deprivation (9.88) or vice versa (12.89). 8.83% belong to the group "vulnerability" with a low income and one deprivation. 15.2% are affected by one-sided poverty, i.e. only income poverty (3.38%) or multiple deprivations having an adequate income (11.82) are observed. Less individuals show characteristics belonging to the two groups of moderate poverty (4.03; 4.48). Regarding school education and occupational education 46.41% show a low level, 32.94 a medium level and 20.64% a high level.

The mean of health status in 2007 and 2008 is 3.47 which correspond to the answers "good" to "fair". Further information regarding household characteristics and other socio-demographic variables can be found in table 2.

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Table 6: Data description

N= 16,188 in 7,983 households

Topic	Explanation	Total (%)	Female (%)	Male (%)	Mean (SD) if available
Dietary behaviour	1=healthy diet	46.94	56.50	36.98	
	0= no healthy diet	53.06	43.50	63.02	
Weight status	1=normal weight	46.42	43.50	39.49	
	0=overweight	53.58	56.50	60.51	
Health behaviour2	1= health-conscious behaviour	39.97	48.28	27.55	
	0= no healthy-conscious behaviour;	60.03	51.72	72.45	
SES Winkler	SES total				10.70 (4.14)
	low SES	31.78	32.89	30.63	
	medium SES	48.65	49.07	48.22	
	Reference=high SES	18.95	17.55	20.40	
Poverty By Groh-Samberg	extreme poverty	9.00	10.65	9.30	
	moderate poverty: income poverty and one deprivation	4.58	5.85	4.29	
	moderate poverty: low income and multiple deprivation	4.03	4.79	4.13	
	one-sided poverty: adequate income and multiple deprivation	11.82	11.88	14.41	
	one-sided poverty: income poverty and no deprivation	3.38	4.39	3.10	
	vulnerability: low income and one deprivation	8.83	10.21	9.35	
	fragile prosperity: adequate income and one deprivation	9.88	10.06	11.91	
	fragile prosperity: low income and no deprivation	12.89	14.28	14.33	
	Reference: prosperity (adequate income, no deprivations)	35.59	37.96	41.80	
Education (school/ occupational qualification)3	low education	46.41	41.26	44.64	
	medium education	32.94	32.33	28.52	
	Reference: high education	20.64	18.82	19.36	
Unemployment	Number of months in unemployment/HH4				1.83 (4.82)
	current unemployed	8.75	9.13	8.34	
	Reference: current employed	91.25	90.87	91.66	
Health 2007	1=bad, 5= very good				3.47 (0.93)
Health 2008	1=bad, 5= very good				3.47 (0.94)
Work disability	work disability >6 weeks/ year	3,67	3.03	4.33	
	Reference: work disability <6 weeks/ year	96.33	96.97	95.67	
Sex	female	51.01			
	Reference: male	49.09			
Age					41.62 (13.38)
Age²					1911.38 (1107.00)
Marital status	married, living separated	2.21	2.33	2.01	
	Single, unmarried	33.41	29.71	36.13	
	divorced	10.31	11.29	8.93	
	widowed	2.20	3.49	0.80	
	Reference: married, living together	51.87	51.56	50.45	
Migration background	no migration background	90.25			
	Reference: migration background	9.75	10.20	9.27	
Region of residence	East Germany	17.92	17.34	18.52	
	Reference: West Germany	82.08	82.66	81.48	
Children	Number of children (0-14 years) in HH				0.43 (0.81)
Household	Number of Persons in HH				2.69 (1.28)

[2] Indicator combines 5 types of health behaviour: dietary behaviour, weight status, smoking, alcohol consumption and physical activity

[3] Only used in the models when using the combined poverty indicator by Groh-Samberg.

[4] Only used in the models when using SES by Winkler and Stolzenberg.

4.2. Results of the multivariate analysis

Dietary behaviour (a), weight status (b) and health behaviour (c) as dependent variables are analysed using SES (I) and the combined poverty indicator (II) within 36 logistic regression. The models are computed for the total population (general model) and by sex as well as without (1) and with (2) adjusting for further independent variables (**see tables 7 and 8**). Subsequently, only models of type 2 are interpreted in detail.

4.2.1 Ia Diet and SES based on Winkler and Stolzenberg

Regarding the SES, the results of the six logistic regressions (type 1 and 2) are on the highest significance level ($\leq 0,001$) in each model (**see table 7**). Individuals with a high SES are 1.85 more times likely to follow a **health-conscious diet** than people with a low SES (=$1/OR_{low}$ $_{SES}$[5]). This effect is higher for women (1.92) than for men (1.75). Even if the effect is less strong persons with a medium SES have also fewer chances (total 0.74, female 0.76, male 0.70) to follow a healthy diet than the reference group. Surprisingly, current unemployed persons are 1.20 times more likely to eat healthy. As already assumed (c.f. 33), related to socio-demographic variables the strongest effect is sex: women are 2.69 more likely to follow a health-conscious diet than men. Women without migration background are 1.30 more likely to eat healthy. With increasing number of persons living in a household the fewer the chances for a healthy diet. However, the more children are living in a household the more likely is being in the group of healthy eating. The strongest effect can be observed for women (1.24 vs. 1.12). No significant OR can be observed for health 2007, age and marital status.

4.2.2 Ib Weight status and SES based on Winkler and Stolzenberg

Analysing the determinants of **weight status** almost all OR of SES are significant. Individuals with a low SES have fewer chances having a normal weight in comparison to the high SES group. Women with high SES are 2.22 (1.51) times more likely to be normal weight than women with low (medium) SES. In contrast men with high SES are only 1.25 (1.32) more likely to be normal weight than men with low (medium) SES. Furthermore the general model (not separated by sex) shows that women are 2.5 times more likely to be normal weight than men. Neither unemployment within the household nor current unemployment of an individual is relevant for a person's weight status. Health status of the previous and the current year are significant on a level of min ≤ 0.01: the better the health status the higher is the chance to be normal weight taking into account that the chances are higher for women than for men (e.g. for 2008: 1.25 vs. 1.13).

Regarding the marital status single and divorced individuals are more likely to be normal

weight than married persons who are living in the same household. The strongest effect can be observed for single men (1.83). In contrast widowed women are less likely (0.70) to be normal weight in comparison to the reference group. Also women living in East Germany are less likely (0.80) to be normal weight than women from West Germany. There is no statistical differences between the two weight groups concerning work disability, married, living separated, migration background and household characteristics.

4.2.3 Ic Health behaviour and SES based on Winkler and Stolzenberg

The strongest significant effects are observable for the model of the combined **health behaviour index**. OR for the SES variables are highly significant. The reference group is 2.32 (1.43) times more likely to follow a health-conscious behaviour than the group of the low (medium) SES. Separated by sex the OR is lower for women with low SES than for men (0.40 vs. 0.48). For medium SES the OR is lower for men than for women (0.59 vs. 0.70). Regarding unemployment only the number of months/ household is significant, but the differences are not high (0.97). In contrast self-reported health-status influences the health behaviour: the better the health status the higher is the chance to show beneficial health behaviour. In the group of socio-demographic variables being female has the strongest effect: Being female, the chance for good health behaviour is 3.18 times higher than for men. Furthermore, singles compared with the reference (married persons living together), women without migration background compared to those with migration background as well as living in West Germany have higher chances to follow a health-conscious behaviour than East Germans. For age and the number of persons living in one household only small differences are observable which are significant in parts.

4.2.4 IIa Diet and the combined poverty indicator by Groh-Samberg

By examining the results for the six logistic regressions using the combined poverty indicator by Groh-Samberg results are only significant in parts and just in models where only the index is used without adjusting for other determinants (**see table 8**). For the model where a **healthy diet** is the dependent variable results are only significant for "extreme poverty", "moderate poverty" and "vulnerability". The reference group ("prosperity") is 1.75 times more likely to follow a health-conscious diet than extreme poor individuals. The effect is stronger for women (1.92) than for men (1.49). Also persons who have a low income and are affected by multiple deprivations are less likely to eat healthy (0.62).

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[5] Odds Ratios for the reference group = 1/ OR in table

Table 7: Results of the logistic regression models: Dietary behaviour, weight status and health behaviour and SES by Winkler & Stolzenberg

	Ia Diet (OR: healthy diet =1)						Ib Weight status (OR: normal weight=1)						Ic Health behaviour (OR health oriented=1)					
	total	female	Male	total	female	male	total	female	male	total	female	male	total	female	male	total	female	male
SES low	0.51***	0.44***	0.52***	0.54***	0.52***	0.57***	0.74***	0.50***	1.04	0.60***	0.45***	0.80***	0.46***	0.36***	0.54***	0.43***	0.40***	0.48***
SES medium	0.71***	0.69***	0.67***	0.74***	0.76***	0.70***	0.81***	0.72***	0.85***	0.72***	0.66***	0.76***	0.70***	0.69***	0.62***	0.66***	0.70***	0.59***
SES high	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Unemployment: Number of months/ HH				0.98***	0.98**	0.99				0.99	0.99	1.00				0.97***	0.96***	0.98**
Current unemployed				1.20*	1.17	1.21				0.90	0.82	1.03				0.98	1.02	0.94
Employed				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Health 2007				1.04	1.04	1.05				1.17***	1.20***	1.15***				1.18***	1.18***	1.17***
Health 2008				1.19***	1.23***	1.15***				1.20***	1.25***	1.13***				1.28***	1.28***	1.26***
Work disability >6 weeks/year				0.80*	0.76	0.84				0.95	0.99	0.96				0.84	0.92	0.79
Work disability < 6 weeks/year				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Female				2.69***						2.50***						3.18***		
Male				Ref.						Ref.						Ref.		
Age				0.99	1.00	0.98				0.91***	0.93***	0.89***				0.95***	0.98	0.90***
Age²				1.00***	1.00	1.00**				1.00***	1.00**	1.00***				1.00***	1.00	1.00***
Married, living separated				0.92	0.87	1.00				1.23	1.27	1.26				1.14	0.91	1.61*
Single				0.93	0.91	0.95				1.67***	1.47***	1.83***				1.27***	1.14	1.41***
Divorced				0.87	0.84	0.92				1.53***	1.56***	1.53***				1.00	0.96	1.07
Widowed				0.97	0.94	1.23				0.70**	0.70*	0.80				0.79	0.77	0.76
Married, living together				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
No migration background				1.06	1.30**	0.85				1.12	1.08	1.18				1.41***	1.65***	1.14
Migration background				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
East Germany				0.85***	0.87*	0.83**				0.91	0.80***	1.04				0.81***	0.81***	0.80***
West Germany				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Persons/ HH				0.93***	0.93**	0.94*				0.97	0.96	0.97				0.95*	0.94*	0.95
Children 0-14/HH				1.18***	1.24***	1.12*				1.05	1.08	1.07				1.03	1.07	1.05
Pseudo R²	0.01	0.01	0.01	0.07	0.04	0.03	0.003	0.013	0.001	0.101	0.079	0.086	0.01	0.02	0.09	0.10	0.06	0.06

***, **, * denote significance level at the 0, 1%, 1% and 5% level respectively

If a person is only affected by a single deprivation and income poverty or has a low income the chances are slightly higher (0.74 and 0.79). Participants with low education status are significantly less likely (0.59, women: 0.54, men 0.65) to follow a health-conscious diet than with high education. High educated persons are also 1.37 times more likely to eat healthy than medium educated persons. Unemployed persons are also 1.21 times more likely to eat healthy. The result is only significant for the whole sample but not when separating by sex. Furthermore the better the current health status is the higher the chance being in the group of healthy eating (1.18, women 1.21, men 1.14). Work disability longer than 6 weeks/ year reduce the chance of eating healthy only for the whole sample.

Regarding socio-demographic characteristics females (2.67), women without migration background (1.25), individuals living in West Germany (1.20) and households with children (1.17), especially women (1.23) have higher chances to follow a health-conscious diet. No significant OR can be observed for health 2007, age, marital status and persons/ household.

4.2.5 IIb Weight status and the combined poverty indicator by Groh-Samberg

Regarding **weight status** and the poverty index significant results can be found for the general model (female and male together) and for females but not for males.

Participants who are affected by "extreme poverty", "moderate poverty – income poverty and single deprivation", "one-sided poverty based on income", "vulnerability" and "fragile prosperity based on income" have fewer chances to be normal weight in comparison to prosperous individuals. Participants with low education status are significantly less likely (0.69) to be **normal weight**. High educated persons are also 1.20 times more likely to be normal weight than medium educated persons. The current employment status is not statistically significant. Health status of the previous and the current year are significant on a level of min ≤ 0.01: the better the health status the higher is the chance to be normal weight taking into account that the chances are higher for women than for men (e.g. for 2008: 1.24 vs. 1.13). Regarding the marital status single and divorced individuals are more likely to be normal weight than married persons who are living in the same household. The strongest effect can be observed for single men (1.80). In contrast widowed women are less likely (0.69) to be normal weight in comparison to the reference group. Also women living in East Germany are less likely (0.80) to be normal weight than women from West Germany. There is no statistical differences between the two weight groups concerning work disability, married, living separated, migration background and household characteristics.

Table 8: Results of the logistic regression models: Dietary behaviour, weight status and health behaviour and the combined poverty index by Groh-Samberg

	IIa Diet (OR: healthy diet=1)						IIb Weight status (OR: normal weight=1)						IIc Health behaviour (Health oriented=1)					
	total	female	male	total	female	male	total	female	male	total	female	male	total	female	male	total	female	male
Extreme poverty	**0.48*****	**0.40*****	**0.51*****	**0.57*****	**0.52*****	**0.67****	**0.86***	**0.53*****	**1.37****	**0.77****	**0.54*****	1.15	**0.36*****	**0.25*****	**0.50*****	**0.39*****	**0.31*****	**0.57****
Moderate poverty: Income poverty and one deprivation	**0.69*****	**0.54*****	0.78	**0.74*****	**0.71****	0.79	0.87	**0.63*****	1.11	**0.67*****	**0.53*****	0.97	**0.61*****	**0.38*****	0.97	**0.57*****	**0.42*****	1.11
Moderate poverty: Low income and multiple deprivation	**0.52*****	**0.48*****	**0.50*****	**0.62*****	**0.64*****	**0.60*****	0.98	**0.73****	1.29	0.97	0.77	1.22	**0.49*****	**0.41*****	**0.52*****	**0.57*****	**0.53*****	**0.63****
One-sided poverty: Multiple deprivation	**0.68****	**0.55*****	0.86	0.78	0.63	0.92	0.77	**0.58****	1.04	0.92	0.67	1.11	**0.62*****	**0.52*****	0.79	0.78	**0.64***	1.00
One-sided poverty: Income poverty	0.89	**0.75***	0.95	0.96	1.03	0.87	0.96	0.88	0.88	**0.72****	**0.66****	0.77	**0.82***	**0.77***	**0.69***	0.82	0.89	0.69
Vulnerability: Low income & one deprivation	**0.68*****	**0.64*****	**0.67*****	**0.79*****	**0.77****	**0.82***	0.92	**0.70*****	1.17	**0.81****	**0.66*****	1.02	**0.61*****	**0.51*****	**0.67*****	**0.63*****	**0.56*****	**0.74****
Fragile Prosperity: one deprivation	1.17	1.44	0.92	1.11	1.30	0.97	1.16	1.28	1.02	0.92	1.11	0.80	1.23	1.21	0.99	0.97	1.06	0.86
Fragile Prosperity: Low income	**0.85*****	**0.82****	**0.84***	0.94	0.97	0.91	**0.88****	**0.78*****	0.97	**0.84****	**0.72*****	0.99	**0.72*****	**0.69*****	**0.72*****	**0.78*****	**0.74*****	0.82
Prosperity	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Low education				**0.59*****	**0.54*****	**0.65*****				**0.69*****	**0.67*****	**0.68****				**0.54*****	**0.54*****	**0.53*****
Medium education				**0.72*****	**0.73*****	**0.70*****				**0.83*****	**0.86***	**0.78*****				**0.76*****	**0.78*****	**0.70*****
High education				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Current unemployed				**1.21****	1.19	1.20				0.88	0.81	0.97				0.92	0.97	0.84
Employed				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Health 2007				1.04	1.04	1.05				**1.17*****	**1.19*****	**1.15****				**1.18*****	**1.17*****	**1.18*****
Health 2008				**1.18*****	**1.21*****	**1.14*****				**1.19*****	**1.24*****	**1.13****				**1.26*****	**1.26*****	**1.25*****
Work disability >6 weeks/year				**0.80****	0.77	0.84				0.95	1.01	0.94				0.85	0.94	0.78
Work disability < 6 weeks/year				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Female				**2.67*****						**2.49*****						**3.15*****		
Male				Ref.						Ref.						Ref.		
Age				1.00	1.00	0.99				**0.91*****	**0.94*****	**0.89***				**0.95*****	0.98	**0.91*****
Age²				**1.00****	1.00	**1.00***				**1.00*****	**1.00****	**1.00*****				**1.00*****	1.00	**1.00*****
Married (living separated)				0.93	0.87	1.02				1.26	1.34	1.24				1.19	0.96	**1.67****
Single				0,93	0.91	0.95				**1.66*****	**1.51*****	**1.80***				**1.27*****	1.18	**1.39*****
Divorced				0.89	0.86	0.93				**1.52*****	**1.58*****	**1.52****				1.03	1.00	1.07
Widowed				0.97	0.94	1.21				**0.69****	**0.69***	0.77				**0.79****	0.78	0.70
Married, living together				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
No migration background				1.03	**1.25***	0,83				1.12	1.08	1.17				**1.34*****	**1.55*****	1.12
Migration background				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
East Germany				**0.83*****	**0.83****	**0.83****				**0.90*****	**0.80*****	0.99				**0.79*****	**0.80*****	**0.76*****
West Germany				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.				Ref.	Ref.	Ref.
Persons/ HH				0.96	0.96	0.97				0.99	1.00	0.98				0.99	0.97	0.99
Children 0-14/HH				**1.17*****	**1.23*****	**1.11***				1.05	1.08	1.06				1.04	1.08	1.04
Pseudo R²	0.01	0.02	0.01	0.07	0.04	0.03	0.001	0.01	0.002	0.10	0.08	0.09	0.01	0.02	0.01	0.10	0.07	0.06

***, **, * denote significance level at the 0, 1%, 1% and 5% level respectively

4.2.6 IIc Health behaviour and the combined poverty indicator by Groh-Samberg

The strongest differences can be observed for the model with **health behaviour** as dependent variable. The reference group "prosperity" is 2.56 times more likely to follow a health-conscious behaviour than persons of the group "extreme poverty". The effect is stronger for women (3.23) than for men (1.75). Also OR for both groups of "moderate poverty[6]", women of the group "one-sided poverty - multiple deprivation", "vulnerability" as well as "fragile prosperity – low income" are less likely to show beneficial health behaviour in comparison to the reference group. Furthermore, high educated individuals are 1.85 (1.31) time more likely to realize healthy behaviour than low (medium) educated persons. There a no significant differences between current employed and unemployed individuals. However, self-reported health-status influences the health behaviour: the better the health status the higher is the chance to show beneficial health behaviour, e.g. for 2008: 1.26. In the group of socio-demographic variables being female is the strongest effect: Being a female the chance for good health behaviour is 3.15 times higher than for men

Furthermore, the older a person the less is the chance for healthy behaviour (0.95). In comparison to those who are married and live together persons, men who married but live separated and singles are more likely to behave beneficial. By contrast widowed persons are 0.79 times less likely to show a healthy lifestyle.

Women without migration background (1.55) as well as participants living in West Germany (1.27) have higher chances to follow a health-conscious behaviour than East Germans.

5. *Discussion*

With exception of one OR all results regarding the SES were highly significant and show an inverse gradient with different dimensions of health behaviour: the lower the SES the lower the chances to realize a health-conscious behaviour.

Less clear are the results for models using the combined poverty index. However, lowest OR can be observed for participants who are affected by "extreme poverty". In parts, individuals in the two groups of "moderate poverty", "vulnerability" and "fragile prosperity – low income" have fewer chances to realize beneficial health behaviour. "One-sided poverty – income poverty" is only relevant for women in relation to weight status, "one-sided poverty – multiple deprivation" plays only a role for women regarding health behaviour. "Fragile prosperity – one deprivation" never shows significant values.

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[6] OR for men in the groups of "moderate poverty – income poverty & 1 deprivation" as well as "fragile prosperity – low income" are not significant.

Education status which is extra included only in models with the combined poverty indicator seems to be of comparable relevance like the poverty indicator to explain the different dimensions of health behaviour.

The highest OR (min 2.49) showed the variable for women compared with men. Other socio-demographic variables which can be also seen as life domains which are less changeable in time like migration background, region of residence, marital status and household characteristics are partly significant too.

Thus, data of GSOEP can confirm both previous empirical results as well as the "model of explaining health inequality" by Elkeles and Mielck (1997) and the "explanation of health inequality" by Mackenbach (2006) (1; 17) which describe an inverse relationship between socio-economic status and dietary behaviour, weight status as well as health behaviour in general. This study shows that the models are also valid for poverty, an extreme form of social inequality.

Using the combined poverty index it is obvious that poverty groups have to be regarded in more detailed groups than it is allowed by the three SES groups which are often used in epidemiological studies. Additionally, the combined poverty indicator allows identifying why a person is classified in a certain group. Not only persons who are affected by poverty but also persons who are at-risk to become poor ("fragile prosperity") can be identified. In contrast, SES is not oriented on poverty thresholds because SES does not only aim to identify poor individuals respectively households but social status.

To enhance further analyses using SES more than three SES group should be examined: the social status scaling by Winkler and Stolzenberg allows classifying SES in smaller groups too (c.f. 2). Especially the group of low SES could be split up into more detailed groups.

Otherwise, due to its high relevance future models using the combined poverty index should also consider the life domain of education.

Additionally, all models confirm the assumption that health behaviour is differentiated by sex so that further analyses should be also conducted separated by sex.

In conclusion, this study shows that both multidimensional indicators allows identifying an inverse relationship between low SES respectively poverty and several types of health behaviour. However, poverty should be analysed not only as low SES but also more in detail.

Outlook

Since poverty and social inequality are no static phenomena further research will focus next to the multidimensional aspects on dynamic panel analysis including previous waves of GSOEP. Previous research showed that poverty has dynamic character: some people are short term poor e.g. due to unemployment. Only a minority is long term poor (15). Additionally, not only duration but also

continuity/ discontinuity of poverty have to be considered (45). We will try to find an answer whether and to which extend poverty dynamics influence dietary behaviour, weight status and health behaviour in general and whether dynamic processes can be indentified.

Limitations

Data of GSOEP focuses mainly on socio-economic aspects in Germany Data regarding health behaviour are part of the questionnaire but not in detail. However, epidemiological surveys offer fewer details regarding socio-economic aspects which we have considered in our analysis. Additionally, one has to take into account that the results are not valid for extreme types of poverty like homeless persons, illegal immigrants, addicts or persons who are highly deprived because they are not listed in GSOEP.

Acknowledgements

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