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ORIGINAL ARTICLE

Income or living standard and health in Germany: different ways of measurement of relative poverty with regard to self-rated health

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Abstract
Objectives Current study introduces the living standard concept as an alternative approach of measuring poverty and compares its explanatory power to an income-based poverty measure with regard to subjective health status of the German population.
Methods Analyses are based on the German Socio-Economic Panel (2001, 2003 and 2005) and refer to binary logistic regressions of poor subjective health status with regard to each poverty condition, their duration and their causal influence from a previous time point. To calculate the discriminate power of both poverty indicators, initially the indicators were considered separately in regression models and subsequently, both were included simultaneously.
Results The analyses reveal a stronger poverty–health relationship for the living standard indicator. An inadequate living standard in 2005, longer spells of an inadequate living standard between 2001, 2003 and 2005 as well as an inadequate living standard at a previous time point is significantly strongly associated with subjective health than income poverty.
Conclusion Our results challenge conventional measurements of the relationship between poverty and health that probably has been underestimated by income measures so far.

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Introduction

Empirical studies already proved that poor people have worser health outcomes than richer people. Significant associations between poverty and ill health are consistent for developing (Zaidi 1988; Murray 2006; Gwatkin et al. 2007; Peters et al. 2008) as well as for developed countries such as, for example, Germany (Fuchs 1995; Hahn et al. 1995; Dowler and Dobson 1997; Helmert et al. 1997a, b; Thiede and Traub 1997; Benzeval et al. 2000; Heinzel-Gutenbrenner 2001; Sturm and Wells 2001; Santana 2002; Wagstaff 2002; Regidor et al. 2003; Drewnowski and Specter 2004; Nolte and McKee 2004; Nielsen et al. 2004; Lampert and Kroll 2006; Shaw et al. 2006). In this context, longitudinal studies for developed countries have suggested that the poverty–health relation is primarily based on causal influences of poverty and that especially long-term poverty as well as persistent poverty is harmful to health (Lynch et al. 1997; Benzeval and Judge 2001; McDonough and Berglund 2003; McDonough et al. 2005). Nonetheless, several authors have suggested that the relationship between poverty and ill health are causally intertwined (Blane et al. 1993; Thiede and Traub 1997; Wagstaff 2002; Halleröd and Larsson 2008).

For developed countries like Germany, poverty is commonly defined in relative terms meaning a relative exclusion from societal living due to a lack of material, social or cultural resources in comparison to a given average (Piachaud 1987; Ringen 1988; Atkinson 1998; Citro and Michael 1995). According to this definition, health researchers predominantly indicate relative poverty

by income. In market economies, income reflects, to a certain extent, the accessibility to a large number of market goods (medical care, nutrition, housing, etc.). Furthermore, income is relative easy to obtain for all developed societies and their measurements are comparable within and between societies (Ringen 1988; Andress 1999, 2003; Andress et al. 2001; Perry 2002). Nonetheless, the use of an income-based poverty measure has been criticized because its inquiry (1) does not take other financial resources and advantages into account, (2) neglects temporal fluctuations of income (3) ignores certain financial burdens and (4) is sensitive towards social refusal (Ringen 1988; Whelan 1993; Andress 1999, 2003; Andress et al. 2001; Perry 2002; Nolan and Whelan 2007).

In contrast, the living standard concept of Peter Townsend (1979), already introduced in the early 1980s, overcomes the problems of income-based poverty measurement by focusing directly on the outcome of people's actual resource allocation in terms of achieving a certain living standard (Ringen 1988). Accordingly, individual living standard is a result of how people utilize the resources available to them. If, due to financial shortages, they lack a generally accepted living standard, people are denoted as relatively poor (Mack and Lansley 1985; Townsend 1987). The measurement of a generally accepted living standard thereby relies on a list of items and activities that reflects the socially perceived necessities for an adequate participation in society. In this context, Townsend (1987) differentiates between relative deprivation and relative poverty with regard to an inadequate living standard. People who are unable to participate in societal living because of aspects such as ill health or education are determined as relative deprived, but only defined as poor if their problems are due to financial shortages. In comparison with income-based indicators, the benefits of the living standard approach are: (1) it focuses on the outcome of all invested resources, (2) it comprehends poverty as a multidimensional concept and (3) it refers directly to the actual living situation of an individual (Ringen 1988; Desai and Shah 1988; Whelan 1993; Muffels 1993; Halleröd 1995, 1996, 2006; Andress 1999, 2003; Lipsmeier 2001; Andress et al. 2001; Böhnke and Delhey 2001; Whelan et al. 2004; Boarini and d'Ercole 2006; Nolan and Whelan 2007; Jensen et al. 2007; Guio 2009).

The differences and characteristics of both poverty indicators have been documented by a wide range of publications. These have consistently shown that income poverty is only weakly associated to an inadequate living standard, although income measures are considered as indirect determinants of people's living situation (Desai and Shah 1988; Mayer and Jencks 1989; Deleeck and van den Bosch 1992; Muffels et al. 1992; Muffels 1993; Callan et al. 1993; Delhausse et al. 1993; Halleröd 1994, 1995; Nolan and Whelan 1996a, b; Kangas and Ritakallio 1998; Andress 1999; Andress and Lipsmeier 1999, 2000; Böhnke and Delhey 1999, 2001; Klocke 2000; Lipsmeier 2001; Andress et al. 2001, 2004; Layte et al. 2001; Whelan et al. 2001, 2002b, 2003, 2004; Bradshaw and Finch 2003; Jensen et al. 2003, 2007; Halleröd et al. 2006; Boarini and d'Ercole 2006; Whelan and Maitre 2006). In this context, studies have shown that long-term income poverty contributes much more to an inadequate living standard than shorter periods, especially since other financial resources can supplement possible income losses in the short run (Mayer and Jencks 1989; Layte et al. 2001; Whelan et al. 2002a, b, 2003, 2004; Whelan and Maitre 2006). These results are consistent with other studies, which have indicated that income is only one of several important factors such as property ownership, health, age, education, employment and marital status that contribute to individual's living standard (Desai and Shah 1988; Mayer and Jencks 1989; Muffels et al. 1992; Delhausse et al. 1992; Mayer 1993; Muffels 1993; Callan et al. 1993; Halleröd 1995, 1996; Andress and Lipsmeier 1999; Nolan and Whelan 1996a, b; Kangas and Ritakallio 1998; Böhnke and Delhey 1999, 2001; Andress 1999, 2006; Lipsmeier 2000; Andress et al. 2001; Layte et al. 2001; Whelan et al. 2002b, 2003, 2004; Short 2005; Bradshaw and Finch 2003; Jensen et al. 2003, 2007; Boarini and d'Ercole 2006; Halleröd et al. 2006). Furthermore, the less explanatory power of income-based poverty indicators is confirmed by studies that have consistently shown that an inadequate living standard is significantly strongly associated with subjective well-being as well as with psychosocial and economic distress than income poverty (Nolan and Whelan 1996b; Böhnke and Delhey 1999, 2001; Whelan et al. 2001, 2002a, b; Layte et al. 2001; Vetter et al. 2006; Lorant et al. 2007; Whelan and Maitre 2009). In addition, Bradshaw and Finch (2003) found that an inadequate living standard is rather connected to an exclusion from essential services and social relations than low income. Furthermore, Stronks et al. (1998) illustrated for different regions in the Netherlands that different types of an inadequate living standard are significantly associated to subjective health and that a considerable part of the increased health risks of lower income groups are explained by an insufficient living standard. More recently, Halleröd and Larsson (2008) have shown that in Sweden a wide range of welfare problems such as political participation, crime, housing deprivation, illness, unhealthy behaviors and psychosocial burdens are significantly more common with an inadequate living standard than with income poverty. Accordingly, the theoretical and empirical debate reveals that both indicators measure different kind of degrees of poverty: the income weaker and the living standard stronger in terms of their assessment of the shortages of wealth.

The objective of our study is to evaluate the impact of different relative poverty measures on the magnitude of the poverty–health relation. According to the theoretical and empirical debate, we consider that the magnitude of the poverty–health relation will vary with specific poverty indicators, and, more precisely, that the living standard indicator will be strongly associated to subjective health than income.

To verify these assumptions, three research questions will be considered that correspond to common issues of health research referring to the relation between poverty and health. This will encompass a cross-sectional analysis of the poverty–health relation, a long-term analysis about the association between the specific poverty duration and health, and a longitudinal analysis to assess the causal influence of poverty on health.

Methods

Analyses are based on longitudinal data from the German Socio-Economic Panel Study (GSOEP) 2001, 2003 and 2005 (SOEP Group 2001; Grabka 2002; Wagner et al. 2007). Besides information about respondents' socio-demographic characteristics and current health status, since 2001 the GSOEP evaluates the current living standard of its respondents every 2 years. For this reason, the following analyses are based on longitudinal subsamples from 2001, 2003 and 2005. Additionally, we restricted our analysis to persons 18 years and older. The representative size of respondents depends on the specific research question we have pursued: for cross-sectional analysis information of 18,313 participants was available in 2005; for long-term analysis that refers to the duration of the specific poverty situation, information of 11,483 participants was available in 2005; for longitudinal analysis of the years 2001, 2003 and 2005 information of 14,654 persons was available (see Table 1).

The dependent variable subjective health status was indicated by a distinction between poor and good health measured with a question about the subjective health condition. In this context, several studies have emphasized the validity and reliability of subjective health measures (Farmer and Ferraro 1997; Idler and Benyamini 1997; Jylhä 2009). The exact wording and response option of current health question is consistent with recommendations of the WHO (1996) and the EURO-REVES 2 group (Robine et al. 2003). Participants were asked, "In general, how would you describe your current health status?" Those who responded "very good" "good" or "satisfying" were considered to be in good health, while those who responded "poor" or "bad" health were considered to be in poor health.

The key variable for constructing our measure of income poverty is an open question of the German Socio-Economic Panel about the disposable household income in the last month after taxes and transfers are subtracted. Following conventional practice, we have adjusted the disposable household income for household size and composition by using the modified OECD scale (Hagenaars et al. 1994), with every member of a household receiving an individual income. We defined an individual as poor if his or her disposable income is below 50% of the median disposable income within the German population.

The actual living standard of an individual was measured in 2001, 2003 and 2005 on the basis of eleven indicators which were part of the household questionnaire of the GSOEP. In this context, people were asked whether a color television, a telephone, a car, furniture, an adequate housing, a good neighborhood, the affordability with regard to payments, savings for emergencies, a vacation for at least a week once a year, a dinner at least a month or a hot meal with meat, fish or poultry apply to their household, and if not, whether financial or other reasons were responsible for this (see Table 2).

The indicators within the GSOEP are based on previous data sources (Social Sciences Bus Survey III/1996; German Welfare Survey 1998/1999) for which several studies have shown their reliability with regard to indicate the societal necessities by the majority of the German population (Andress 1999, 2006; Lipsmeier 1999, 2001; Andress and Lipsmeier 1999, 2000; Böhnke and Delhey 1999, 2001; Andress et al. 2001, 2004). The measurement of individuals' living standard is based on previous studies that have realized the living standard approach with the GSOEP (Andress et al. 2004; Andress 2006; Groh-Samberg and Goebel 2007). Accordingly, we will create an un-weighted additive index that indicates the number of lacking living standard items due to financial reasons. Based on the approach of Andress et al. (2004) a person will be denoted as 'poor' (1 = inadequate living standard), if three living standard items are lacking due to financial reasons. If a person states that she/he possesses more than four of these items or that they are lacking them due to other reasons, she/he will be denoted as 'not poor' (0 = adequate living standard). Finally, those who are not assignable to a group due to missing values will be excluded from analysis.

Furthermore, several control factors were considered to control for possible confounding effects. These included socio-demographic characteristics such as age, gender, marital status, occupational status, education, nationality and residence (East- or West-Germany).

Statistical analysis

The statistical analyses are based on three research questions that correspond to common issues within health research and refer to comparison of the explanatory power

Table 1 Descriptive summary of dependent and independent analysis variables of the German Socio-Economic Panel in cross-sectional analysis in 2005, cross-sectional analysis in 2005 with poverty duration and longitudinal analysis in 2001, 2003 and 2005

	Cross-sectional analyses in 2005		Cross-sectional analysis in 2005 with poverty duration		Longitudinal analysis in 2001, 2003, 2005	
	All participants (poor health status), *n* (%)	All participants (adequate health status), *n* (%)	All participants (poor health status), *n* (%)	All participants (adequate health status), *n* (%)	All participants (poor health status in *t*), *n* (%)	All participants (adequate health status in *t*), *n* (%)
Overall	3,219 (18)	15,094 (82)	2,152 (19)	9,331 (81)	5,058 (18)	22,881 (82)
Income poverty						
Cross-sectional						
<50% in 2005	390 (25)	1,199 (75)			337 (28)	858 (72)
>50% in 2005	2,829 (17)	13,895 (83)			2,380 (19)	10,343 (82)
<50% in 2003	–	–	–	–	269 (23)	898 (77)
>50% in 2003	–	–	–	–	2,072 (16)	10,782 (84)
Duration						
<50% At no time point		–	1,921 (18)	8,691 (82)	–	–
<50% in 2005	–	–	88 (22)	312 (78)	–	–
<50% in 2003 and 2005	–	–	51 (25)	150 (75)	–	–
<50% in 2001, 2003 and 2005	–	–	92 (34)	178 (66)	–	–
Time-lagged						
<50% in 2003_{t-1}	–	–	–	–	241 (25)	708 (75)
>50% in 2003_{t-1}	–	–	–	–	2,100 (16)	10,972 (84)
<50% in 2005_{t-1}	–	–	–	–	293 (26)	848 (74)
<50% in 2005_{t-1}	–	–	–	–	2,424 (19)	10,353 (81)
Living standard poverty						
Cross-sectional						
Inadequate in 2005	757 (25)	2,290 (75)	–	–	641 (28)	1,665 (72)
Adequate in 2005	2,462 (16)	12,804 (84)	–	–	2,076 (18)	9,536 (85)
Inadequate in 2003	–	–	–	–	476 (23)	1,573 (77)
Adequate in 2003	–	–	–	–	1,865 (16)	10,107 (84)
Duration						
Inadequate at no time point	–	–	1,695 (17)	8,122 (82)	–	–
Inadequate in 2005	–	–	142 (23)	475 (77)	–	–
Inadequate 2003 and 2005	–	–	111 (25)	334 (75)	–	–
Inadequate in 2001, 2003 and 2005	–	–	204 (34)	400 (66)	–	–
Time-lagged						
Inadequate in 2003_{t-1}					409 (25)	1,240 (75)
Adequate in 2003_{t-1}					1,932 (16)	10,440 (84)
Inadequate in 2005_{t-1}					542 (27)	1,476 (73)
Adequate in 2005_{t-1}					2,175 (18)	9,725 (82)
Control variables						
Age (years)						
18–29	151 (5)	2,772 (95)	45 (5)	915 (95)	176 (6)	2,803 (94)
30–39	275 (9)	2,901 (91)	177 (9)	1,889 (91)	439 (8)	5,121 (92)
40–49	544 (14)	3,349 (86)	320 (13)	2,239 (87)	840 (14)	5,359 (86)
50–59	653 (21)	2,461 (79)	430 (21)	1,628 (79)	1,008 (22)	3,668 (78)
60–69	733 (25)	2,272 (75)	507 (24)	1,591 (76)	1,275 (26)	3,681 (74)
>70	863 (39)	1,339 (61)	673 (39)	1,069 (61)	1,320 (37)	2,249 (63)

Table 1 continued

	Cross-sectional analyses in 2005		Cross-sectional analysis in 2005 with poverty duration		Longitudinal analysis in 2001, 2003, 2005	
	All participants (poor health status), *n* (%)	All participants (adequate health status), *n* (%)	All participants (poor health status), *n* (%)	All participants (adequate health status), *n* (%)	All participants (poor health status in *t*), *n* (%)	All participants (adequate health status in *t*), *n* (%)
Gender						
Male	1,440 (16)	7,366 (84)	985 (18)	4,541 (82)	2,232 (17)	11,073 (83)
Female	1,779 (19)	7,728 (81)	1,167 (20)	4,790 (80)	2,826 (19)	11,808 (81)
Nationality						
German	2,981 (17)	14,068 (83)	2,010 (19)	8,746 (81)	4,633 (18)	21,169 (82)
Other	238 (19)	1,026 (81)	142 (20)	585 (80)	425 (20)	1,712 (80)
Residence						
East-Germany	829 (18)	3,679 (82)	599 (20)	2,427 (80)	1,379 (19)	6,039 (81)
West-Germany	2,390 (17)	11,415 (83)	1,553 (18)	6,904 (82)	3,679 (18)	16,842 (82)
Educational attainment						
Still attending to school	18 (5)	330 (95)	–	–	4 (9)	41 (91)
Secondary general school	1,528 (25)	4,493 (75)	1,087 (26)	3,147 (74)	2,511 (24)	7,912 (76)
No graduation	109 (28)	278 (72)	63 (31)	143 (69)	195 (31)	440 (69)
Intermediate school	652 (13)	4,212 (87)	420 (13)	2,708 (87)	985 (13)	6,590 (87)
Upper secondary school	187 (10)	1,686 (90)	116 (11)	899 (89)	273 (11)	2,250 (89)
Higher education	524 (13)	3,489 (87)	340 (14)	2,079 (86)	757 (14)	4,662 (86)
Other graduation	201 (25)	606 (75)	126 (26)	355 (74)	333 (25)	986 (75)
Occupational status						
Unemployed	238 (21)	898 (79)	148 (23)	504 (77)	405 (23)	1,382 (77)
Untrained and trained worker	198 (15)	1,106 (85)	119 (15)	687 (85)	331 (15)	1,918 (85)
Trained and employed as skilled worker	133 (11)	1,072 (89)	89 (11)	722 (89)	201 (10)	1,854 (90)
Foreman and master craftsman	30 (12)	222 (88)	24 (14)	150 (86)	47 (11)	373 (89)
Self-employed	118 (11)	966 (89)	60 (10)	533 (90)	160 (11)	1,258 (89)
Employee with simple duties, with(without) training/education certificate	132 (12)	976 (88)	74 (10)	645 (90)	197 (11)	1,633 (89)
Employee with qualified duties	239 (11)	2,027 (89)	159 (10)	1,411 (90)	377 (10)	3,395 (90)
Employee wit highly qualified duties or managerial function	120 (8)	1,391 (92)	75 (8)	865 (92)	169 (8)	1,906 (92)
Civil service (lower and middle level)	26 (13)	174 (87)	24 (16)	127 (84)	37 (11)	291 (89)
Civil service (upper and executive level)	79 (13)	542 (87)	39 (12)	287 (88)	80 (11)	623 (89)
Not employed	1,785 (31)	3,964 (69)	1,293 (31)	2,874 (69)	2,905 (30)	6,656 (70)
In occupational training	96 (6)	1,615 (94)	35 (7)	453 (93)	118 (8)	1,398 (92)
Other	25 (15)	141 (85)	13 (15)	73 (85)	31 (14)	194 (86)
Relationship status						
No serious/permanent partnership	765 (20)	3,021 (80)	504 (24)	1,629 (76)	1,203 (22)	4,150 (78)
In serious/permanent partnership	380 (12)	2,809 (88)	185 (12)	1,356 (88)	479 (12)	3,607 (88)
Married	2,074 (18)	9,264 (82)	1,463 (19)	6,346 (81)	3,376 (18)	15,124 (82)

Table 2 Living standard indicators within the German Socio-Economic Panel (GSOEP 2001)

The household has a color television
The household has a telephone
The household has a car
Furniture which is worn out but can still be used is replaced by new furniture
The flat is located in a building which is in good condition
The building is located in a good neighborhood
I can pay the rent or the payment or mortgage/interest payments on time[a]
I have put some money aside for emergencies
I take a vacation away from home for at least 1 week every year
I invite friends over for dinner at least once a month
I eat a hot meal with meat, fish, or poultry at least every other day

The above question deals with what you are able to afford. Which of the following applies to you? For points which do not apply to you, please indicate whether this is for financial or other reasons

[a] In 2003 and 2005 a separate question was applied. People were asked, whether they are able to pay the rent or mortgage/interest payments without any difficulty? (yes/no/does not apply, do not pay rent or mortgage/interest payments

of the poverty measures considering self-rated health. The first analysis tends to a cross-sectional examination of the relationship between poverty and health in 2005. In the second analyses, the explanatory power of the income and the living standard indicator is examined by an investigation of their durability concerning subjective health. In this context, we distinguish between people that were never poor in 2001, 2003 and 2005 (0); only in 2005 (1), in 2003 and 2005 (2), or at all times poor (3). Finally, the third analysis focuses on the causal influences of both poverty indicators on health. Therefore, longitudinal analysis with temporal lagged poverty measures was applied on the German Socio-Economic Panel that consist information of each respondent for the years 2001, 2003 and 2005.

To evaluate and compare the explaining power of the income and living standard measure with regard to subjective health status, for each part of the research analysis binary logistic regression with a sequenced integration of each poverty measure was applied. Binary logistic regression is well suited for the analysis and prediction of dichotomous outcome variables through continuous and/or categorical variables (Wooldridge 2003). Related to the specific data structure, for the first two analyses binary logistic regression for cross-sectional data was applied. By contrast, for panel analysis, which refers to the causal relation of the poverty measures on health, logistic regression with random effects was applied. The attraction of random effect modeling is the ability to control for serial correlation of the unobserved characteristics of each individual via time (Greene 2008). In this context, the estimated standard errors will be corrected for the panel structure of the data.

To specify the explaining power of each poverty measure, initially subjective health status is predicted separately by each of the two poverty indicators and finally by both simultaneously. This analytical strategy implies a hierarchical structure of the estimation models that facilitates a comprehensive analysis and comparison of the explaining power of each poverty measure in respect of subjective health. Furthermore, the estimated likelihood-ratio test is used to compare the prediction improvement by introducing the specific poverty measure into the joint model. The estimated likelihood ratio is applied to decide whether the inclusion of parameters fits the data set significantly better than a simpler model. Hence, the likelihood-ratio test enables an assessment of the explanatory strength of each poverty measure by comparing the model fit between both the separate models and the joint model.

Results

Table 3 presents binary logistic regressions for the cross-sectional relationship between each poverty measure and subjective health status adjusted for age, gender, nationality, residence, education, occupation and partnership. In this context, models 1 and 2 estimates separately the association of the income and living standard measure with subjective health status, while the joint model 3 adjust for each poverty measure. The separate models (model 1 and model 2) indicate that each poverty measure is significantly associated with poor health. Thereby, a comparison of both poverty effects shows that an inadequate living standard is more strongly associated with poor health (OR 2.14, CI 1.91–2.39) than income poverty (OR 1.46, CI 1.27–1.69). This result is enhanced by the likelihood-ratio tests of both models, which indicates that the living standard indicator fits the data much better ($L^2 = 0.1144$) than the income indicator ($L^2 = 0.1057$).

In model 3 the effects are adjusted for each poverty measure to identify the final explanatory power of both poverty indicators. The results confirm the previous findings. The actual living standard is still more strongly associated with subjective health status than the income situation. The odds ratio to report poor health is for those measured by an inadequate living standard 2.09 times higher than for others (CI 1.86–2.34). By contrast, income poverty is no longer significantly associated with poor health due to the inclusion of the living standard indicator. Furthermore, the likelihood-ratio tests for the separate and joint models show that the implementation of the living standard indicator improved the data fit of model 1 much

Table 3 Odds ratio for poor subjective health status by income and living standard measures of poverty, German Socio-Economic Panel (GSOEP) 2005

	Model 1[a,c] OR[b] (95% CI)	Model 2[a,c] OR[b] (95% CI)	Model 3[a,c] OR[b] (95% CI)
Income poverty			
At or above poverty level	1.00		1.00
Below poverty level	1.46 (1.27–1.69)		1.12 (0.96–1.30)
Living standard poverty			
Adequate living standard		1.00	1.00
Inadequate living standard		2.14 (1.91–2.39)	2.09 (1.86–2.34)
Likelihood-ratio test L^2	1,799.15	1,947.26	1,949.41
Pseudo R^2	0.1057	0.1144	0.1145
Degrees of freedom *df*	29	29	30
N	18,313	18,313	18,313

OR odds ratio, *CI* confidence interval

[a] Calculations are based on bivariate logistic regression for cross-sectional data

[b] Adjusted for gender, age, nationality, residence, education and occupation

[c] Results are consistent for men and women (results not shown)

Table 4 Odds ratio for poor subjective health status in 2005 by the duration of income and living standard poverty, German Socio-Economic Panel (GSOEP) 2001, 2003 and 2005

	Model 1[ac] OR[b] (95% CI)	Model 2[ac] OR[b] (95% CI)	Model 3[ac] OR[b] (95% CI)
Duration of income poverty			
Below poverty level at no time point	1.00		1.00
Below poverty level in 2005	1.30 (0.99–1.70)		0.98 (0.74–1.29)
Below poverty level in 2003 and 2005	1.28 (0.90–1.82)		0.78 (0.54–1.13)
Below poverty level in 2001, 2003 and 2005	1.52 (1.15–2.02)		0.85 (0.62–1.15)
Living standard poverty			
Inadequate living standard at no time point		1.00	1.00
Inadequate living standard in 2005		1.93 (1.56–2.40)	1.97 (1.58–2.44)
Inadequate living standard in 2003 and 2005		2.16 (1.70–2.76)	2.24 (1.75–2.87)
Inadequate living standard in 2001, 2003 and 2005		2.99 (2.43–3.66)	3.17 (2.54–3.96)
Likelihood-ratio test L^2	1,094,05	1,222.73	1,225.23
Pseudo R^2	0.0987	0.1104	0.1106
Degrees of freedom (*df*)	30	30	33
N	11,483	11,483	11,483

OR odds ratio, *CI* confidence interval

[a] Calculations are based on bivariate logistic regression for cross-sectional data

[b] Adjusted for gender, age, nationality, residence, education and occupation

[c] Results are consistent for men and women (results not shown)

better (L^2 from 0.1057 to 0.1145) than the inclusion of the income poverty indicator into model 2 (L^2 from 0.1144 to 0.1145).

The estimated models in Table 4 refer to the association between the duration of each poverty condition and subjective health status. As described in the previous section, we have suggested three models to evaluate the explanatory power of each indicator. In this context, the results show that the living standard is more strongly associated with subjective health status than income poverty. While model 1 indicates that rather a long-term spell of income poverty correlates with a poor health status, models 2 and 3 illustrate that the likelihood to report poor health increases continuously with the duration of an

Table 5 Odds ratio for poor subjective health status in 2003 and 2005 by current and lagged income and living standard poverty, German Socio-Economic Panel (GSOEP) 2001, 2003 and 2005

	Model 1[a,c] OR[b] (95% CI)	Model 2[a,c] OR[b] (95% CI)	Model 3[a,c] OR[b] (95% CI)
Income poverty (in *t*)			
At or above poverty level	1.00		1.00
Below poverty level	1.53 (1.25–1.87)		1.12 (0.91–1.38)
Income poverty (lag, $t-1$)			
At or above poverty level	1.00		1.00
Below poverty level	1.42 (1.15–1.74)		1.09 (0.88–1.34)
Living standard (in *t*)			
Adequate living standard		1.00	1.00
Inadequate living standard		2.24 (1.90–2.65)	2.18 (1.84–2.58)
Living standard (lag, $t-1$)			
Adequate living standard		1.00	1.00
Inadequate living standard		1.82 (1.54–2.16)	1.78 (1.50–2.11)
σ_a^{d}	2.49	2.43	2.44
p^{e}	0.65	0.64	0.64
Log likelihood	−11,073.67	−10,995.89	−10,994.84
No. observations	27,939	27,939	27,939
No. individuals	14,654	14,654	14,654

OR odds ratio, *CI* confidence interval

[a] Calculations are based on logistic regression model with random effects for longitudinal binary responses

[b] Adjusted for gender, age, nationality, residence, education and occupation

[c] Results are consistent for men and women (results not shown)

[d] σ_a indicates the standard deviation of the random effect

[e] p indicates the proportion of the total variance contributed by the between subjects variance

inadequate living standard. According to model 3, the odds ratio for reported poor health is already significantly higher for those with an inadequate living standard only in 2005 (OR 1.97, CI 1.58–2.44). Thereby, the odds ratio of poor health rises substantially with the duration of an inadequate living standard from 2.24 in 2003 and 2005 (CI 1.75–2.87) to 3.17 in 2001, 2003 and 2005 (CI 2.54–3.96).

Finally, Table 5 presents the lagged effects of each poverty measure on subjective health status to indicate the causal influences of poverty on health. According to models 1 and 2 in Table 5, the time-lagged effects of the poverty measures are significantly associated with individual health. Thereby, the lagged effect of an inadequate living standard on current health status is much stronger (OR 1.82, CI 1.54–2.16) than the time-lagged income effect (OR 1.42, CI 1.15–1.74). The greater explanatory strength of the living standard indicator is also reflected by the results of the final model in Table 5 (model 3). The time-lagged effect of an inadequate living standard still increases the odds to report poor health about 1.78 (CI 1.50–2.11), while the time-lagged effect of income poverty is no longer associated with individual health. A log-likelihood ratio test finally confirms this result. While the income indicator could not improve the log likelihood of model 2 significantly ($\log L$ from −10,995.89 to −10,994.84; likelihood-ratio test, 2.14), due to an implementation of the living standard indicator the fit of model 1 is improved significantly ($\log L$ from −11,073.67 to −10,994.84; likelihood-ratio test, 158.37). Accordingly, in each model the results indicate that the poorer the person, the greater the likelihood she/he will be in poor health.

Discussion

The focus of present analyses was to explore how different ways of conceptualization of poverty affects their relation to health. Different analyses were conducted to compare an income-based indicator with a living standard-based indicator referring to subjective health. According to the theoretical and empirical debate, it was assumed that, in the case of Germany, the estimated magnitude of the poverty–health relation would vary with the specific poverty indicator, and that, more precisely, the living standard indicator would be strongly associated with subjective health than income.

In order to address this question, we applied cross-sectional as well as longitudinal analyses with data from the German Socio-Economic Panel from 2001, 2003 and 2005. Our analyses confirm that the explaining power of the poverty–health relationship depends on the specific type of poverty measurement. In comparison to the income indicator, the magnitude of the poverty–health association is stronger if poverty is reflected by current living standard. This conclusion can be drawn from each part of the analyses with the GSOEP: cross-sectional, long-term as well as causal analyses reveal a stronger poverty–health association for the living standard indicator.

These findings are consistent with previous international studies that have indicated a stronger association between an inadequate living standard and subjective health status (Stronks et al. 1998; Halleröd and Larsson 2008).

A possible explanation for these results calls upon the impreciseness of the income indicator compared to the living standard measure (Ringen 1988; Whelan 1993; Andress 1999, 2003; Andress et al. 2001; Perry 2002; Nolan and Whelan 2007). But our results also indicate that only longer spells of income poverty is associated to poor subjective health, while an inadequate living standard is associated with increased health risks immediately. Thus, the differences between both indicators seem to get smaller the longer the spell of income poverty endures. This result might be interpreted as a consequence of the personal living conditions of each type of poverty. Several authors have argued that people who suffer under a longer spell of income poverty will assure their living standard as long as financial savings are available (Mayer and Jencks 1989; Layte et al. 2001; Whelan et al. 2001, 2002a, b, 2003, 2004; Andress 2003; Whelan and Maitre 2006). If these resources are completely exhausted, then living standards will decrease.

Despite the differences between both concepts, this study supports the general findings of international health researchers and literature: each poverty indicator is significantly related to subjective health (Stronks et al. 1998; Santana 2002; Nielsen et al. 2004; Nolte and McKee 2004; Halleröd and Larsson 2008; Lampert and Kroll 2006); long-term poverty is more important for subjective health than short-run poverty (Lynch et al. 1997; Benzeval and Judge 2001; McDonough and Berglund 2003; McDonough et al. 2005); and temporal preceding poverty has a significant influence on subjective health status (Lynch et al. 1997; Benzeval and Judge 2001).

Our study has some limitations, which should be kept in mind when drawing conclusions from it: the construction of each poverty indicator is in general strongly subjective, since it relies on normative decisions and morally oriented values (Piachaud 1987; Kangas and Ritakallio 1998; Andress 1999; Andress and Lipsmeier 2000; Andress et al. 2001; Lipsmeier 2001). In addition, a careful evaluation of the impact of different poverty measures requires information about the physical and psychosocial health status that are not available in the GSOEP. Furthermore, because of the fragmentary structure of the longitudinal data set provided by the German Socio-Economic Panel, a reliable analysis could not be established. Analysis of the causal influences of poverty on health requires a longer period of time suggesting that there is scope to extend this study even further.

Since we introduced the living standard concept as an alternative poverty indictor, its methodological problems should be considered in detail. The central challenge refers to the capability of the living standard approach to reflect the perceived necessities of the population and its subgroups adequately (Desai and Shah 1988; Muffels 1993; Lipsmeier 1999, 2001; Halleröd 1994, 1995, 1996, 2006; McKay 2004; Guio 2009). For example, Lipsmeier (2001) have suggested that the importance of a car is decreased for people that live in urban cities and/or for those that are older. Furthermore, several authors have recommended that individuals adapt their preferences towards a specific living standard to what is economically achievable (Lipsmeier 1999; McKay 2004; Halleröd 2006; Halleröd et al. 2006). Thus, people will devalue the necessity of living standard items if they cannot afford these, especially in longer spells of economic hardship. Moreover, the choice of a specific number of necessities as a threshold for living standard poverty appears as arbitrary (Halleröd 1994; Kangas and Ritakallio 1998; Lipsmeier 1999, 2001; Andress and Lipsmeier 2000; Böhnke and Delhey 2001; Guio 2009). Finally, the evaluation of individual's living standard could not reflect differences in the quality, the quantity and the distribution of current living standard indicators within a household (Walker 1987; Desai and Shah 1988; Andress and Lipsmeier 2000). We tried to respond to these problems by focusing on previous studies that have used the GSOEP (Andress et al. 2004; Andress 2006; Groh-Samberg and Goebel 2007).

In conclusion, our findings expand current debates about the poverty–health association within health research by identifying differences between the income and the living standard approach with regard to subjective health in Germany. For this reason, it is necessary that future empirical investigations of the poverty–health relationship should rely on a careful assessment of the poverty concept. The meaning of specific conditions that each poverty situation suggests is important in order to get a deeper understanding of the poverty–health relationship.

Conflict of interest statement None.

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