



Does Poverty Affect Early Language in 2-year-old Children in Germany?

Claudia Karwath¹ · Manja Attig¹ · Jutta von Maurice¹ · Sabine Weinert²

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Abstract

Previous studies reported negative effects of financial deprivation on child development during early childhood. As already shown, child development, in particular language development, is associated with family background, e.g., educational level. However, less is known about the impact of (restricted) financial resources on early language skills. Therefore, the present study investigates whether family income, measured as a metric variable by net equivalence income, and poverty, operationalized as income groups based on official income thresholds, impact vocabulary and grammar skills of 2-year-old children even when taking the educational level of the mother as well as aspects of the home-learning environment (joint picture book reading) and other relevant variables into account. Drawing on a German sample of $N = 1782$, we found that especially poverty is significantly associated with early language skills over and above maternal education and joint picture book reading. Hence, our results indicate the relevance to consider the effect of (restricted) financial resources and especially poverty on child development during early childhood additionally to other indicators of social background.

Keywords Income · Poverty · Early childhood · Language · Inequality · Child development

Highlights

- Children that experienced poverty during the first year show comparatively lower early language skills even when maternal education and joint picture book reading are considered.
- Using income groups defined by official income thresholds allow to more directly analyse the impact of poverty on children.
- Especially poverty is found to affect child development even in a rich country with a strong social system such as Germany.

Introduction

As recently emphasized by the Organisation for Economic Co-operation and Development (OECD, 2018b) poverty has a negative impact on all household members, however, children are affected in particular. A large amount of research, especially from the U.S., examined the detrimental impact of poverty on child outcomes showing that children

living in poverty are negatively affected in their health, cognitive, language, and socio-emotional development as well as in their school achievement, and their later educational attainment compared to their peers who do not experience poverty (for a brief overview: Brooks-Gunn & Duncan, 1997; Dearing et al., 2006; Duncan et al., 2012). Furthermore, poverty unfolds its effects across a broad age range, namely from prenatal to adulthood, having the most damaging effects during early childhood, preschool, and early school years (Barajas et al., 2008). Additionally, poverty is found to affect a child's home-learning environment and parent-child interactions (e.g., Brooks-Gunn & Duncan, 1997; Garrett et al., 1994; Hartas, 2011; Kalil et al., 2016). According to the OECD, nearly 1 in 7 children (0–17 years) are negatively affected by living in relative income poverty, and in two-third of the OECD countries

✉ Claudia Karwath
claudia.karwath@lifbi.de

¹ Leibniz Institute for Educational Trajectories, Wilhelmsplatz 3, 96047 Bamberg, Germany

² University of Bamberg, Markusplatz 3, 96050 Bamberg, Germany

child poverty even increased during the last years with a large cross-country variation (OECD, 2018a, 2018b).

However, though poverty is found to affect child development negatively, the understanding of the consequences of growing up in poverty for children during early childhood remains limited (Barajas et al., 2008; Schoon et al., 2010). Thus, analysing the timing of poverty is of high relevance. Here, especially the first three years of a child's life are found to be important: In this time children are highly dependent on their family. Experiences, knowledge, nurture, and socialization of children are based on the family they grow up with (for a brief overview: Hart & Risley, 1995). Considering current research on early child development, various studies report the association with educational background or an overall construct of socioeconomic status, especially for early language development (e.g., Hart & Risley, 1995, 1999, 2003; Hoff-Ginsberg, 2000; Linberg et al., 2020; Linberg et al., 2019; Linberg & Wenz, 2017; Robertson, 1997; Weinert, 2010). At the age from about 18 months onwards, children are found to differ in their vocabulary when considering social background, whereas the results are rather mixed for early grammar skills (e.g., Fernald et al., 2013; Weinert & Ebert, 2013). Additionally, early language is also found to benefit by joint activities with the child, such as joint picture book reading (e.g., Attig & Weinert, 2019; Bus et al., 1995). However, though an increased amount of studies examined the impact of educational background or socioeconomic status as well as with joint activities on language development, to our knowledge only a few studies considered the association with (restricted) financial resources, such as family income or poverty, in particular with language development.

Therefore, this article analyses the impact of (restricted) financial resources during the first years of a child's life. In particular, we focus on early language skills as child language has been shown to impact later cognitive, educational, and socio-emotional development (e.g., Ebert, 2011, 2015; Rose et al., 2018; Schuth et al., 2017) and are particularly relevant to school success and later participation in society (e.g., OECD, 2019). Moreover, early evolving interindividual differences at the age of three, which covary substantially with social background, proved to be rather stable across preschool age with highly relevant implications for school learning (Weinert & Ebert, 2013). Further, as most studies only consider vocabulary skills, we go beyond that and additionally include early grammar skills. As language development already starts during the first months of a child's life (Siegler et al., 2014), we focus on the impact of family income, measured as a metric variable by net equivalence income, and poverty, operationalized as income groups based on official income thresholds, at the age of about seven months and its effects on later language skills at the age of two years. We also extend previous

research findings on child poverty using a German sample. In doing so, we not only fill the lack of research on the consequences of poverty on children growing up in German (Laubstein et al., 2016), but additionally expand especially the research on child poverty by focusing on a high-income country with a well-established social system.

Child Poverty in Germany

The study of Corak et al. (2005) pointed out that while children had a slightly lower chance of living in poverty¹ than the general population during the 1980s and early 1990s, this changed since then to the detriment of children. The authors link the upwards trend of child poverty with the unification of West and East Germany and thus the related economic adjustments as well as the downgraded situation of children from (recently arrived) non-citizen households. Since 2008, the proportion of children living in poverty in Germany has remained unchanged at about 15% (Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung/ Bundesinstitut für Bevölkerungsforschung, 2021). Consequently, each 6th child in Germany is growing up and living in poverty. In 2016, about 14% of all children under 12 years and about 18% of all children between 12 and 17 years experienced poverty (Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung, 2018). Thus, some children are born into a poor family and experience the negative effects of poverty from early on. This is especially true for children growing up with single parents, in households with migration background, lower educated families, and families with a higher number of children (Autorengruppe Bildungsberichterstattung, 2020; Familienreport, 2020; Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung, 2018; Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung/ Bundesinstitut für Bevölkerungsforschung, 2021). These statistics suggest, that even in Germany, which is one of the richest countries and is known for its effective social system, child poverty is a huge problem. For example, in the international rating on child poverty by the OECD, Germany ranks in the intermediate range with other countries (OECD, 2018a) without such a strong social system (e.g., United Kingdom, Japan or New Zealand; for a brief overview: Esping-Andersen, 1990).

¹ In the German context, mostly income poverty is used to describe poverty. Here, usually, the official German poverty threshold of less than 60% of the net equivalence income is used, which describes a person as "at risk of poverty" (Statistisches Bundesamt, 2006). As this category is not used in an international context, we label families beyond this threshold as "poor" within this paper and by that deviate from common German labels.

However, the effect of poverty on the development and education of children is hardly considered in German research, although first studies on child poverty are dated back to the 1980s. In particular, Laubstein et al. (2016) addressed the state of research on child poverty in Germany in their metastudy and summarized that, so far, no systematic and regular studies on the consequence and impact of poverty on children exist. In fact, the insufficient state of research on child poverty in the German context did not change since the metastudy by Laubstein et al. (2016). Until now, there is a lack of knowledge on the effects of poverty for children born into and growing up in poverty in Germany. Not least, since most research on poverty is found in the U.S. and against the background that countries deal differently with issues of poverty, for instance with respect to social support and health systems, the understanding of the effects of poverty on child development in different countries may be especially relevant. As documented by the study of Bradbury et al. (2018) generalizing results across societies is not warranted without explicit testing the effects of income. On the other hand, if effects show up across different systems this may contribute substantially to our understanding of the factors that impact early child development.

Theoretical Background

Children are dependent on other persons and thus experiencing poverty is associated with the economic circumstances within the family (Brooks-Gunn & Duncan, 1997; Laubstein et al., 2016). Hence, especially the economic model (Becker, 1981; Conger & Donnellan, 2007) and the family stress model (Conger et al., 1992) are used to describe and explain the effect of (family) poverty on the development of children.

The economic model (Becker, 1981), also known as family investment model, which “is rooted in economic principles of investment and builds on the notion that higher-SES compared with lower-SES parents have greater access to financial (e.g., income), social (e.g., occupational status) and human (e.g., education) capital” (Conger & Donnellan, 2007, p. 179). The model assumes a dependence between available resources within families and the development of children and adolescents, proposing that families with a greater amount of resources have the opportunity to invest more in the development of their children and therefore support their academic and social success as compared to disadvantaged families. According to the model, possible investments are learning materials within the household, parental stimulation, standard of living (e.g., housing), and residing in good quality locations (Conger & Donnellan, 2007). For example, families with lower income

may have a lower quality of housing (e.g., space per individual), less healthy food, less quality of childcare and schooling, and/or live more often in low-quality neighbourhoods (e.g., with greater exposure to pollution and violent crime). Furthermore, low-income families may be restricted in providing their children with relevant resources such as books or educational toys (Duncan & Magnuson, 2013; OECD, 2018a, 2018b) resulting in a less stimulating home-learning environment.

The second theoretical account considers a more psychological and sociological point of view by referring to family processes (Chase-Lansdale & Pittman, 2002). In this context, the family stress model proposed by Conger et al. (1992) is often mentioned: It assumes that economic hardship can lead to economic pressure, which affects family functioning and individual adjustment. In particular, the model defines low income, high debts, and negative financial events (e.g., work instability) as indicators of economic hardship and economic pressure as unmet material needs (e.g., adequate food), the inability to pay bills, or make ends meet as well as cutting back on necessary expenses (e.g., health insurance) (Conger & Donnellan, 2007). For example, according to the model financial strain may lead to stressful situations for parents, to parental depression, or other forms of psychological parental distress. Consequently, financial restrictions may negatively impact family climate and parenting behaviour (e.g., lead to a more punitive parenting style), limit parental interactions with their children, disrupt family processes, may lead to a less stimulating home-learning environment, or may cause problems between work and childcare arrangements (Duncan & Magnuson, 2013; OECD, 2018a, 2018b) and therefore impact child development negatively.

As Dearing et al. (2006) outline, the environmental context and the experiences of children are substantially associated with cognitive, language, social-emotional, and neurobiological development and thus poverty might negatively affect most areas of development. Furthermore, as poor children additionally face higher health risks (e.g., Chen et al., 2002), the authors refer to the combined effects of poverty and poor health, both becoming risk factors for developmental problems themselves. Moreover, especially studies from the U.S. highlight that poverty seems to be more harmful during early childhood than during later life (Brooks-Gunn & Duncan, 1997; Dearing et al., 2006; Duncan et al., 2012). However, relatively few studies focus on the impact of poverty during a child’s first years (for a summary see Barajas et al., 2008; Schoon et al., 2010). Although studies focused on poverty experienced in early childhood, these effects are mostly examined on outcomes later in life such as achievement, health, behaviour, or earnings in adulthood (e.g., Duncan & Brooks-Gunn, 1997; Holzer et al., 1997). This also traces back to the fact that

longitudinal studies most often address adolescents or young adults as participants and thus cannot analyse the effect of poverty during early childhood (e.g., see overview by Brooks-Gunn et al., 2000).

Empirical Results on the Impact of Poverty on Children's Language Skills

Various studies have shown the association of social background with language development starting at the age of 18 months onwards (e.g., Fernald et al., 2013; Hart & Risley, 1999; Weinert & Ebert, 2013). Children from families with low socioeconomic status are found to show lower levels of language skills than children from families with a higher socioeconomic status (e.g., Hoff, 2006, 2013; Law et al., 2019). Here, especially vocabulary is found to be associated with family background. One of the most cited studies by Hart and Risley (1995) on social background and language development points out that children growing up in families with a low socioeconomic status have smaller vocabularies compared to children from families with a higher socioeconomic status. Though the results on the effect of social background on language development are quite robust for children at the age of three and above, studies considering children under 3 years show contradictory findings. For example, the study by Fernald et al. (2013) reports differences in vocabulary related to social background for children at 18 months and two years, whereas Peyre et al. (2014) found an association between parental education and language skills at the age of three but not for vocabulary at the age of two. Additionally, Bus et al. (1995) described in their meta-analysis on the frequencies of book reading to preschoolers, that parent-preschool reading is related to such outcomes as language growth. The findings by Attig and Weinert (2019) pointed out that early joint picture book reading predicts language skills already in 2-year-old children.

However, though the effect of social background and joint activities on language development is well documented, comparatively little is known about the effect of (restricted) financial resources, measured for example by family income or poverty, on (early) language skills. Studies that focused on the effect of family income on language processes early in life predominantly showed a negative effect of low family income on early language (e.g., Huttenlocher et al., 2010; McKean et al., 2015; Linberg & Wenz, 2017; Peyre et al., 2014; Weinert & Ebert, 2013). Although family income is found to be associated with early language outcomes, using a continuous variable of family income may underestimate the adverse impact of a specific situation as, for example, the experience of poverty can be, as the whole range of family

income does not consider non-linear associations. Furthermore, although some studies used categorical variables for family income, these vary between studies and, again, do not measure the effect of specific, life-impacting constellations as the experience of poverty.

Studies that focused directly on the effect of poverty on early language outcomes report lower language skills for poor children: The studies by Smith et al. (1997), Berger et al. (2009) and Biedinger (2009) found lower vocabulary in 3-to-5-year old children living in poverty and Law et al. (2017) described a difference of 4.5 points in naming vocabulary for poor versus non-poor children at the age of 11. Further, the study by Groos and Jehles (2015) reported negative effects of poverty on language for children in primary school age and found that daycare institutions with a higher proportion of poor families affected children's German language skills negatively.

Furthermore, as especially language skills are relevant for future cognitive, social, and educational development (Weinert, 2022), it is an important theoretical question whether different facets of language are affected to the same extent. In fact, it has been argued that vocabulary is particularly prone to environmental stimulation while early grammar is acquired even under rather restricted environmental conditions (e.g., Vasilyeva & Waterfall, 2011) at least in the very early phases of grammar acquisition. In particular, nativist theories of language acquisition (e.g., Chomsky, 1988; Fodor, 1983; van der Lely & Pinker, 2014) argue in favor of a rather robust acquisition of early grammar while neuroconstructivist, usage-based, or connectionist accounts emphasize the importance of the context of language use (e.g., Elman et al., 1996; Karmiloff-Smith, 2015; Mareschal et al., 2007; Tomasello, 2003). Thus, exploring the effects of (restricted) financial resources by differentiating between the effect of family income and the effect of poverty on vocabulary and grammar separately also contributes to the discussion on language acquisition in the context of social background.

The Present Study

To add to previous research, the present study focuses on the effect of (restricted) financial resources on early child language in Germany. Since financial resources can be operationalized in different ways, we decided for two operationalizations: First, we use family income as measured by the metric variable of net equivalence income and second, we defined income groups based on official income thresholds to consider special financial situations as poverty. By doing so, we are able to disentangle if different facets of income can cause different results on early child development. For early child language we consider both

early vocabulary as well as early grammar skills and explicitly include relevant predictive variables that have been shown to impact children's language skills such as maternal education (e.g., Hart & Risley, 1995, 1999, 2003) and joint book reading (Bus et al., 1995). Additionally, we control for further variables, which are associated with language skills, such as children's gender and age (e.g., Zubrick et al., 2007) as well as number of siblings (e.g., Karwath et al., 2014). As mentioned above, especially children from lower-educated families, with a higher number of siblings and growing up in a single-parent household are found to experience poverty more often (e.g., Autorengruppe Bildungsberichterstattung, 2020; Familienreport, 2020; Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung, 2018; Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung/ Bundesinstitut für Bevölkerungsforschung, 2021). As we are interested in the effects of income in the early phases of a child's life, we additionally consider parental leave, which in Germany normally is taken in the first year of a child's life and mostly reduces the amount of available income (Federal Ministry for Family Affairs, Senior Citizens, Women and Youth, 2021).

As for Germany studies addressing especially the effect of poverty on children are still missing (Laubstein et al., 2016) and there are hardly any studies (for exceptions see: Berger et al., 2009; Biedinger, 2009; Law et al., 2017; Smith et al., 1997) addressing the effect of poverty on early language outcomes, this paper concentrates on the effect of (restricted) financial resources with a special focus on experiencing poverty in the early phases of a child's life and its effect on language in 2-year-old children. For this purpose, the first research question of interest is: Do (restricted) financial resources, in particular family income and living in poverty, impact early language skills in 2-year-old children?

As vocabulary and grammar may be influenced by different factors (e.g., Vasilyeva & Waterfall, 2011) in the early phases of language acquisition, the second research question is: Are there different effects of family income and poverty when considering vocabulary and grammar in 2-year-old children?

Method

Sample

The presented analyses are based on the Newborn Cohort Study of the German National Educational Panel Study (NEPS; Blossfeld et al., 2011; <https://doi.org/10.5157/NEPS:SC1:5.0.0>). This study uses a representatively drawn sample of infants born in Germany in 2012 with their parents who were followed within a longitudinal design

from seven months onwards (Abmann et al., 2015; Weinert et al., 2016; Zinn et al., 2018). In the first wave, 3431 families agreed to take part in the longitudinal study.

To analyse the impact of families' social background on early language skills, information on families' income and education in the first year of life (6 to 8 months) were used as well as measures of early child language at about 25 to 27 months. All assessments were conducted at the families' homes by trained interviewers.

We limited our analyses to children growing up monolingually (majority language German) for whom valid information on the outcome measure (vocabulary and grammar) at age 2 is available. Therefore, our analyses are based on a sample of $N = 1782$ cases.

We excluded families speaking other languages than the majority language German at home due to several reasons: Firstly, the data set does not include early child language measures on other languages than the majority language. Furthermore, if children grow up bi- or multilingually, the results for these children are not comparable to those growing up monolingually as we cannot consider the language status in all languages. Not least, for this group more detailed analyses would be necessary on language input in the various languages spoken at home as this is a major source of variance and may differ widely across families.

Variables

Early child language at age 2

Children's language skills were assessed via an extensive language check-list (ELFRA-2; Grimm & Doil, 2006) filled in by the parent (mostly the mother) in wave 3 when the children were between 25 to 27 months old. The ELFRA-2 is a validated standardized and widely used instrument to assess children's early language skills (the instrument has been constructed comparable to the MacArthur Communicative Development Inventories; CDI; Fenson et al., 1993). It includes the assessment of productive vocabulary (260 items), syntax (26 items), and morphology (11 items). The instrument was developed for the assessment of early language skills in German (Grimm & Doil, 2006) with substantial and significant correlations to direct measures of children's language competence via language tests (correlations between 0.45 and 0.85 e.g., with the SETK-2 or RDLIS-III; see Sachse et al., 2007a). Furthermore, the ELFRA-2 shows good prognostic validity for later language skills/language disorders (between 59% and 64% using the RAZ-Index; Sachse et al., 2007b).

As we differentiate between vocabulary and grammar as dependent variables in our analyses, we used z-standardized-sum-scores for vocabulary and grammar respectively, the

latter being averaged over syntax and morphology (inter-correlation syntax-morphology: $r = 0.86$, $p < 0.001$).

Financial resources

To evaluate the effect of (restricted) financial resources, we draw on the differentiation between family income and income groups. We used income information based on the self-report of the respondents on their family net income in wave 1. First, for family income we used the net equivalence income, which was generated by the modified equivalence scale of the OECD, which assigns the value of 1 to the household head, the value of 0.5 to each other person at age 14 or above, and the value of 0.3 to each child under the age of 14 (OECD, 2013). Second, we divided the sample into three income groups using the official national thresholds for the year 2012 (Statistische Ämter 2020): (1) Families with less than 60% of the median equivalence income are defined as “poor” (for a brief overview: Statistisches Bundesamt, 2006), (2) families having more than 150% of the median equivalence income are defined as belonging to the “high income” group (for a brief overview: Grabka & Frick, 2008; Lauterbach & Ströing, 2009), and (3) families in between these two thresholds are defined as having an “average income” (reference category).

Further indicators of family background

Mothers’ education at wave 1 is considered as an additional indicator of social background.

Mothers’ education is grouped into a three-level scale (see Linberg et al., 2019): (a) low education (no qualification to intermediate secondary education without vocational qualification), (b) intermediate education (intermediate secondary education with vocational qualification to higher education institution with vocational qualification, reference category), and (c) high education (degree from university of applied science to higher tertiary education: the completion of a traditional, academically orientated university education).

Table 1 shows the correlations for maternal education with family income and income groups. Maternal education and both indicators of financial resources show a significant correlation of medium size. Thus, maternal education and families’

Table 1 Correlations between maternal education and family income as well as income groups (Spearman)

	Family income	Income groups
Maternal education	0.39***	0.35***

The information is based on 15 multiple imputed datasets
Significance level: *** $p < 0.001$

Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

income are measuring different aspects of social background and are not replaceable with each other, suggesting to consider these indicators independently from each other.

Home-learning environment

Joint picture book reading was considered as an indicator of the home-learning environment. Parents were asked to indicate the frequency of joint picture book reading with the child on a five-level scale (1 = never, 5 = several times a day) in wave 1.

Control variables

We also included two additional social background indicators from wave 1 in our analyses: The variable single parent (0 = no; 1 = yes) defined by a partner living in the household as well as the self-reported information, if at least one parent is in parental leave (0 = no; 1 = yes). Furthermore, we included the child’s age and gender (dichotomous variable; 0 = boy, 1 = girl) as well as the number of siblings in the household at wave 3 as further control variables.

Table 2 shows the descriptive characteristics of the sample.

Analytic strategy

To analyse the effect of financial resources on early language competencies, we apply two analytic strategies: Multiple regression analyses as well as path analyses using structural equation modeling (SEM).²

First, we use stepwise multiple regression analyses to test for the effect of (restricted) financial resources on child language while taking into account the other independent variables (e.g., educational background). In our multiple regression analyses, we use family income and income groups (i.e., poverty and high income compared to average income) on child vocabulary and grammar separately. Considering first the analysis for family income, Models 1 to 4 address the analysis for vocabulary and Models 5 to 8 for grammar.

Model 1 describes unconditional gaps by computing the association between family income and child vocabulary without controlling for other variables. Model 2 adds the control variables gender, age, the number of siblings, single parent, and parental leave. In Model 3, maternal education was added to test whether the effect of family income remains after controlling for maternal education and thus whether family income has an additional independent effect on vocabulary over and above maternal educational

² We decided to use both analyses in our study, because central structure equation models are saturated, which is not the case for regression models.

Table 2 Descriptive statistics

	Mean/ Percent	SD	Min	Max	Imputed
Language scores (standardized)					
Vocabulary	0.16	0.93	-2.12	1.81	0.00%
Grammar	0.14	0.92	-1.68	1.75	0.00%
Social background					
Family income	1,797.77	858.53	185.76	14,285.71	15.82%
Income groups					15.82%
Poor	8.11%				
Average income	66.35%				
High income	25.54%				
Maternal education					0.56%
Low	7.46%				
Intermediate	46.74%				
High	45.79%				
Home-learning environment					
Picture book reading	3.09	1.46	1	5	0.00%
Control variables					
Child's gender					0.00%
Girls	48.32%				
Boys	51.68%				
Child's age	26.45	1.04	22.22	32.12	0.00%
Number of siblings	0.73	0.80	0	6	0.00%
Single parent					0.00%
Yes	5.67%				
No	94.33%				
Parental leave					0.11%
Yes	85.13%				
No	14.87%				

N = 1782. The information is based on 15 multiple imputation datasets
SD Standard Deviation. *Min* Minimum. *Max* Maximum

Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

background. The last model, Model 4, analyses the effect of family income after additionally considering the joint activity of picture book reading as an indicator of the home-learning environment that proved to be particularly relevant to language acquisition (Attig & Weinert, 2019; Bus et al., 1995). The identical model structure is conducted for the analyses for child grammar (Model 5 to 8) and the models with income groups for child vocabulary and grammar. Note, that theoretical assumptions suggest differential relationships of the family background indicators with early child vocabulary and grammar.

Second, as child vocabulary and grammar are hypothesised to be correlated, we additionally conducted an integrated path analysis using a maximum likelihood estimator to test for the assumed paths while considering all predictors and control variables analysed in the stepwise regressions as well as both measures of child language within one model. Intercorrelations between variables, and particularly between the two language measures, were included in the models. Regarding the exogenous variables, we did not consider correlations between the child's age and gender with family income or income groups, education, joint picture book reading, number of siblings, single parent, and parental leave as a relationship between these variables cannot be assumed due to theoretical arguments. By not considering all correlations for the exogenous variable, we were able to estimate model fit indices (e.g., Chi-square, RMSEA) and thus report the fit to our data. Including all correlations between the exogenous variables, on the other hand, resulted in saturated models. However, the presented results of the path analyses are not affected, regardless of whether all or only the correlations we allowed between the exogenous variables are taken into account. Thus, we are able to reanalyse the result of the regression analysis, where a correlation between the two language measures is not possible to consider. We concentrate on cross checking the last model of vocabulary (Model 4) as well as grammar (Model 8) for both family income and income groups. By doing so, we can compare if the analyses of the multiple regression models are in line with the path analyses results.

To address missing data, the multiple chained equations (MICE package in R) were conducted to impute 15 datasets (van Buuren, 2018) for all predictor variables for the descriptives and the multiple regression models. All reported estimates are combined across the 15 imputed data sets using Stata 16 in accordance with Rubin (1987). For the path analyses we addressed missing data using full-information maximum likelihood (FIML)³ in Stata 16 (Accock, 2013). Table 2 shows the amount of missing data for each predictor variable. Only four variables of our analysed sample show missing values, ranging from about 16% for net equivalence income and income groups, to less than 1% for both maternal education and parental leave. All variables are based on self-reports of the respondent persons, the majority of whom was the mother⁴ Hence, missing values are due to non-response.

³ No noteworthy differences in the results are found using the multiple imputed estimation and the full-information maximum likelihood (FIML) estimation.

⁴ The respondent person was usually the mother, as mothers are best able to provide information about pregnancy and the birth of the child. In wave 1 99.66% and in wave 3 98.71% of the interviews were given by the mother.

Table 3 Linear regression on the effect of family income on children’s vocabulary and grammar

	Vocabulary				Grammar			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	β	β	β	β	β	β	β	β
SES								
Family income	0.14*** (0.03)	0.11*** (0.02)	0.06** (0.02)	0.05** (0.02)	0.13*** (0.02)	0.09*** (0.02)	0.05* (0.02)	0.04* (0.02)
Maternal education (ref. intermediate)								
Low			-0.11*** (0.03)	-0.11*** (0.03)			-0.11*** (0.02)	-0.11*** (0.02)
High			0.08*** (0.02)	0.08** (0.02)			0.07*** (0.02)	0.07** (0.02)
Home-learning environment								
Picture book reading				0.12*** (0.02)				0.12*** (0.02)
Control variables								
Child’s gender (ref. boy)								
Girls		0.13*** (0.02)	0.13*** (0.02)	0.12*** (0.02)		0.14*** (0.02)	0.14*** (0.02)	0.14*** (0.02)
Child’s age		0.19*** (0.02)	0.18*** (0.02)	0.18*** (0.02)		0.21*** (0.02)	0.21*** (0.02)	0.20*** (0.02)
Number of siblings		-0.13*** (0.02)	-0.12*** (0.02)	-0.11*** (0.02)		-0.12*** (0.02)	-0.11*** (0.02)	-0.10*** (0.02)
Single parent (ref. no)								
Yes		-0.06** (0.02)	-0.04 (0.02)	-0.04 (0.02)		-0.06** (0.02)	-0.04 (0.02)	-0.04 (0.02)
Parental leave (ref. no)								
Yes		0.02 (0.02)	0.01 (0.02)	0.01 (0.02)		0.01 (0.02)	-0.00 (0.02)	0.00 (0.02)
Adjusted R^2	0.02***	0.11***	0.13***	0.15***	0.02***	0.11***	0.14***	0.15***
ΔR^2	-	0.09***	0.02***	0.02***	-	0.09***	0.01***	0.01**

$N = 1782$. The information is based on 15 multiple imputation datasets

β Standardized beta coefficients. R^2 Coefficient of determination. ΔR^2 Increase of the coefficient of determination. Standard errors in parentheses

Significant levels are indicated as: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

Results

In the following, we report the unconditioned and conditioned regression results as well as the results for the path analyses separately for family income and income groups.

The Impact of Family Income on Early Child Vocabulary and Grammar

Table 3 presents the linear regression results for vocabulary and grammar considering family income. Model 1 to Model 4 show the effect of family income on vocabulary and Model 5 to Model 8 the effect of family income on grammar.

Starting with vocabulary, Model 1 shows the unconditioned impact of the average family net equivalence income on early vocabulary having a significant positive effect

($\beta = 0.14, p < 0.001$). Additionally, we see that only 2% of the variance in a child’s vocabulary is explained by family income. Although the family income effect decreases when considering control variables (Model 2), maternal education (Model 3), and joint picture book reading (Model 4) the positive effect of family income remains significant (Model 4: $\beta = 0.05, p < 0.01$). Especially Model 3 shows that additionally controlling for maternal education not only decreases the effect of family income, but also that maternal education and family income both show significant effects on early vocabulary at the age of two. When joint picture book reading is additionally included in the model, the effect of maternal education stays stable, while the effect of family income is slightly reduced. Furthermore, joint picture book reading at the age of seven months is associated with vocabulary size in 2-year-old children.

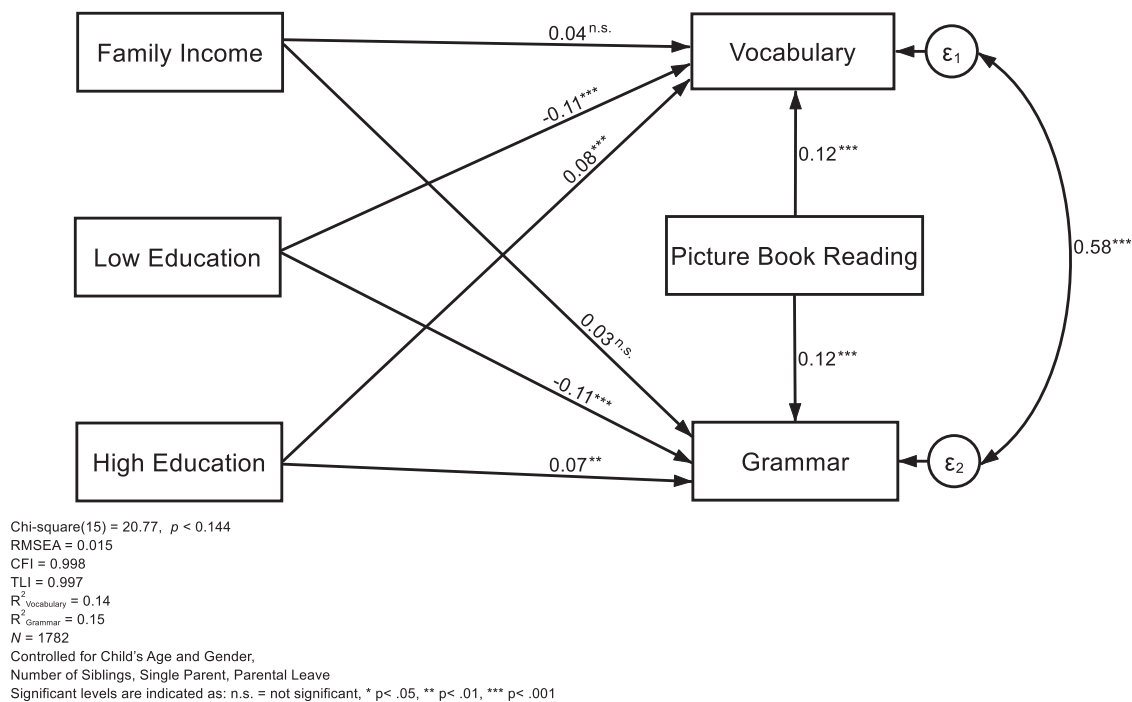


Fig. 1 Path analysis with significant standardized paths on child vocabulary and grammar (considering family income and frequency of joint book reading). Intercorrelations between the variables vocabulary, grammar, maternal education, joint picture book reading, number

of siblings, single parent and parental leave are considered. Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

Considering early grammar (Model 5 to Model 8), a similar pattern of results is found: Family income (Model 5) shows an overall positive unconditional effect on grammar at the age of two years (Model 1: $\beta = 0.13$, $p < 0.001$), explaining again 2% of the variance. The significant positive effect of family income on early grammar remains significant when controlling for all other relevant factors (Model 8: $\beta = 0.04$, $p < 0.01$). As already shown for vocabulary, controlling for maternal education reduces the effect of family income, which still remains significant in addition to maternal education (Model 7). Although joint picture book reading is found to decrease the effect of family income slightly, again it still remains significant (Model 8). Additionally and in line with the results for vocabulary, joint picture book reading at the age of seven months is found to have a significant positive effect on early grammar skills.

In the next step, we considered child vocabulary and grammar simultaneously as well as all other analysed variables within a path analysis (Fig. 1). Using the path analysis, we consider the correlation between early vocabulary and grammar, which is 0.58 ($p < 0.001$). In line with the findings from the regression model, we again find an effect of maternal education and joint picture book reading on both language indicators. Furthermore, when considering all relevant variables simultaneously family income is not related to child vocabulary ($\beta = 0.04$, n.s.) or grammar

($\beta = 0.03$, n.s.) anymore. This is in contrast to the regression model, in which we found significant positive effects of family income on vocabulary ($\beta = 0.05$, $p < 0.01$) and grammar ($\beta = 0.04$, $p < 0.05$). The path analysis demonstrates a good fit to the data ($\chi^2(15) = 20.77$, n.s.; RMSEA = 0.015; CFI = 0.998; TLI = 0.997). The explained variance for the path analysis is 14% for vocabulary and 15% for grammar and thus similar to the regression models (15%). To sum up, our path analysis underlines the findings for the effects of maternal education and joint picture book reading on early vocabulary and grammar from the multiple regression analyses, whereas we do not find a significant (additional) effect of family income on vocabulary and grammar in 2-year-old children, at least when considering other relevant variables such as joint picture book reading and the correlation between vocabulary and grammar.

The impact of belonging to different income groups on early child vocabulary and grammar

Splitting income into groups defined by income thresholds, the picture of the effects of income becomes even more pronounced: In Model 1 (Table 4), both poverty and high income show a significant unconditional effect on vocabulary. Our analyses indicate a negative unconditional effect for children growing up in poverty ($\beta = -0.15$, $p < 0.001$),

Table 4 Linear regression on the effect of income groups on children’s vocabulary and grammar

	Vocabulary				Grammar			
	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β	Model 7 β	Model 8 β
SES								
Income groups (ref. average income)								
Poor	-0.15*** (0.03)	-0.14*** (0.03)	-0.10*** (0.03)	-0.10** (0.03)	-0.12*** (0.02)	-0.10*** (0.02)	-0.06* (0.02)	-0.06* (0.02)
High income	0.10*** (0.02)	0.07*** (0.02)	0.04* (0.02)	0.04 (0.02)	0.09*** (0.02)	0.06** (0.02)	0.03 (0.02)	0.03 (0.02)
Maternal education (ref. intermediate)								
Low			-0.09*** (0.03)	-0.08** (0.03)			-0.10*** (0.02)	-0.09*** (0.02)
High			0.08*** (0.02)	0.08*** (0.02)			0.07** (0.02)	0.07** (0.02)
Home-learning environment								
Picture book reading				0.13*** (0.02)				0.12*** (0.02)
Control variables								
Child’s gender (ref. boy)								
Girls		0.13*** (0.02)	0.12*** (0.02)	0.12*** (0.02)		0.14*** (0.02)	0.13*** (0.02)	0.13*** (0.02)
Child’s age		0.19*** (0.02)	0.19*** (0.02)	0.18*** (0.02)		0.21*** (0.02)	0.21*** (0.02)	0.20*** (0.02)
Number of siblings		-0.12*** (0.02)	-0.12*** (0.02)	-0.11*** (0.02)		-0.11*** (0.02)	-0.11*** (0.02)	-0.10*** (0.02)
Single parent (ref. no)								
Yes		-0.03 (0.03)	-0.02 (0.03)	-0.01 (0.02)		-0.04 (0.02)	-0.03 (0.02)	-0.03 (0.02)
Parental leave (ref. no)								
Yes		0.02 (0.02)	0.01 (0.02)	0.01 (0.02)		0.00 (0.02)	-0.00 (0.02)	-0.00 (0.02)
Adjusted R^2	0.04***	0.12***	0.14***	0.15***	0.03***	0.12***	0.14***	0.15***
ΔR^2	-	0.07***	0.02***	0.01***	-	0.09***	0.02***	0.01**

$N = 1782$. The information is based on 15 multiple imputation datasets

β Standardized beta coefficients. R^2 Coefficient of determination. ΔR^2 Increase of the coefficient of determination. Standard errors in parentheses

Significant levels are indicated as: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

whereas there is a positive unconditional effect for children growing up in a high income family ($\beta = 0.10, p < 0.001$). Compared to family income, the amount of explained variance by income groups is slightly higher (4%). Considering all influential factors included in the analysis (Model 1 to

Model 4) only the negative effect of poverty remains: Children that experienced poverty at the age of seven months showed a less advanced vocabulary at the age of two years (Model 4: $\beta = -0.10, p < 0.001$), whereas children living in families with a higher net income did not benefit

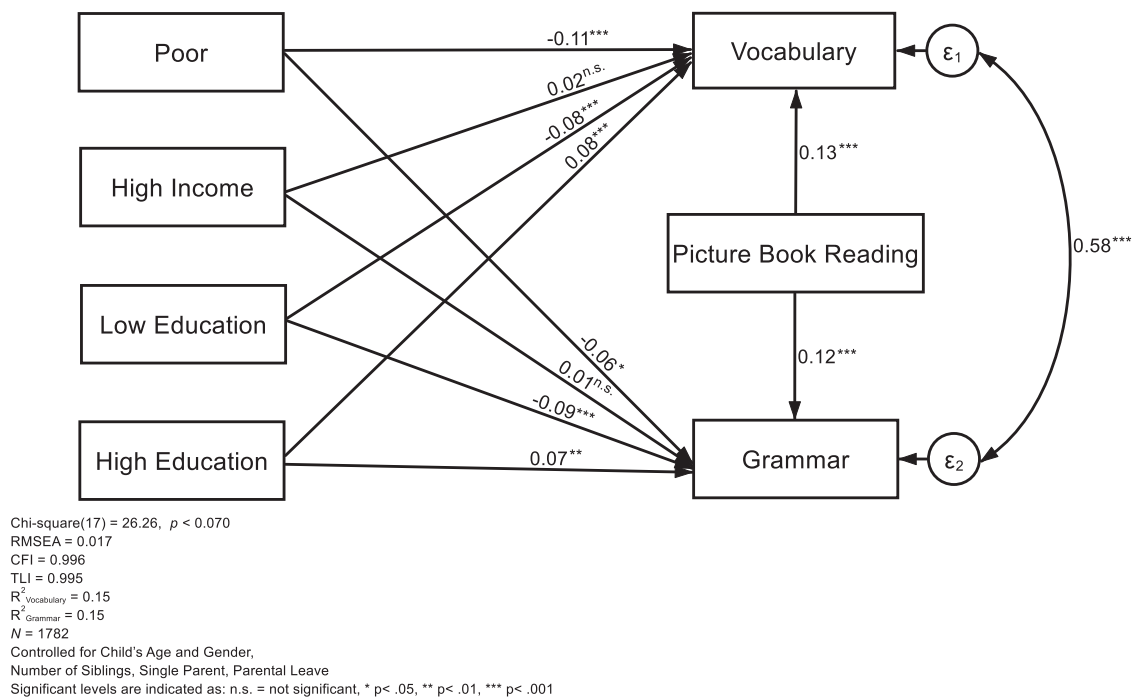


Fig. 2 Path analysis with significant standardized paths on child vocabulary and grammar (considering income groups and frequency of joint book reading). Intercorrelations between the variables vocabulary, grammar, maternal education, joint picture book reading, number

of siblings, single parent and parental leave are considered. Source: Newborn Cohort Study of the National Educational Panel Study (<https://doi.org/10.5157/NEPS:SC1:5.0.0>)

compared to the average group (Model 4: $\beta = 0.04$, n.s.). However, controlling for maternal education decreases the effect of income groups; yet, again both maternal education and income groups show a significant effect on early vocabulary at the age of two (Model 3). Considering additionally joint picture book reading (Model 4), the negative effect of experiencing poverty at the age of seven months on vocabulary at the age of two remains stable, while children growing up in a high income family are not found to have a significant advantage in early vocabulary. Additionally, similar to the family income, our analysis indicates a significant positive effect of joint picture book reading.

Considering early grammar (Table 4) a similar pattern of results is found (Model 5 to Model 8): Children that experienced poverty in their first year of life show comparatively restricted grammar skills (Model 5: $\beta = -0.12$, $p < 0.001$), whereas children growing up in a high income family are found to have more advanced grammar skills (Model 5: $\beta = 0.09$, $p < 0.001$). This unconditional effect explains 3% of the variance. Considering all predictive variables (Model 6 to Model 8) the picture for early grammar skills is similar to early vocabulary: Not only maternal education and joint picture book reading are found to have a significant impact on grammar at the age of two years; our analyses additionally indicate a negative effect of experiencing poverty during the first months of a child's life (Model 8: $\beta = -0.06$, $p < 0.05$), while there is no significant

effect for children of growing up in a high income family (Model 8: $\beta = -0.03$, n.s.).

As for family income, we conducted an additional analysis using a path analysis for income groups. In contrast to the analysis with family income, our path analysis confirms the results in the regression models. Considering the effect of maternal education, joint picture book reading as well as all control variables (Fig. 2), we found no significant effect of high income on vocabulary ($\beta = 0.02$, n.s.) and grammar ($\beta = 0.01$, n.s.). However, the significant negative effect of poverty on vocabulary ($\beta = -0.11$, $p < 0.001$) and grammar ($\beta = -0.06$, $p < 0.05$) using a path analysis is similar to the results in the regression analysis, showing that even the consideration of all relevant variables as well as the correlation of vocabulary and grammar ($r = 0.58$, $p < 0.001$) does not vanish the detrimental effect of poverty on early language development. Additionally, we find an effect of maternal education as well as of joint picture book reading for both language measures. Again, the path analysis demonstrates a good fit to the data ($\chi^2(17) = 26.26$, n.s.; RMSEA = 0.017; CFI = 0.996; TLI = 0.995). The explained variance for the path analysis is the same (15%) as shown for the regression models (15%). In sum, our path analysis underlines the findings from the multiple regression analysis in Table 4 on the effect of income groups, and here especially the adverse effect of poverty, on early child vocabulary and grammar.

Discussion

Child poverty is not only of high relevance across countries, it is also shown in previous (international) studies to affect children and their later life negatively (e.g., Brooks-Gunn & Duncan, 1997; Barajas et al., 2008). However, as most studies on poverty consider outcomes later in life (e.g., Duncan & Brooks-Gunn, 1997; Holzer et al., 1997), comparatively less is known about outcomes during the first years, although according to the economic model (Becker, 1981; Conger & Donnellan, 2007) and the family stress model (Conger et al., 1992) children are assumed to be affected in their early development growing up in poverty. Not only are these children assumed to be provided with less family resources (e.g., books or educational toys), they are additionally assumed to grow up in a family environment experiencing economic pressure with negative effects on parenting behaviour (e.g., punitive parenting style), parental interaction with the child, or family process, thus being disadvantageous for early child development (Duncan & Magnuson, 2013; OECD, 2018a, 2018b). In line with this argument, various studies documented disparities in early development according to the educational background of the children starting at about 18 months onwards (e.g., Fernald et al., 2013; Hart & Risley, 1995, 1999, 2003; Weinert & Ebert, 2013). Furthermore, especially German research lacks to consider the effect of poverty on children (Laubstein et al., 2016).

Thus, our study investigated the effect of (restricted) financial resources during the first year of life considering additionally the effect of maternal education and joint picture book reading on the language skills of 2-year-old children. As financial resources can be operationalized in different ways, we decided to use a metric form of income, namely family income measured by net equivalence income, as well as income groups defined by official income thresholds, with which we are able to consider special income situations such as poverty or high income. Furthermore, as it has been argued that vocabulary is more affected by social background than early grammar (e.g., Vasilyeva & Waterfall, 2011), we examined if family income and poverty affect both language domains similarly. To investigate the effect of (restricted) financial resources on early language, we applied the following analysis strategy: First, we conducted multiple regression models. Using this stepwise approach, we were able to demonstrate the extent to which the effect of family income and income groups is still observable when other relevant variables for early language development are considered. As we used early vocabulary and grammar for language development and as both language measures are correlated, we additionally considered path analyses to see if the results of the regression analyses can be confirmed. The present paper,

therefore, addressed two questions: (1) whether (restricted) financial resources, in particular family income and living in poverty, impact early language skills in 2-year-old children and (2) whether there are different effects of family income and poverty when considering vocabulary and grammar in 2-year-old children.

Overall, our analyses go in line with current studies on the effects of educational background (Hart & Risley, 1995, 1999, 2003; Linberg et al., 2019; Weinert & Ebert, 2013) and joint picture book reading (Attig & Weinert, 2019; Bus et al., 1995) on language development: Children who, in the early phases of life, grow up in a family with a higher educated mother and who are more often exposed to joint picture book reading show more advanced language skills at the age of two years. Here, maternal education as well as joint picture book reading influences both language domains, early vocabulary and early grammar. However, our analyses additionally point out, that especially poverty should be considered as an additional indicator of social background on early child development. These results are getting even more clear when considering path analyses. Though our regression analyses show, that both family income and poverty predicted later vocabulary and grammar (even when considering many other influential variables), this cannot be confirmed by the path analyses. In these models, only the adverse effect of poverty remains significant for both language measurements. Additionally, as we present standardized coefficients, our results show the high relevance of growing up in poverty on early language development: Comparing the standardized coefficients of the path analysis for joint picture book reading ($\beta = 0.13$), low ($\beta = -0.08$) and high education ($\beta = 0.08$) as well as poverty ($\beta = -0.11$), we see that joint picture book reading and poverty have slightly higher effects on early vocabulary than maternal education. For grammar, poverty ($\beta = -0.06$) has the lowest effect, followed by high ($\beta = -0.07$) and low education ($\beta = 0.09$) as well as joint picture book reading ($\beta = 0.12$).

Our results indicate that early language skills of children are associated with (restricted) financial resources. However, our study goes beyond the general effect of income and refers to the special detrimental situation of growing up in a poverty shaped household: Though we did not find a significant effect of family income especially in the path analysis when simultaneously considering maternal education and joint picture book reading and allowing the correlation of vocabulary and grammar, our results indicate that children growing up in families with a higher income do not seem to benefit in their early language skills, whereas children experiencing poverty at the age of seven months are found to have lower language skills being two years old. These results are evident for both analysed language domains: early vocabulary and early grammar skills.

Taken as a whole, our analyses show the importance of considering the effect of (restricted) financial resources and especially poverty on early development, even when other relevant variables such as maternal education and joint picture book reading are considered. Furthermore, our results indicate, that the explained variance for family income and income groups is ranging between 2% and 4%. Though the explained variance is relatively small, it shows that early development is associated with (restricted) financial resources. Moreover, comparing family income and income groups, our analyses suggest, that using a continuous variable of family income indeed underestimates the adverse impact of poverty. In our analyses this is true for both early vocabulary and early grammar skills. This result not only suggests, that there is a poverty effect on early language skills, but also points to the relevance that poverty should be considered in future research on early childhood additionally to other indicators of social background. This is especially important, as our results suggest, that poverty may affect different facets of language equally.

Additionally, our results go in line with existing national (Biedinger, 2009; Groos & Jehles, 2015) and international studies (Berger et al., 2009; Law et al., 2017; Smith et al., 1997), by showing that even in Germany, being one of the richest countries in the world and having a strong social system, experiencing poverty in early childhood is associated with language development. This leads to the assumption that both theories, the family stress model (Conger et al., 1992) and the economic model (Becker, 1981), which are used in international studies to explain the effect of poverty on child development, may also be applied to the German context. In specific, low family income or poverty in German families may also affect family functioning and individual adjustment (e.g., more punitive parenting style, limited parental interaction with child) as well as available resources within the family (e.g., quality of housing, books, or educational toys) thus having an impact on child development from early on (Dearing et al., 2006). Though our analyses found an association between poverty and early language skill even when controlling for relevant indicators such as maternal education and joint picture book reading, future research in the German context should consider the underlying mechanisms in more detail. This is of relevance to ensure that the theoretical assumptions of the family stress model (Conger et al., 1992) and the economic model (Becker, 1981) can actually be applied to the German context as well.

Our study has some limitations that should be taken into account when interpreting our results. First of all, as the assessments in the Newborn Cohort Study of the NEPS measures language skills mainly in the majority language German we could not consider other language(s) spoken within the families. Thus, we limited our analyses to

children growing up in families only speaking the German language. Hence, our results mirror the effect of financial deprivation for this specific group without considering children growing up with other language(s). Furthermore, not considering children growing up bi- or multilingual, we do not consider children with migration background in our analyses, which are found to experience more often poverty (Autorengruppe Bildungsbericht, 2018). However, considering only monolingual children, we underestimate the amount of poor children in the analysed subsample. Though currently about 15% children in Germany are living in poverty (Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung, 2018), the amount of poor children in our analysed subsample is about 8%. Considering that the amount of poor children for the realized sample of the Newborn Cohort Study in wave 1 is about 15%, the small amount of children living in poverty is traced back to not considering children with migration background.

Moreover, as our analysed subsample has a small amount of families living in poverty, we were not able to consider longer periods of poverty over waves. To be more specific, starting with a smaller amount of 8% of poor families in wave 1, the proportion of these families still being poor in wave 3, where we considered early language skills, decreased by about a half, leading to an even smaller sample size. However, though some (international) studies reported negative effects of long lasting poverty on child development (e.g., Brooks-Gunn & Duncan, 1997; Duncan et al., 1998; Korenman et al., 1995; Schoon et al., 2012), future research should not only consider the timing of poverty but additionally the duration of children living in poverty from early on. This is especially relevant for Germany, where we have no studies considering the duration of child poverty and its consequences.

Furthermore, all information used in our analyses is given by the parents. This comes with some disadvantages: For example, using self-reports of the respondents on their families' net income is associated with a higher refusal rate, which is due to the fact that questions about income are shown to be very sensitive. Refusing or not answering correctly this kind of question goes along with higher missing rates, as we see in our data: the highest missing rate relates to the information on income with 16%, whereas we only have 1% for educational background and parental leave. Furthermore, as described above, the used extensive language check-list (ELFRA-2) is filled by the parents and therefore may be associated with a bias. Klaiber (2007) examined parents' response behaviour filling in the ELFRA-2 and found, for example, that the instructions in the ELFRA-2 leave parents some room for interpretation when to tick the words (i.e., if the child uses the word regularly or if the child has used the word only once) and

may lead to possible different ticking behaviour among parents. However, Klaiber (2007) cannot confirm a different ticking behaviour of parents according to their educational background.

Finally, in our study we only considered income poverty. Though Butterwege et al. (2008) argued, that income is the main feature of poverty, different kinds of definitions of poverty exist. However, especially international studies, such as the study of Schenck-Fontaine and Panico (2019), show that although income poverty is an important measure it may not capture economic hardship on children sufficiently. Though we considered an official and commonly used threshold for poverty in Germany (Statistisches Bundesamt, 2006), we only draw some light on the effects of one dimension of poverty on child outcomes. To understand the effect of poverty in a comprehensive way, considering other dimensions of poverty (e.g., material deprivation) is of high relevance.

Overall, our findings show that more research on the consequences of poverty for early childhood is of high relevance. Here, the timing of child poverty is of high interest, as our results show that even the experience of poverty at the age of seven months and so during the first years of a child's life are found to affect later language development negatively. Additionally, as even in a rather rich country with a strong social system like Germany our results suggest that children are negatively affected by poverty, more studies across different countries are of importance to completely understand the impact of financial deprivation on early child development.

Conclusion

Our results substantiate that social background impacts language development from early on and that this holds true for both vocabulary and grammar, although the latter has been considered as less affected by environmental factors. Furthermore, especially poverty affects children's language development even after controlling for maternal education and joint picture book reading, showing that even in a country like Germany economic hardship has an effect on young children.

Additionally, as we differentiated between family income, measured as a metric variable by net equivalence income, and income groups, defined by official income thresholds, our results indicate that the effect of income is non-linear. Hence, using income groups based on official statistics (e.g., poverty), not only allows displaying non-linear effects but furthermore being comparable with future studies considering the effect of poverty.

In sum, more research is needed to determine the effect of poverty especially on the developmental outcomes during early childhood. Thereby, longitudinal research should

investigate long-term effects of poverty considering not only different length of poverty but also their timing. This is especially true for Germany, where about each 6th child is living in poverty (Statistisches Bundesamt/ Wissenschaftszentrum Berlin für Sozialforschung/ Bundesinstitut für Bevölkerungsforschung, 2021), but currently little is known about the consequences of poverty on child development in a rather rich country with a strong social system (Laubstein et al., 2016).

Data availability

This paper uses data from the National Educational Panel Study (NEPS): Starting Cohort 1–Newborns, <https://doi.org/10.5157/NEPS:SC1:5.0.0>. From 2008 to 2013, NEPS data were collected as part of the Framework Programme for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, the NEPS survey is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

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Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

Ethical Statement The NEPS study is conducted under the supervision of the German Federal Commissioner for Data Protection and Freedom of Information (BfDI) and in coordination with the German Standing Conference of the Ministers of Education and Cultural Affairs (KMK) and – in the case of surveys at schools – the Educational Ministries of the respective Federal States. All data collection procedures, instruments and documents were checked by the data protection unit of the Leibniz Institute for Educational Trajectories (LIfBi). The necessary steps are taken to protect participants' confidentiality according to national and international regulations of data security. Participation in the NEPS study is voluntary and based on the informed consent of participants. This consent to participate in the NEPS study can be revoked at any time. All parents of the Newborn Cohort of the NEPS give their agreement for participation and answering questions during the assessments as well as written consent for participating in the video-taped measures to each measurement point.

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