

Changes in Family Poverty Status and Child Health

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abstract

OBJECTIVES: In this study, we aim to assess the associations over time between poverty and child weight status, asthma, and health-related quality of life (HRQoL).

METHODS: We analyzed data for 3968 children from the Generation R Study, a population-based cohort study in the Netherlands. Net household income and the number of adults and children living from this income were measured at 4 time-points (during pregnancy and at ages 2, 3, and 6). Poverty was defined on the basis of the equivalized household income being <60% of the median national income. Child health outcomes were measured at age 6 years. The association was explored by using logistic and linear regression models.

RESULTS: In this cohort, 9.8% of children were born into poverty and 6.0% had experienced 3 to 4 episodes of poverty. Independent of current poverty status, children born into poverty had an odds ratio (OR) of 1.68 for having overweight/obesity and a lower physical HRQoL (OR = -1.32) than those not born into poverty. Children having experienced 3 to 4 episodes of poverty had an OR of 1.94 for having asthma and a lower physical HRQoL (OR = -3.32) compared with children from never-poor families. Transition out of poverty before age 2 was associated with lower risk of asthma and a higher physical HRQoL compared with children who remained in poverty.

CONCLUSIONS: Being born into poverty or experiencing multiple episodes of poverty is associated with negative child health outcomes, such as having overweight, asthma, or a lower HRQoL. Support for children and families with a low household income is warranted.



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WHAT'S KNOWN ON THIS SUBJECT: Previous studies have revealed that being born into poverty and/or cumulative poverty results in more adverse social, psychological, and physical outcomes. Data on the impact of poverty status change on children's health are scarce.

WHAT THIS STUDY ADDS: Poverty at birth and/or cumulative poverty are associated with an increased risk of overweight/obesity and asthma, and lower physical health-related quality of life. Transition out of poverty before age 2 is associated with higher physical health-related quality of life and lower risk of asthma.

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It has been suggested that poverty is the most important social determinant of child health in high-income countries.^{1,2} Following a life-course approach,³ poverty may affect child health during sensitive periods. For instance, being born into poverty^{4,5} and/or the accumulation of poverty over time⁶ result in more adverse health outcomes. Identifying how the timing and accumulation of poverty are associated with child health outcomes may offer insights into who could best be offered support, and at what point in time.

There is an extensive amount of literature reporting the negative impact of poverty status on children's weight status and asthma.⁷⁻¹³ However, the association between poverty and child health has been studied mostly by using a cross-sectional study design.⁷⁻⁹ Only a few studies have addressed the issue of timing or accumulation of poverty over time and their impact on overweight or obesity and asthma using a longitudinal study design.¹⁰⁻¹³ Studying the longitudinal changes in poverty status can provide insights into the consequences of poverty transitions on child health.¹⁴ Specifically, a review suggested that early life circumstances are fundamental for good health in adulthood.¹⁵ The period of "The First Thousand Days" of life (ie, the period from conception to the child's second birthday) is considered to provide a window of opportunity for early support of healthy growth and development of children.¹⁶⁻¹⁸ This is in line with findings from Lee et al,¹⁰ who suggested that poverty before age 2 was associated with the development of obesity in adolescence. Roos et al¹⁹ indicated that transitions out of poverty before age 2 may increase the probability of a child being ready for school. In our study, we add to the literature by studying the impact of poverty over the period from pregnancy until the child is aged 6 years on 3

complementary health outcomes. Apart from physical health, measured by overweight or obesity and asthma, a subjective perception of children's physical, psychological, and social functioning, ie, health-related quality of life (HRQoL), is explored, providing a broader view of the impact of poverty on child health.

The aims of the current study were twofold. First, we examined whether the timing, namely whether the child was born into poverty, and accumulation of poverty, ie, the number of episodes of poverty from birth until child age 6 years, are associated with child weight status, asthma, and HRQoL at child age 6 years. Second, we evaluated whether the transition into or out of poverty before age 2 was associated with child health outcomes at age 6 years. We hypothesized that children who were born into poverty and children living in families who experienced more episodes of poverty between birth and age 6 years have a higher risk of overweight or obesity and asthma and a lower HRQoL. We expected that transition out of poverty after age 2 would be associated with unfavorable child health outcomes at age 6 years.¹⁹

METHODS

Study Design

The study was embedded in the Generation R Study, which is a prospective population-based cohort study performed in Rotterdam, the Netherlands. Details of the methodology of the study have been published previously.²⁰ The study was approved by the Medical Ethics Committee of the Erasmus University Medical Center (MEC 217.595/2002/202). All pregnant women who had a delivery date between April 1, 2002, and January 31, 2006, living in the study area, were invited to participate in the study. A total of 8305 children participated in the study at age 6

years. Children with net household income measurements at 3 time points, at least (during pregnancy and at ages 2, 3, and 6), were included in the study ($N = 4495$). In total, 154 children did not have any data available regarding the health outcome measurements (weight status, asthma, and HRQoL) and were therefore excluded. To avoid clustering of data, second ($n = 368$) and third children ($n = 5$) of the same mother were excluded, leaving a study population of 3968 participants. Written informed consent was obtained from all participants.

Poverty Status

Questionnaires were used to collect primary data (92% completed by mothers, 7% by fathers, and 1% by others). Parents were asked to indicate the net household income category via a multiple-choice question (eg, 3200–4000 euros per month) at 4 time points (during pregnancy and at child ages 2, 3, and 6 years). This amount included monthly income from work, benefits, and/or income from assets that they received in-hand after tax and contributions had been deducted. The measurement during pregnancy was conducted at the enrollment. More than three-quarters (77.8%) of the mothers were enrolled before 18 weeks of pregnancy, 11.8% were enrolled between 18 and 25 weeks, 1.5% were enrolled after 25 weeks, and 8.9% were enrolled at postnatal period. Parents were also asked about the number of adults and children in the household (ie, the number of units) living from this income. We assigned a mean income (eg, 3600 euros for 3200–4000 euros per month) to each category. Equalized total household income (income per unit) was calculated.²¹ Poverty at birth, and at ages 2, 3, and 6 years (yes or no) was defined on the basis of an equalized total household income of <60% of the median national income per unit according to

the Organisation for Economic Co-operation and Development household equivalence scale.^{22,23} A missing measurement of poverty was considered as not poor.

Poverty status was defined in two ways: poverty at birth and cumulative poverty. Poverty at birth (yes or no) was defined by using the measure during pregnancy.⁴ Cumulative poverty was defined by the number of episodes of poverty in between pregnancy and child age 6 years: never poor (ie, no episodes of poverty), intermittently poor (ie, 1 or 2 episodes of poverty), or chronically poor (ie, 3 or 4 episodes of poverty).⁶

Regarding the second study question, the timing of poverty change was classified as occurring before or after age 2.¹⁹ Two separate subcohorts were created. One cohort consisted of children who were born into poverty ($n = 328$). The timing of poverty change was defined as one of the following: no change, transition out of poverty before age 2 (poverty status at age 2 was not poor), or transition out of poverty after age 2 (poverty status at age 2 was still poor). The other cohort consisted of children who were born outside of poverty ($n = 3640$). The timing of poverty change was defined as one of the following: no change, transition into poverty before age 2 (poverty status at age 2 was poor), or transition into poverty after age 2 (poverty status at age 2 was still not poor).

Health Outcomes

Three health outcomes were used as indicators of child health status at age 6 years: weight status (overweight or obesity versus normal weight), asthma (yes or no), and HRQoL. Height and weight (in lightweight clothes and without shoes) were measured at the Generation R research center. BMI was calculated as weight in kilograms divided by height in meters squared. Children visited the research center at a mean (\pm SD) age of 5.9 ± 0.3 years.

Children were categorized as overweight/obesity or normal weight according to international age- and sex-specific BMI cutoff points, which have been interpolated from the adults cutoff for normal, overweight, and obesity.²⁴ Information on if the child had ever received a physician diagnosis of asthma was obtained by using a questionnaire with adapted items from the International Study of Asthma and Allergies in Childhood core questionnaires.²⁵ HRQoL was measured by using the Child Health Questionnaire (CHQ-PF28). There are 28 items, with 4-, 5-, or 6-response options across 13 scales in the CHQ-PF28. The items from each of the scales were summed and transformed into 0 (lowest) to 100 (highest) levels of health.²⁶ Ten scales were used in scoring a two-dimensional summary on the physical summary component scale (PhS) and the psychosocial summary component scale (PsS).²⁷

Both summary scales were considered to be the main outcomes of the CHQ-PF28.

Potential Confounders

On the basis of the literature, several characteristics were considered potential confounders in the analyses: maternal age, maternal educational level, migration background, child's sex, and child's age. Maternal age (years) and educational level were obtained by using a questionnaire at enrollment. Maternal educational level was categorized into three levels: low (no education, primary school, prevocational education, intermediate general education, or 4 years of general secondary education), middle (≥ 5 years general secondary education or intermediate vocational education), and high (higher vocational education, university, or higher academic education). In accordance with the

TABLE 1 Characteristics of Children and Their Families ($N = 3968$)

Characteristic	Total, n (%)	Missing, n (%)
Family characteristics		
Maternal educational level		128 (3.2)
High	2280 (59.4)	
Middle	1056 (27.5)	
Low	504 (13.1)	
Poverty during pregnancy (yes)	328 (9.8)	614 (15.5)
Poverty at child age 2 y (yes)	343 (9.2)	238 (6.0)
Poverty at child age 3 y (yes)	350 (9.7)	347 (8.7)
Poverty at child age 6 y (yes)	356 (9.0)	228 (5.7)
Cumulative poverty		0 ^a
0 episodes	3319 (83.6)	
1–2 episodes	411 (10.4)	
3–4 episodes	238 (6.0)	
Children's characteristics		
Sex		0
Male	1985 (50.0)	
Female	1983 (50.0)	
Age, mo (SD)	5.9 (0.3)	106 (2.7)
Migration background		4 (0.1)
Western	3074 (77.5)	
Non-Western	890 (22.5)	
Weight status		317 (8.0)
Normal	3163 (86.6)	
Overweight/obesity	488 (13.4)	
Asthma diagnosis (yes)	201 (6.0)	636 (16.0)
CHQ-PF28 physical summary score, mean (SD)	57.44 (6.15)	576 (14.5)
CHQ-PF28 psychosocial summary score, mean (SD)	53.01 (6.73)	576 (14.5)

The table is based on a nonimputed data set. The missing values of confounders were imputed when performing the regression analyses.

^a Children with net household income measurements at 3 time points, at least (during pregnancy and at ages 2, 3, and 6), were included in the study. A missing measurement of poverty was considered as not poor.

definitions by Statistics Netherlands, we defined the migration background of the family (Western, non-Western) on the basis of the country of birth of the parent; this was assessed by using questionnaires when the child was 6 years old.²⁸ If one of the parents was born outside the Netherlands, the country of birth of this parent determined the migration background of the family. If both parents were born outside the Netherlands, the country of birth of the mother determined the migration background.²⁸

Statistical Analyses

Descriptive statistics were used to describe poverty and child health outcomes in the sample. Logistic regression models were used to study the associations between poverty status and categorical outcomes (weight status and asthma). Linear regression models were used to study the associations between poverty status and HRQoL. Adjusted logistic and linear regression models were used to correct for potentially confounding variables; both family (maternal age, maternal educational level, migration background) and child (sex and age) variables were included. Models of associations between poverty at birth and child health outcomes were additionally adjusted for poverty at child age 6 years to study the associations independently of the current poverty situation.

Interactions were tested between migration background and poverty

status to verify if the associations between poverty status and child health outcomes differed by family migration background. Apart from an interaction between migration background and being born into poverty regarding psychosocial HRQoL, no statistically significant interactions were found. Sensitivity analyses were performed by using more detailed categories of the variable migration background (ie, Dutch, other western, Moroccan, Turkish, Surinamese, and other non-Western) in the models as a confounder to explore the associations between poverty status and child weight status, asthma, and HRQoL (Supplemental Tables 5–7).

Five imputed data sets were generated by using a fully conditional specified model based on the relationships between the variables included in this study. Pooled effect estimates (odds ratios [ORs] and β coefficients) and the 95% confidence intervals (CIs) from these 5 imputed data sets were reported. Associations were evaluated at the $P < .05$ level. Statistical analyses were performed by using IBM SPSS Statistics for Windows (version 24.0; IBM SPSS Statistics, IBM Corporation, Armonk, NY).

RESULTS

Poverty Status From Pregnancy Until Age 6 Years

Of the 3968 children in the cohort, 328 (9.8%) were born into poverty. Up to child age 6 years, 411 (10.4%)

of their families had experienced 1 or 2 episodes of poverty since pregnancy and 238 (6.0%) had experienced 3 or 4 episodes of poverty. Thus, 649 (16.4%) of the children had spent at least 1 year in poverty before the age of 6 years (Table 1).

Children born into poverty had higher rates of overweight or obesity (27.7%) and asthma (11.5%) at age 6 years than those not born poor (both $P < .001$) (Table 2). Physical HRQoL score was lower in 6-year-old children born into poverty (mean: 55.56; SD: 8.13) than those not born poor (mean: 57.58; SD: 5.95) ($P < .001$). Children who lived in chronically poor families had the highest rates of overweight or obesity (23.4%), and asthma (13.2%), and the lowest physical HRQoL score (mean: 54.17; SD: 9.01) (Table 2).

Associations Between Poverty Status and Health Outcomes

The odds and β coefficients of each child's health outcomes according to the family poverty status are summarized in Table 3. After adjustment for confounders and current poverty status, children who were born into poverty had an OR of 1.68 (95% CI: 1.21 to 2.32) for having overweight or obesity at age 6 years, and they were at higher risk of having a lower score for physical HRQoL (-1.32 ; 95% CI: -1.79 to -0.84) than those not born into poverty. Children who were born into poverty had an OR of 1.62 (95% CI: 0.97 to 2.72) for having asthma compared

TABLE 2 Distribution of Health Outcomes in 6-Year-Old Children According to Poverty Status ($N = 3968$)

	Born Into Poverty		<i>P</i>	Cumulative Poverty			<i>P</i>
	No	Yes		Never Poor	Intermittently Poor	Chronically Poor	
Overweight/obesity	401 (12.0)	87 (27.7)	<.001	345 (11.4)	89 (22.6)	54 (23.4)	<.001
Asthma	173 (5.6)	28 (11.5)	<.001	158 (5.5)	20 (6.8)	23 (13.2)	<.001
HRQoL							
PhS	57.58 (5.95)	55.56 (8.13)	<.001	57.66 (5.92)	57.09 (5.90)	54.17 (9.01)	<.001
PsS	53.03 (6.68)	52.87 (7.36)	.73	53.07 (6.56)	52.13 (7.95)	53.66 (7.11)	.03

The table is based on a nonimputed data set. χ^2 tests were used for categorical variables, and analysis of variance tests were used for continuous variables.

TABLE 3 Associations Between Poverty Status and Child Health Outcomes (*N* = 3968)

	Born Into Poverty ^a		Cumulative Poverty		
	No	Yes	Never Poor	Intermittently Poor	Chronically Poor
Overweight/obesity	Reference	1.68 (1.21 to 2.32) ^b	Reference	1.36 (1.01 to 1.84) ^b	1.15 (0.78 to 1.69)
Asthma	Reference	1.62 (0.97 to 2.72)	Reference	1.04 (0.62 to 1.75)	1.94 (1.10 to 3.41) ^b
HRQoL					
PhS	Reference	−1.32 (−1.79 to −0.84) ^b	Reference	−0.62 (−1.02 to 0.22)	−3.32 (−3.88 to −2.76) ^b
PsS	Reference	0.28 (−0.51 to 1.07)	Reference	−0.65 (−1.54 to 0.25)	0.80 (−0.40 to 1.99)

The table is based on an imputed data set. Models are adjusted for maternal age, maternal educational level, migration background, child's sex, and child's age. ORs and the associated 95% CIs were reported regarding overweight/obesity and asthma; β and the associated 95% CIs were reported regarding HRQoL.

^a Models are additionally adjusted for poverty at child age 6 y.

^b Statistical significance.

with children not born into poverty, although the association was not statistically significant. Children from chronically poor families had an OR of 1.94 (95% CI: 1.10 to 3.41) for having asthma compared with children from never-poor families, and they were at higher risk of having a lower score for physical HRQoL (−3.32; 95% CI: −3.88 to −2.76). Children from families experiencing intermittent poverty had an OR of 1.36 (95% CI: 1.01 to 1.84) for having overweight or obesity, but the association was not significant among children who lived in chronically poor families (OR = 1.15; 95% CI: 0.78 to 1.69). No significant association was observed between poverty status and psychosocial HRQoL.

Timing of Poverty Change

Children born into poverty, whose family became nonpoor before they turned 2 years of age, had an OR of 0.32 (95% CI: 0.12 to 0.88) for having asthma and a higher score for physical HRQoL (4.42; 95% CI: 1.62 to 7.22) compared with children who remained in a poor family (Table 4).

Children born outside of poverty, whose family became poor before they turned 2 years of age, had a lower score for physical HRQoL (−2.15; 95% CI: −3.27 to −1.03). No association was observed between transition into poverty after age 2 years and the health outcomes.

Sensitivity Analyses

When detailed categories of the variable migration background were used in the models as confounders, the results were comparable to the previous analyses. Children born into poverty or growing up in chronically poor families experienced more adverse health outcomes compared with their counterparts.

DISCUSSION

In this study, we aimed to examine the associations of family poverty status, from pregnancy up to child age 6 years, with child health outcomes for weight status, asthma, and HRQoL at 6 years. Consistent with our hypotheses, we observed associations between family poverty status and

child health outcomes. Poverty in early childhood was associated with an increased risk of overweight or obesity. Cumulative poverty between pregnancy and age 6 years was associated with a higher risk of asthma. Both poverty at birth and cumulative poverty were associated with lower physical HRQoL. Transition out of poverty before age 2 was associated with lower risk of asthma and a higher physical HRQoL compared with children who remained in poverty.

To guide the interpretation of the associations, two available models can help explain the different associations we observed between the measures of poverty status and child health outcomes.^{29,30} First, in accordance with accumulation models, the duration of poverty plays an important role because the impact of poverty accumulates over time.³¹ In our study, chronic poverty was associated with higher odds of asthma, which is in line with several previous studies.^{6,32} In one study, researchers reported that poverty in the

TABLE 4 Associations Between Timing of Poverty Change and Child Health Outcomes

	Born Into Poverty			Not Born Into Poverty		
	No Change	Transition out of Poverty Before Age 2	Transition out of Poverty After Age 2	No Change	Transition Into Poverty Before Age 2	Transition Into Poverty After Age 2
Overweight/obesity	Reference	2.05 (0.97 to 4.32)	1.86 (0.86 to 4.00)	Reference	1.02 (0.65 to 1.60)	1.02 (0.63 to 1.63)
Asthma	Reference	0.32 (0.12 to 0.88) ^a	0.45 (0.16 to 1.25)	Reference	0.85 (0.37 to 1.94)	1.28 (0.60 to 2.74)
HRQoL						
PhS	Reference	4.42 (1.62 to 7.22) ^a	3.66 (0.73 to 6.58) ^a	Reference	−2.15 (−3.27 to −1.03) ^a	0.32 (−0.86 to 1.50)
PsS	Reference	0.05 (−2.52 to 2.62)	−0.54 (−3.23 to 2.14)	Reference	0.03 (−1.28 to 1.22)	−0.91 (−2.23 to 0.41)

The table is based on an imputed data set. Models are adjusted for maternal age, maternal educational level, migration background, child's sex, and child's age.

^a Statistical significance.

first and fourth years of a child's life is associated with a higher risk of asthma attacks at age 4 years.³² Another study revealed that, among children aged three-and-a-half years, children from chronically poor families had a greater probability of experiencing asthma attacks than children from never-poor families.⁶ Family stress has been reported to be more prevalent in families with cumulative poverty.³³ There is a considerable amount of literature indicating an association between child exposure to stress and the development of asthma.³⁴⁻³⁶ These studies suggest that family stress may play a role in the pathway between cumulative poverty and childhood asthma. Furthermore, families with cumulative poverty may be more vulnerable to multiple adverse effects, such as neighborhood poverty. In 2018, it was reported in the Netherlands that 84% of the families with children experiencing poverty lived in rented social housing.³⁷ The impact of neighborhood poverty may be stronger for families that report poverty than for families who do not report poverty.³⁸ In our study, we observed no association between chronic poverty and overweight or obesity at child age 6 years. This is in line with findings from a nationally representative longitudinal study in the United States by Min et al¹² among a cohort of children followed-up from age 5 to 16 years. Min et al¹² observed no significant association between children from the persistently poor group (ie, experiencing 4 times of poverty in 4 measurements) and their overweight or obesity risk, compared with children who were never poor. Future studies are needed to confirm our findings regarding the association between cumulative poverty and overweight or obesity in younger children.

Second, period models suggest that family income at a certain time point is more critical to health.³⁹ Previous studies have revealed that poverty in early life is a sensitive period for poorer academic achievement,⁴⁰

adolescent smoking,⁴ and adolescent overall health status.⁴¹ Our results add to the evidence that poverty at birth is associated with a higher risk of overweight or obesity at age 6 years. These associations were independent of the current family poverty status. Thus, support for children whose families experience poverty early in life may have an important impact on health later in childhood and in adulthood.

Our study reveals that children who were born into poverty or experienced chronic poverty had lower physical HRQoL. That poverty status was not associated with psychosocial HRQoL might result from the young age of this population. Future studies observing children from a younger age until adolescence are warranted to provide greater insights into the associations between poverty status and child HRQoL.

In limited studies have researchers examined the duration of the period children were exposed to poverty among both children who transition out of and into poverty. A study in Canada revealed that children whose family left or transitioned into poor neighborhoods before the child was aged 2 showed significant differences in school readiness compared with children whose family left or transitioned into poor neighborhoods after age 2.¹⁹ In our study, we add evidence of the association between poverty status change and various health outcomes. Our results revealed that transition out of poverty before age 2 was associated with a higher physical HRQoL and lower risk of asthma compared with children whose family remained in poverty. Transitions into or out of poverty after age 2 were not associated with either health outcome. Further studies are needed to examine the impact of the timing of poverty change.

A strength of this study is the longitudinal design; net household income was measured at 4 different

time points, from prenatal to child age 6. We were, therefore, able to identify the associations between the dynamics of poverty and various health outcomes. This study also benefitted from a large sample size. Nevertheless, some limitations should be considered. First, poverty was measured by self-reported household income rather than from official records. Additionally, children with missing data on net household income at >1 time point were excluded from the analyses. This could have led to a selection bias in the case in which parents with the highest or lowest income tend to not report their family situation. However, our results revealed that the level of poverty in this study was comparable to that observed in the whole of the Netherlands.^{42,43} Second, in this study, the country of birth of the parents was used to define the migration background of the family of the child. We have no information on the ethnic identity as defined by the parents themselves. People born in the same country might have different ethnic backgrounds, which cannot be distinguished in this study.⁴⁴ Future studies are recommended to take more components of (cultural) background of the families into account. Third, information on whether the child received a physician diagnosis of asthma was obtained by using a questionnaire, which was adapted from the International Study of Asthma and Allergies in Childhood Core Questionnaire. This questionnaire is considered to be a reliable instrument and sufficient for epidemiological studies.⁴⁵ However, misclassification due to self-reporting may be present.

CONCLUSIONS

Children born into poverty were found to have a higher risk of overweight or obesity. Children growing up in chronically poor families are more at risk for asthma

and a lower physical quality of life than children never experiencing poverty. Transition out of poverty at an early age was associated with a lower risk of asthma and a higher physical quality of life. Support for children whose families have a low household income is warranted.

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ABBREVIATIONS

CHQ-PF28: Child Health Questionnaire
CI: confidence interval
HRQoL: health-related quality of life
OR: odds ratio
PhS: physical summary component scale
PsS: psychosocial summary component scale

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