Early Poverty and Children's General Health at 8 Years of Age in the Taiwan Birth Cohort Study

Wan-Lin Chiang¹ · Tung-liang Chiang¹

Accepted: 14 January 2019 / Published online: 23 January 2019
© The Author(s) 2019

Abstract

There are growing concerns about the effects of poverty on children's health, but few studies have examined how the long-term experience of poverty affects the general health of children. We sought to investigate the relationship between children's poverty experience from birth to school age and their general health status. Data from the Taiwan Birth Cohort Study (TBCS), a nationally representative sample of 17,853 children born in 2005 were used. Mother-rated health of children at age 8 was assessed. We used logistic regression to examine how the duration and timing of child poverty are related to children's general health, controlling for child and maternal characteristics. Of the 17,853 cohort members, 23.6% experienced early poverty (persistent, 5.9%; occasional, 17.7%) before age 5, and 11.4% experienced concurrent poverty at the age of 8. Children born into poverty and remaining poor were more likely to have poor health than those who were never poor. Early poverty (persistent poverty: odds ratio (OR) = 1.50; 95% confidence interval (CI) 1.27–1.78; occasional poverty: OR = 1.25; 95% CI 1.12–1.39) was more detrimental to children's general health than concurrent poverty (OR = 1.23; 95% CI 1.09–1.40). A long-lasting gradient effect of early poverty on the general health of children was detected, suggesting an urgent need to prevent children from growing up in persistent poverty.

Keywords Birth cohort · Persistent poverty · Early poverty · Child health · Taiwan

1 Introduction

Poverty is a highly significant social determinant of children's health (Commission on Social Determinants of Health 2008). Children who are born and raised in poor families may be exposed to a cluster of specific risk factors or have a greater general

✉ Tung-liang Chiang
tlchiang@ntu.edu.tw

¹ Institute of Health Policy and Management, College of Public Health, National Taiwan University, No. 17, Xu-Zhou Road, Taipei 10055, Taiwan

susceptibility to stress and diseases (Bradley and Corwyn 2002; Brooks-Gunn and Duncan 1997; Marmot et al. 1984). Consequently, they are more likely to have a wide range of adverse outcomes in physical, cognitive, social development, and lifelong effects on life chances and subsequent health (Bradley and Corwyn 2002; Brooks-Gunn and Duncan 1997; Duncan et al. 1998; Galobardes et al. 2004).

The life course approach offers a framework to link early poverty to health in later years through different models including cumulative effects, pathway effects, and latent effects (Ben-Shlomo and Kuh 2002; Hertzman 1999). First, the accumulation model assumes that the duration and intensity of exposure to early poverty has a cumulative, dose-response relationship to poor health in later life (cumulative effects). Second, repeated exposure to early poverty will increase the likelihood of exposure to multiple adversities, thereby raising the risk of damage to health (pathway effects). Third, the latency model posits that exposure to poverty in earlier life stages has a lifelong impact on later health, as early childhood is a critical period of biological development (latent effects). Therefore, acknowledging the duration and timing of child poverty is necessary to achieve a better understanding of the relationship between the poverty experience and later health outcomes (UNICEF 2012). Yet, only a few studies have examined the duration and timing of child poverty, particularly concerning the long-term effects of early childhood poverty on child health (Chen et al. 2007; Lee et al. 2014; Najman et al. 2010).

Moreover, a measure of general health status is essential for examining the effects of early poverty, because it is more comprehensive and can reflect the general susceptibility to illness or severity of diseases (Eisen et al. 1979; Idler and Benyamini 1997). However, previous longitudinal studies often focus on specific health conditions of children, like asthma, acute health problems, growth delay, obesity, or chronic illness (Chen et al. 2007; Ehounoux et al. 2009; Lee et al. 2014; Najman et al. 2010; Nikiéma et al. 2010). As far as we know, only one study conducted by Séguin et al. (2007) has explored the association between persistent poverty and the mother's perceptions of children's health in Quebec, but its small sample size may have insufficient power to test the effect.

Taiwan is one representative of the newly industrialized and non-western countries in East Asia (Bradbury et al. 2001). This study, using a large-scale, nationally representative birth cohort in Taiwan, aimed to examine the relationships between duration and timing of exposure to poverty from birth to school age and the general health status of children at age 8 after controlling for the child and maternal characteristics. Specifically, two hypotheses will be tested: (1) The duration of poverty before age 5 has a cumulative dose-response relationship with children's general health at age 8. (2) Exposure to poverty during the first five years of life has a long-term harmful impact on the general health of children of school age, independently of their current poverty status.

2 Methods

2.1 Study Population

The Taiwan Birth Cohort Study (TBCS) is the first large-scale longitudinal study of children in Taiwan. By using two-stage stratified random sampling, a nationally representative cohort of 24,200 babies born in 2005 was initially drawn from the National Birth Report Database, with a sampling rate of approximating 11.7%. Details of the information

about the TBCS have been described in a previous publication (Chiang et al. 2010). The first study contact with the cohort children was at age 6 months, which provided information on 21,248 (87.8%) infants. Four waves of follow-up surveys were conducted at 18 months, 3 years, 5.5 years, and 8 years of age, with a response rate of 94.9%, 93.7%, 92.8%, and 91.8%, respectively. All five surveys were conducted in the home via face-to-face interviews by trained staff with the mother or primary caregiver (> 93% were with the mother), who gave informed consent.

There were two criteria for inclusion in this study's sample: completion of the five waves of TBCS interview surveys between 2005 and 2013, and that respondents had available data for their poverty histories. Our final analytical sample comprised 17,853 children. The socio-demographic characteristics of the analytical sample were not statistically different from those of the baseline sample. The study was approved by the Institutional Review Board at National Taiwan University Hospital (ID number: 201704076RINB).

2.2 Variables

The primary dependent variable in this study was the general health status of children aged 8 years. Based on the mother's rating, we classified children into two groups: fair/poor (fair, poor, or very poor), and good (very good or good).

The independent variable was the type of child poverty. We used parental income as our indicator of poverty to identify families with less than 50% of the national median income at each wave between 2005 and 2013 of the TBCS survey. If the mother or primary care giver answered '\$30,000 New Taiwan Dollars (NTD) or less' to the question 'What is your (parents of child) monthly income in the last year?', then the family was defined as living in poverty (30 NTD=1 US\$; 46 NTD=£1) (Chiang and Chiang 2018).

Based on each family's history of poverty, we used two features of poverty – timing and duration – to account for poverty dynamics. The timing of poverty was divided into early poverty (from birth to 5 years of age) and concurrent poverty (at age 8). Early poverty was further grouped into three types: persistent poverty, occasional poverty, and never in poverty (Chiang and Chiang 2018). Persistent poverty was defined as being poor during at least three consecutive waves of the survey. Children occasionally experiencing poverty (occasional poverty) were defined as those meeting the definition of living in poverty at least once but never for longer than two consecutive waves of the survey. Never in poverty was defined as never being in poverty during the five-year window of observation.

The main control variables of this study were child and maternal characteristics. Child characteristics included demographic factors (sex and birth order), neonatal health status (preterm and low birth weight) and early rearing environment (predominant breastfeeding). Predominant breastfeeding after birth was defined as infants who were predominantly breastfed for more than 120 days after birth (Wu et al. 2015). Maternal characteristics included age at birth of child (less than 25 years, 25–29 years, 30–34 years, and more than 35 years), nationality (Taiwan, foreign-born (China, Southeast Asia or others)), and level of education (junior high school or below, senior high school, and college and above). These control variables were selected because they are associated with children's health, and all these covariates were measured when the child was 6-months-old.

2.3 Statistical Analysis

We conducted descriptive analyses to provide a socio-demographic profile of the sample and different types of poverty. Bivariate associations of poverty types and each covariate with the health status of children were assessed by χ^2 test. After the descriptive analysis, we estimated the unadjusted odds ratio (OR) for children's health by poverty types. Multivariate models of the relation between poverty types and children's health were then presented using logistic regression and controlling for confounding variables. All statistical analyses were conducted using SAS software, version 9.3 (SAS Institute, Cary, NC).

3 Results

Of the 17,853 cohort members, 23.6% of children in the TBCS had experienced poverty before the age of 5 years (5.9% persistent poverty, 17.7% occasional poverty), and 11.4% had experienced poverty at age 8 (Table 1).

Bivariate analysis indicated that children were generally more likely to be in fair/poor health at 8 years of age if they had ever experienced poverty, particularly those in early poverty and persistent poverty (Table 2). The results also showed that boys, first-borns, those born before 37 weeks of gestation, those with low birth weight, and children not predominantly breastfed for more than four months had a significantly higher prevalence of fair/poor health at 8 years of age. Mother's characteristics, including delivering the child when younger than 24 years and having a low level of education (less than junior high school), were found to be significantly associated with the fair/poor health of children (Table 3).

Logistic regression analysis demonstrated a relationship between poverty types and children's general health, unadjusted and adjusted for control variables (Table 4). In the unadjusted model, children who lived in persistent poverty (OR = 1.68, 95% confidence interval (CI) 1.46–1.94) and occasional poverty (OR = 1.32, 95% CI 1.20–1.45) during the first five years of life were more likely to have fair/poor health at 8 years than those who had never experienced poverty. We also found that children experiencing concurrent poverty (OR = 1.49; 95% CI 1.34–1.66) were more likely to have poorer health.

The inclusion of control variables in the model attenuated the associations between poverty types and children's general health, but the associations remained significant (Table 4). Early poverty predicted fair/poor health after controlling for concurrent poverty (persistent poverty: OR = 1.50; 95% CI 1.27–1.78; occasional poverty: OR = 1.25; 95% CI 1.12–1.39). Similarly, concurrent poverty was associated with having fair/poor health after controlling for early poverty (OR = 1.23; 95% CI 1.09–1.40). The results also indicate that early poverty has a stronger influence on children's general health than concurrent poverty.

4 Summary and Discussion

Using the TBCS data, we examined the relationship between the duration and timing of exposure to poverty from birth to school age and children's general health at age 8.

Table 1 Descriptive tables of poverty types and socio-demographic characteristics in Taiwan Birth Cohort Study

	N	%	Mean	SD	Range
Total	17,853	100.0			
Poverty types					
Early poverty*					
Persistent†	1057	5.9			
Sometimes	3158	17.7			
Never	13,638	76.4			
Current poverty					
Yes	2043	11.4			
No	15,810	88.6			
Child's characteristics					
Sex					
Girl	8480	47.5			
Boy	9373	52.5			
Birth order					
First	8938	50.1			
Non-first	8906	49.9			
Birth weight, g			3106.6	443.7	594–5500
≥2500	16,654	93.3			
< 2500 (low birthweight)	1199	6.7			
Gestational age, week			38.4	1.6	25–43
≥37	16,377	91.7			
< 37 (preterm)	1476	8.3			
Predominant breastfeeding					
No	15,057	84.3			
Yes	2794	15.7			
Mother's characteristics					
Age at birth of the child, year			30.0	4.8	15–49
≤24	2471	13.8			
25–29	5801	32.5			
30–34	6477	36.3			
≥35	3104	17.4			
Education					
≤Junior high school	2395	13.4			
Senior high school	7103	39.8			
≥College	8330	46.7			
Missing	25	0.1			

*Early poverty: family's history of poverty across four time periods at the age of 6 months, 18 months, 3 years, and 5.5 years

†Persistent poverty was defined as being poor for consecutive periods of at least three waves of the survey

Children born and growing in poor families were more likely to have poor health than those of the never in poverty group. Early poverty before age 5, and particularly persistent poverty, was more detrimental to children's general health than concurrent poverty at age 8.

Table 2 Poverty types and health of children

Poverty types	Total	Health at 8 years of age				<i>p</i> value
		Fair/Poor		Good		
		N	n	%	n	
Total	17,853	3606	20.2	14,247	79.8	
Early poverty*						< .001
Persistent†	1057	297	28.1	760	71.9	
Occasional	3158	740	23.4	2418	76.6	
Never	13,638	2569	18.8	11,069	81.2	
Concurrent poverty						< .001
Yes	2043	540	26.4	1503	73.6	
No	15,810	3066	19.4	12,744	80.6	

*Early poverty: family's history of poverty across four time periods: 6 months, 18 months, 3 years, and 5.5 years

†Persistent poverty is defined as being poor for at least three consecutive waves of the survey

Confirming the accumulation model of life course perspective (Ben-Shlomo and Kuh 2002), we found a gradient effect concerning the duration of poverty on the general health of children in Taiwan. That is, children who experienced persistent poverty had poorer health than children who experienced occasional poverty, and those in occasional poverty had poorer health than children who were never poor. Poverty is highly related to multiple forms of deprivation, including lack of the basic necessities of life, absence of housing facilities, and living in communities with environmental problems. Moreover, poor families are more likely to provide a lower quality of home enrichment, parenting, and child care (Evans 2004). As the duration of exposure to poverty increases, the damaging effect of a cluster of adversities on children's health and development may accumulate gradually over the life course (Ben-Shlomo and Kuh 2002; Black et al. 2017; Lynch and Smith 2005).

Our findings also support the proposition that early poverty has a long-term effect on the general health of children at the age of 8 years (Ben-Shlomo and Kuh 2002). In addition, we found that early poverty had more harmful effects than concurrent poverty on the health of the Taiwanese birth cohort's members. Previous studies have mainly focused on specific health and development conditions before the age of 5 years, showing that the experience of early poverty is highly associated with cognitive development, growth delay, and behavioural problems in children (Duncan et al. 1994; Ehounoux et al. 2009; Kiernan and Mensah 2009; Schoon et al. 2012). Moreover, using the US National Longitudinal Survey of Youth–Children, Chen et al. (2007) found that early poverty had a stronger effect on chronic or limiting conditions of children at the age of 10–11 than current poverty.

Why does early poverty have a long-lasting effect on children's general health? There are two plausible explanations. First, low socioeconomic conditions during the prenatal period and early childhood may affect children's constitution, leading to a permanent change in their general susceptibility to environmental challenges or illnesses (Hertzman

Table 3 Socio-demographic characteristics and health of children

	Total	Health at 8 years of age				p value
		Fair/Poor		Good		
	N	n	%	n	%	
Total	17,853	3606	20.2	14,247	79.8	
Child's characteristics						
Sex						< .001
Girl	8480	1569	18.5	6911	81.5	
Boy	9373	2037	21.7	7336	78.3	
Birth order						< .001
First	8938	1928	21.6	7010	78.4	
Second and higher	8906	1676	18.8	7230	81.2	
Low birthweight						< .001
No	16,654	3280	19.7	13,374	80.3	
Yes	1199	326	27.2	873	72.8	
Preterm						< .001
No	16,377	3248	19.8	13,129	80.2	
Yes	1476	358	24.3	1118	75.7	
Predominant breastfeeding						0.02
No	15,057	3087	20.5	11,970	79.5	
Yes	2794	519	18.5	2275	81.5	
Mother's characteristics						
Age at birth of the child, y						0.001
≤24	2471	565	22.9	1906	77.1	
25–29	5801	1189	20.5	4612	79.5	
30–34	6477	1256	19.4	5221	80.6	
≥35	3104	596	19.2	2508	80.8	
Nationality						0.37
Foreign-born	2171	423	19.5	1748	80.5	
Taiwanese	15,682	3183	20.3	12,499	79.7	
Education						
≤Junior high school	2395	547	22.8	1848	77.2	< .001
Senior high school	7103	1445	20.3	5658	79.7	
≥College	8330	1609	19.3	6721	80.7	
Missing	25	–	–	–	–	

1999; Kunitz 2002; Marmot et al. 1984). For instance, Russ et al. (2014) proposed biological embedding mechanisms— such as the hormonal response system to stress, epigenetic modification, genetic imprinting, learned behaviours, or fetal adaptive response to undernutrition in utero— to explain how social adversity early in life influence long-lasting functional and structural changes over the course of human development. Second, while children experience poverty that is accompanied with specific stressors in a critical

Table 4 Association between poverty types and children's health

	Fair/poor health at 8 years of age							
	OR	95% CI		p value	adjusted OR	95% CI		p value
Early poverty* (ref: never)								
Persistent†	1.68	1.46	1.94	< .001	1.50	1.27	1.78	< .001
Occasional	1.32	1.20	1.45	< .001	1.25	1.12	1.39	< .001
Concurrent poverty (ref: no)								
Yes	1.49	1.34	1.66	< .001	1.23	1.09	1.40	0.001
Child's characteristics								
Sex (ref: girl)								
Boy	1.22	1.14	1.32	< .001	1.24	1.15	1.33	< .001
Birth order (ref: second and higher)								
First	1.19	1.10	1.28	< .001	1.19	1.11	1.29	< .001
Low birthweight (ref: no)								
yes	1.52	1.33	1.74	< .001	1.43	1.23	1.67	< .001
Preterm (ref: no)								
Yes	1.29	1.14	1.47	< .001	1.11	0.96	1.28	0.17
Predominant breastfeeding (ref: no)								
Yes	0.89	0.80	0.98	0.02	0.93	0.84	1.03	0.17
Mother's characteristics								
Age at birth of the child, y (ref: ≥35)								
≤24	1.25	1.10	1.42	< .001	1.08	0.93	1.24	0.32
25–29	1.09	0.97	1.21	0.14	1.04	0.93	1.16	0.53
30–34	1.01	0.91	1.13	0.82	1.03	0.92	1.15	0.64
Nationality (ref: foreign-born)								
Taiwanese	1.05	0.94	1.18	0.38	1.35	1.17	1.55	< .001
Education (ref: ≤junior high school)								
Senior high school	0.86	0.77	0.97	0.01	0.85	0.75	0.97	0.02
≥College	0.81	0.73	0.90	< .001	0.85	0.74	0.99	0.03

*Early poverty: family's history of poverty across four time periods: 6 months, 18 months, 3 years, and 5.5 years

†Persistent poverty is defined as being poor for at least three consecutive waves of the survey

period, these can cause specific and devastating long-term damage across different pathways (Galobardes et al. 2004; Lynch and Smith 2005; Marmot et al. 1984). For example, less access to cognitively stimulating materials and a negative mother–child relationship in early childhood may impair the structure or function of the brain, causing smaller hippocampal volume, greater or less-regulated amygdala, and higher basal cortisol (Johnson et al. 2016). Thus, future research should be conducted to clarify the mechanisms linking early poverty to children's general health.

4.1 Study Strengths and Limitations

The strength of this study lies primarily in its large-scale, nationally representative, longitudinal birth cohort design. We used a longitudinal prospective survey starting at

birth, which avoided a recall bias concerning family income, allowed for accurate understanding of children's mobility across poverty status, and confirmed the temporal relationship between poverty and children's health owing to temporal sequence. Moreover, a large sample size provided enough statistical power to test relationships.

Our study has some limitations. Self-reported parental income without further checking of actual income may have resulted in bias. However, we found that self-reported income to be negatively correlated with self-perceived financial strain and receipt of social welfare services, and positively correlated with house ownership (Chiang and Chiang 2018). Further, we used the mother's perceptions of the health of their children, which may have a mother's subjective bias, instead of children's self-reports to represent children's health. However, previous study has indicated that maternal ratings of child health are a good indicator of children's health status (Monette et al. 2007). Children who had health problems, such as acute diseases, chronic diseases, asthma attacks, or the experience of hospitalisation, were perceived by their mothers to be in poorer health.

4.2 Conclusions

The present findings contribute to understanding in the field of the long-term effect of early-life poverty on the general health status of school-age children. This study demonstrated that persistent poverty during the first five years was an important predictor of children's poor health. Thus, governments should address the issue of early poverty through employment, education, tax and health policies to reduce health inequalities across the life course (Graham and Power 2004; Chiang and Chiang 2018). In addition, paediatricians can assess the long-term economic conditions of children, collaborating with social communities to prevent children from remaining in poverty and improve their health outcomes (Gitterman et al. 2016).

Acknowledgements We thank the Health Promotion Administration, Department of Health and Welfare (DOH 94-HP-1802, DOH 95-HP-1802, DOH 96-HP-1702, DOH 99-HP-1702, DOH 102-HP-1701) as well as the Ministry of Science and Technology (MOST 106-2314-B-002-094-MY2) in Taiwan for financial support, and the Community Health Survey Operation Center for data collection and management. The authors also gratefully acknowledge the time and continuing support given by all the participating families of the Taiwan Birth Cohort Study.

Compliance with Ethical Standards

Conflict of Interest The authors have no conflicts of interest relevant to this article to disclose.

Ethics Approval The study was approved by the Institutional Review Board at National Taiwan University Hospital (reference number 201704076RIN).

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: Conceptual models, empirical challenges and interdisciplinary perspectives. *International Journal of Epidemiology*, 31(2), 285–293.
- Black, M. M., Walker, S. P., Fernald, L. C., Andersen, C. T., Digirolamo, A. M., Lu, C., McCoy, D. C., Fink, G., Shawar, Y. R., & Shiffman, J. (2017). Early childhood development coming of age: Science through the life course. *The Lancet*, 389(10064), 77–90.
- Bradbury, B., Jenkins, S. P., & Micklewright, J. (2001). *The dynamics of child poverty in industrialised countries*. England: Cambridge University Press.
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, 53, 371–399.
- Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children*, 7(2), 55–71.
- Chen, E., Martin, A. D., & Matthews, K. A. (2007). Trajectories of socioeconomic status across children's lifetime predict health. *Pediatrics*, 120(2), e297–e303.
- Chiang, W. L., & Chiang, T. L. (2018). Risk factors for persistent child poverty during the first five years of life in Taiwan birth cohort study. *Child Indicators Research*, 11(3), 885–896.
- Chiang, T. L., Lin, S. J. & Chang, M. J. (2010). An introduction to Taiwan birth cohort study: Background, design, and characteristics of participated children. In: T. L. Chiang, S. J. Lin (Eds.), *The health profiles of Taiwanese children in the 21st century: From birth to thirty-six months* [in Chinese] (pp. 1–12). Taipei: Health Promotion Administration, Ministry of Health and Welfare.
- Commission on Social Determinants of Health. (2008). *Closing the gap in a generation: Health equity through action on the social determinants of health. Final report of the commission on social determinants of health*. Geneva: World Health Organization.
- Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development*, 65(2), 296–318.
- Duncan, G. J., Yeung, W. J., Brooks-Gunn, J., & Smith, J. R. (1998). How much does childhood poverty affect the life chances of children? *American Sociological Review*, 63(3), 406–423.
- Ehounoux, N., Zunzunegui, M., Séguin, L., Nikiema, B., & Gauvin, L. (2009). Duration of lack of money for basic needs and growth delay in the Quebec longitudinal study of child development birth cohort. *Journal of Epidemiology and Community Health*, 63(1), 45–49.
- Eisen, M., Ware, J. E., Jr., Donald, C. A., & Brook, R. H. (1979). Measuring components of children's health status. *Medical Care*, 17(9), 902–921.
- Evans, G. W. (2004). The environment of childhood poverty. *American Psychologist*, 59(2), 77–92.
- Galobardes, B., Lynch, J. W., & Davey Smith, G. (2004). Childhood socioeconomic circumstances and cause-specific mortality in adulthood: Systematic review and interpretation. *Epidemiologic Reviews*, 26(1), 7–21.
- Gitterman, B. A., Flanagan, P. J., Cotton, W. H., Dilley, K. J., Duffee, J. H., Green, A. E., Keane, V. A., Krugman, S. D., Linton, J. M., & Mckelvey, C. D. (2016). Poverty and child health in the United States. *Pediatrics*, 137(4), e20160339.
- Graham, H., & Power, C. (2004). Childhood disadvantage and health inequalities: A framework for policy based on lifecourse research. *Child: Care, Health and Development*, 30(6), 671–678.
- Hertzman, C. (1999). The biological embedding of early experience and its effects on health in adulthood. *Annals of the New York Academy of Sciences*, 896(1), 85–95.
- Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior*, 38(1), 21–37.
- Johnson, S. B., Riis, J. L., & Noble, K. G. (2016). State of the art review: Poverty and the developing brain. *Pediatrics*, 137(4), e20153075.
- Kiernan, K. E., & Mensah, F. K. (2009). Poverty, maternal depression, family status and children's cognitive and behavioural development in early childhood: A longitudinal study. *Journal of Social Policy*, 38(4), 569–588.
- Kunitz, S. J. (2002). Holism and the idea of general susceptibility to disease. *International Journal of Epidemiology*, 31(4), 722–729.
- Lee, H., Andrew, M., Gebremariam, A., Lumeng, J. C., & Lee, J. M. (2014). Longitudinal associations between poverty and obesity from birth through adolescence. *American Journal of Public Health*, 104(5), e70–e76.

- Lynch, J., & Smith, G. D. (2005). A life course approach to chronic disease epidemiology. *Annual Review of Public Health*, 26, 1–35.
- Marmot, M. G., Shipley, M. J., & Rose, G. (1984). Inequalities in death—Specific explanations of a general pattern? *The Lancet*, 323(8384), 1003–1006.
- Monette, S., Séguin, L., Gauvin, L., & Nikiéma, B. (2007). Validation of a measure of maternal perception of the child's health status. *Child: Care, Health and Development*, 33(4), 472–481.
- Najman, J. M., Hayatbakhsh, M. R., Clavarino, A., Bor, W., O'callaghan, M. J., & Williams, G. M. (2010). Family poverty over the early life course and recurrent adolescent and young adult anxiety and depression: A longitudinal study. *American Journal of Public Health*, 100(9), 1719–1723.
- Nikiéma, B., Spencer, N., & Séguin, L. (2010). Poverty and chronic illness in early childhood: A comparison between the United Kingdom and Quebec. *Pediatrics*, 125(3), e1–e9.
- Russ, S. A., Larson, K., Tullis, E., & Halfon, N. (2014). A lifecourse approach to health development: Implications for the maternal and child health research agenda. *Maternal and Child Health Journal*, 18(2), 497–510.
- Schoon, I., Jones, E., Cheng, H., & Maughan, B. (2012). Family hardship, family instability, and cognitive development. *Journal of Epidemiology and Community Health*, 66(8), 716–722.
- Séguin, L., Nikiéma, B., Gauvin, L., Zunzunegui, M.-V., & Xu, Q. (2007). Duration of poverty and child health in the Quebec longitudinal study of child development: Longitudinal analysis of a birth cohort. *Pediatrics*, 119(5), e1063–e1070.
- UNICEF. (2012). *Measuring child poverty. Innocenti report card 10*. Italy: UNICEF Innocenti Research Centre.
- Wu, W. C., Wu, J. C. L., & Chiang, T. L. (2015). Variation in the association between socioeconomic status and breastfeeding practices by immigration status in Taiwan: A population based birth cohort study. *BMC Pregnancy and Childbirth*, 15, 298.