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# Maternal Socioeconomic Status and Infant Low Birth Weight: Interactions Across Generations

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**Maternal Socioeconomic Status and Infant Low Birth Weight; Interactions Across  
Generations**

by

Kira M. Anderson

An undergraduate honors thesis submitted in partial fulfillment

of the requirements for the degree of

Bachelor of Science

In

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And

Public Health Studies: Clinical Health Science

Thesis Advisor

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### **Abstract**

This article examines the interplay between low birth weight (LBW) and socioeconomic status (SES) across generations. Transgenerational research of LBW and SES is limited and poses certain challenges and nuances. A literature review was conducted which gathered studies that analyze both LBW and SES for two or more generations. Results of these studies are mixed, but the body of research is suggestive of patterns in which LBW and low SES may mutually exacerbate each other across generations. Furthermore, the research suggests that these patterns may be more severe among Black women. This paper calls into question the consequences that these transgenerational interactions may have for health equity, and sets forth recommendations for future research in this area.

Transgenerational patterns between low birth weight (LBW) and socioeconomic status (SES) raise important questions for maternal and infant health, but research in this area is limited. Low birth weight is a widely acknowledged marker of neonatal health and the leading cause of infant mortality in the United States (Gavin et al., 2011). According to the Nutrition and Food Safety Department, LBW multiplies the likelihood of death by about 20 when compared to normal birth weight (n.d.). LBW infants are infants born weighing less than 2500 grams (5 lbs 8 ounces) while very low birth weight (VLBW) infants are infants born weighing less than 1500 grams (3 lbs 5 ounces). The global rate of LBW is estimated to be 14.6%, with higher rates in developing countries (Blencowe et al., 2019). The percentage of LBW births in the United States during 2020 was 8.24% among all births and 6.68% among singleton births (Osterman et al., 2021).

Risk factors for LBW delivery include diabetes, previous LBW infants, multiple pregnancy, advanced maternal age (Shaw et al., 2019), smoking, hypertension, and low gestational weight gain (Catov et al., 2016). Importantly, the risk posed by medical factors may be exacerbated and compounded by psychosocial risk factors such as homelessness, low income, level of education, access to prenatal care, and domestic violence (Shaw et al., 2019). The rates of LBW are not randomly distributed across the United States population. Women who are white, married, or have obtained a higher level of education are less likely to deliver a LBW infant (Catov et al., 2016). There is a well documented racial disparity involved in low birth weight. The rate of LBW among births to non-hispanic white women in 2020 was 6.84% compared to non-hispanic Black women at 14.19% (Osterman et al., 2021). The disparity is even more severe for VLBW with a rate of 0.99% among births to non-hispanic white women and a rate of 2.86% among births to non-hispanic Black women (Osterman et al., 2021). Furthermore,

this disparity may be worsening temporally. A study from Catov et al. in 2016 found that average infant birth weight had been gradually decreasing since 1997 but the adjusted annual decrease in birth weight among Black women was twice that of white women (3.78 g and 1.88 g, respectively). There is stronger transmission of LBW across generations among Black women as well (Currie & Moretti, 2007).

Low birth weight and very low birth weight are associated with a number of adverse health outcomes in later life. Infants weighing less than 2500 grams at birth have an increased risk of developing type 2 diabetes mellitus over the lifecourse when compared to infants weighing more than 2500 grams at birth (Zhao et al., 2018). Birth weight and coronary heart disease have been shown to be inversely associated, and a birth weight increase of 1 kg is associated with a 10-20% decreased risk of coronary heart disease (Wang et al., 2014) (Huxley et al., 2007). Some studies have demonstrated an association between LBW and hypertension, but this is not conclusive across the body of literature (Sabri et al., 2021). Furthermore, an estimated 16.9% of VLBW infants develop motor delays or cognitive delays that are apparent around age two (Pascal et al., 2018). This figure may not fully predict the total frequency of delay among VLBW individuals since certain delays are not evident until later in childhood development (Pascal et al., 2018). Low birth weight is of crucial importance as a vital statistic because it is predictive of a number of adverse health outcomes in development and later life.

The relationship between low SES and LBW has been thoroughly studied. There are two main bodies of literature at play in the investigation of this relationship. Some research examines the influence of maternal SES upon infant birth weight outcome. Meanwhile, other research examines the influence of infant LBW upon SES later in life. It is outside the scope of this paper

to fully review each of these discourses, but the key findings contribute to the need for transgenerational research of LBW and low socioeconomic status.

The research indicates an association between an infant's LBW and lower socioeconomic outcomes later in life. In a systematic review of 15 studies, a birth weight increase of 500 g was found to be associated with a 2.8% increase in annual income (Lambiris et al., 2021). This represents a significant loss of income for LBW individuals over the life course, which likely incurs economic disadvantage. Low birth weight is associated with reduced income, but there is also evidence suggesting that it increases vulnerability to fluctuations in the health of the economy. A study from Bharadwaj et al. demonstrated that individuals who weighed more at birth were less likely to utilize underemployment insurance during Sweden's economic crisis in the 1990s (2019). This suggests that people who weighed less at birth were more likely to experience job loss during the economic downturn.

The literature also supports an association between maternal low SES and infant low birth weight. Lifelong exposure to poverty or low SES is likely more impactful for birth weight than isolated exposure during childhood or adulthood (Collins et al., 2008). The connection between maternal low SES and LBW is further strengthened by the research indicating that welfare interventions improve birth weight outcomes. Use of the women, infant, and children (WIC) program was associated with improved birth weight outcomes even during the Great Recession (Blakeney et al., 2020). The research in this area indicates a racial disparity involved in these patterns. It has been shown that lifelong exposure to poverty is most impactful for birth outcomes among Black women (Collins et al., 2008). This racial disparity is also reflected by the fact that birth outcomes - including LBW - worsened the most among Black mothers during the Great Recession (Blakeney et al., 2020).

When taken in tandem, these two bodies of literature may lend themselves to a transgenerational pattern. With maternal low socioeconomic status predicting low birth weight, and infant low birth weight predicting low socioeconomic status, a cyclic pattern across generations has the potential to deepen disparities in health and wealth. This paper sets forth a literature review of the studies that examine both low SES and LBW transgenerationally, and explores how these patterns may contribute to exacerbated health inequity.

### **Methods**

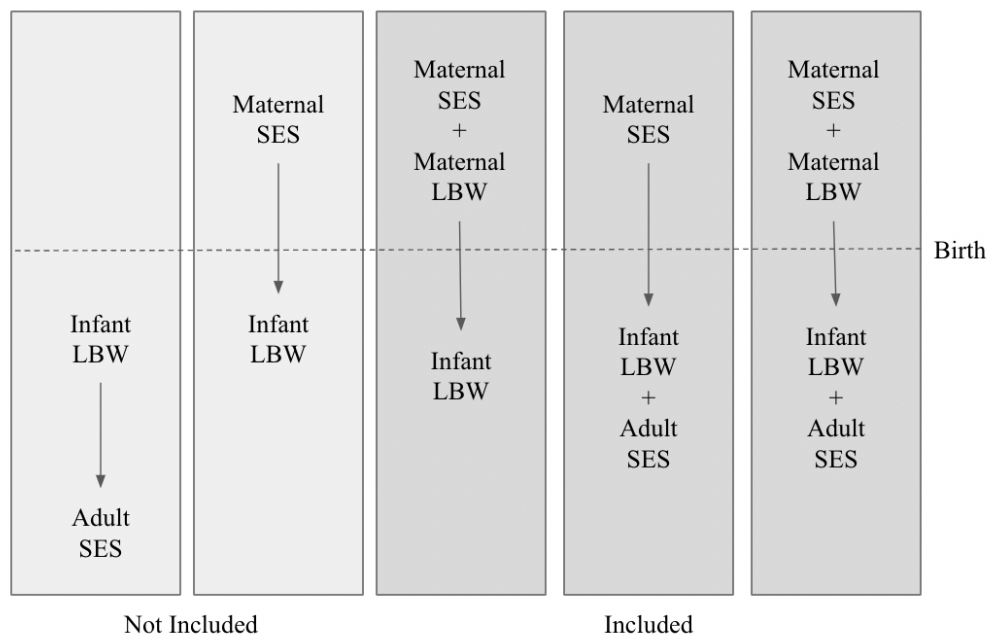
The Portland State University library page was searched with the Boolean term “low infant birth weight” AND “generational poverty”, yielding four articles for inclusion in the literature review. An additional article was found by searching the Portland State University library page, using the Boolean search term (LBW OR "low birth weight") AND ("low SES" OR "low socioeconomic status" OR poverty) AND (intergenerational OR transgenerational OR "across generations"). Follow-up searches were conducted using PubMed and Gale OneFile, yielding no articles. Two additional articles were included from snowballing the citations of already selected articles. Another round of snowballing of these two articles yielded no further items for inclusion, amounting to seven articles in total (Appendix A). Articles were selected for inclusion on the basis of the following criteria:

- 1) The article was published in a peer-reviewed journal.
- 2) The article was published within the last 15 years, with the addition of seminal publications that influenced the development of the discourse.
- 3) The article was available in English.

- 4) The study meets one of the following:
- Birth weight data was collected and analyzed from multiple generations, and socioeconomic data was collected and analyzed from one generation.
  - Socioeconomic data was collected and analyzed from multiple generations, and birth weight data was collected and analyzed from one generation.
  - Both birth weight data and socioeconomic data were collected and analyzed from multiple generations.
- 5) The study sets forth an examination of potential generational patterns in low birth weight and low socioeconomic status.

**Figure 1**

*Study design framework for articles included and not included in the literature review.*





For the purposes of this literature review, “socioeconomic data” encompasses individual income data, neighborhood income data, economic mobility data, neighborhood economic mobility data, social class data, zip code data, or occupational data. Screening for individual income data alone excluded many of the available studies, even if their study design set forth an equally strong and relevant examination of the transgenerational relationship in question.

Studies that examined small-for-gestational age (SGA) births instead of LBW were also included since SGA is a measure of birthweight. An infant is considered to be SGA if their birth weight is below the 10th percentile among infants born at the same gestational age. Conversely, studies examining preterm birth were not included because this metric is not a measure of birthweight.

A generous time range was allotted during searching due to the rarity of articles that examine LBW and low SES across generations.

### **Literature Review**

Research on this topic predominantly uses birth certificates and census records for data collection, with neighborhood income being the most popular proxy for individual income. The Illinois Transgenerational Birth File was used in three studies to assemble a transgenerational data set with cross-referenced economic information from census data (Collins et al., 2009) (Collins et al., 2010) (Castrillio et al., 2014). Data analysis widely relied upon varied regression techniques, although certain researchers call the fittedness of this form of statistical analysis into question (De Stavola et al., 2011).

Results from studies pairing transgenerational research of LBW with transgenerational research of low SES have been mixed (Appendix B). Some studies find that higher SES

alleviates transmission of LBW across generations (Conley & Bennett, 2001). Meanwhile, low SES has been found to strengthen the transgenerational relationship between maternal LBW and infant LBW (Currie & Moretti, 2007) (De Stavola et al., 2011). Robertson and O'Brien concluded that a county's degree of economic mobility across generations is in strong negative association with that county's LBW rates (2018), which suggests that SES across generations is in relationship with birth outcomes.

Importantly, some of the studies find a relationship that is conditional upon race. One study that included only Black mothers found that maternal grandmother's exposure to neighborhood poverty is associated with infant birth weight, regardless of the risk factors experienced by the infant's mother (Collins et al., 2009). Subsequently, Collins et al. (2010) found that maternal LBW is a risk factor for infant LBW regardless of socioeconomic status. However, among non-LBW Black women only, the risk of infant LBW that was attributable to neighborhood income was six times that for non-LBW white women.

In another study, adjusting for transgenerational neighborhood income did not impact the association between maternal SGA and infant SGA (Castrillio et al., 2014). However, this area of research taken as a whole suggests that SES is a factor in the transmission of LBW across generations, and that this relationship may have more severe implications for birth outcomes among Black women. The research is less clear when it comes to whether LBW influences the relationship between parental SES and infant SES in adulthood. The only study to follow SES into the infants' adulthood was from Robertson & O'Brien. However, this was in the form of an economic mobility metric that was assessed for correlation with LBW at the county level (2018), and the study did not form direct conclusions as to how LBW influences the transmission of low SES across generations.

Across the seven articles selected for inclusion in the literature review there were a total of 14 distinct authors, many of whom authored multiple of the studies. The discourse community for transgenerational research of LBW and SES spans medicine and neonatology, sociology, public health and epidemiology, and economic research disciplines.

## **Discussion**

### **Gaps in the Research**

Most of the research in this area has examined the influence of maternal socioeconomic status upon infant LBW or infant LBW upon adult socioeconomic status. This research has exhibited a clear predictive relationship between maternal SES and LBW as well as a correlation between infant LBW and lower SES in adulthood. However, this research doesn't capture interactions between low SES and LBW across generations. As a result, it cannot form conclusions as to whether these interactions reproduce low SES or LBW outcomes.

The research that does meet these criteria is limited, with very little recent research. The articles obtained that met the inclusion criteria span the years 2001 to 2018, with six having been published in the last fifteen years, two having been published in the last ten years, and one having been published in the last five years. This is illustrative of a clear gap when it comes to research of SES and LBW that crosses generations. The body of research is also limited in terms of exploring racial disparities. Certain studies analyze the impact of race upon the correlations in question, but only among non-hispanic Black and non-hispanic white women.

This body of work is more demonstrative of socioeconomic status as a factor in the transmission of LBW, but draws fewer conclusions when it comes to LBW as a factor in the transmission of socioeconomic status. The finding from Robertson & O'Brien (2018) that higher

transgenerational economic mobility is negatively associated with incidence of LBW suggests that LBW could be involved in the generational reinforcement of poverty, but more research is needed.

### **The Illinois Transgenerational Birth File**

Use of the Illinois Transgenerational Birth File is commonplace in this set of literature, as well as in studies that did not meet the criteria for inclusion. The data set is linked between parents and children, and cross-referenced to census data pertaining to the location indicated on the birth records for the mother and infant. This data set is an important tool in this body of research, but it poses certain limitations.

First, the Illinois Transgenerational Birth File relies upon linkage of the parental generation with the infant generation using birth records. Depending on the linking methods, the match rate between generations is typically in the 70-80% range (David et al., 2008).

Non-matching occurs as a result of misspellings in birth records or missing documentation. Searching for only portions of the first and last names - paired with middle initials and birth dates - has been shown to alleviate the impacts of misspellings and improve birth record non-matching in the Virginia Intergenerational Linked Birth File (Chapman & Gray, 2013), which functions similarly to the Illinois Transgenerational Birth File.

Next, the Illinois Transgenerational Birth File relies upon linkage between birth records data and census tract data. This involves matching the residential information provided on the birth records to their corresponding census tracts. Census tracts approximately reflect actual neighborhoods by corresponding to physical boundaries that would normally divide neighborhoods (David et al., 2008). However, only about half of the birth file successfully

matches birth records to census data for both the parental and infant generations (David et al., 2008). Only 14% of the Illinois Transgenerational Birth File matches birth records between both generations with census data for both generations (David et al., 2008), which reduces the sample size for transgenerational research substantially.

It is crucial to consider that non-matching between birth records and/or census data is not likely a randomly distributed occurrence across the population. Those who are most likely to have missing or incomplete records are also those who are most likely to face the most severe social and economic disadvantage (Collins et al., 2009). As such, it is reasonable to speculate that the Illinois Transgenerational Birth File - as well as the research that utilizes it - may not capture the most vulnerable portion of the population (David et al., 2008), for whom this research is most important.

Not all of the studies in this body of work employ the Illinois Transgenerational Birth File. However, almost all of the research implements similar methods involving birth certificate and census matching that involve the same limitations.

### **Proxies for Individual Socioeconomic Status**

The articles included in the literature review use a number of different proxies for socioeconomic status. The study from Conley & Bennett (2001) was the only study that collected individual income data from the mothers using the Panel Study of Income Dynamics, a longitudinal household study from the University of Michigan that has been collecting data since 1968. Income speaks directly to the SES of the individual, which is a clear advantage to this study design.

The other studies measure variables indicative of SES, but not necessarily at the individual level. Those that used the Illinois Transgenerational Birth File measured economic environment and neighborhood poverty by linking birth records with census data (Collins et al., 2009) (Collins et al., 2010) (Castrillio et al., 2014). The income in a given census tract does not necessarily speak to the income of each individual who lives there, but it does reflect the individual's economic environment. Currie & Moretti (2007) used the zip code of the hospital where the mother and infant were born, and measured the poverty rate at those zip codes. A clear limitation of this proxy is that plenty of people don't live in the same zip code as their hospital. As such, this measurement might not capture neighborhood economic environment. The study from De Stavola et al. (2011) used paternal occupation for the grandparent's generation and census data for the parent's generation to deduce social class. Finally, the study from Robertson & O'Brien (2018) used a county level measure of intergenerational economic mobility that linked tax records across generations. The researchers looked for correlations between economic mobility and rates of LBW for each county, rather than patterns between individuals and their offspring.

Almost every study in the literature review uses a neighborhood level or county level proxy for individual socioeconomic status. While this may be a limitation in some respects, exposure to neighborhood poverty is impactful in its own capacity (Currie & Moretti, 2007). Additionally, neighborhood economic environment might be a more resilient and holistic measure of SES because it is less likely to change, whereas individual income fluctuates across the lifecourse (Solon, 1999 as cited in Currie & Moretti, 2007).

## **Research Timelines and the Life-Course Perspective**

Another important complexity involved in this body of research is the chronology of the proxy taken for socioeconomic status. Some research measures SES for a given individual during their pregnancy while some measures SES during infancy or childhood. The relationship between SES and LBW has been shown to be influenced by the duration of the exposure to low socioeconomic status. In a study from Collins et al., lifelong exposure to neighborhood poverty was shown to be an independent risk factor for LBW while exposure to neighborhood poverty during only childhood or adulthood were not (2008). Another study from Gavin et al. found that maternal exposure to low SES during early-life predicted LBW outcomes in the infant generation (2011). Changes of SES over the life course are influential as well. Decreased SES between childhood and adulthood is associated with higher rates of SGA births among non-hispanic white women (Collins et al., 2020).

Among the studies that matched birth records to census records, the SES of the mother was measured only at the time of the infant's delivery. This poses a limitation because it doesn't capture maternal early-life exposures to low SES, which are relevant for birth outcomes.

## **Conclusions & Recommendations**

The literature is suggestive of a damaging relationship between socioeconomic status and low birth weight that may reproduce adverse birth, health, and economic outcomes across generations. Furthermore, these patterns have been shown to be more severe among Black women who are already facing health and wealth inequity. Additional research is needed due to limited research, limitations of that research, inconsistencies in findings, and incomplete study of the impacts for different minority groups. Future research would benefit from more robust and

comprehensive population-level health data collection in order to alleviate many of the existing limitations in the current body of work. This research is crucial due to the potential for these patterns to deepen already existing disparities in health and wealth, especially in a sociopolitical landscape where women's health access faces continued obstruction.



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## Appendix A

### Retrieval of Included Articles

Title	Author	Year	Journal	Searched	Search term
Small-for-Gestational Age and Preterm Birth Across Generations: A Population-Based Study of Illinois Births	Castrillio et al.	2014	Maternal and Child Health Journal	Portland State University Library Search	"low infant birth weight" AND "generational poverty"
Transgenerational effect of neighborhood poverty on low birth weight among African Americans in Cook County, Illinois	Collins et al.	2009	American Journal of Epidemiology	Portland State University Library Search	"low infant birth weight" AND "generational poverty"
Low Birth Weight Across Generations: The Effect of Economic Environment	Collins et al.	2010	Maternal and Child Health Journal	Portland State University Library Search	"low infant birth weight" AND "generational poverty"
Health Endowment at Birth and Variation in Intergenerational Economic Mobility: Evidence From U.S. County Birth Cohorts	Robertson & O'Brien	2018	Demography	Portland State University Library Search	"low infant birth weight" AND "generational poverty"
Birth Weight and Income: Interactions across Generations	Conley & Bennett	2001*	Journal of Health and Social Behavior	Portland State University Library Search	(LBW OR "low birth weight") AND ("low SES" OR "low socioeconomic status" OR poverty) AND (intergenerational OR transgenerational OR "across generations")

Title	Author	Year	Journal	Searched	Search term
Intergenerational Correlations in Size at Birth and the Contribution of Environmental Factors: The Uppsala Birth Cohort Multigenerational Study, Sweden, 1915–2002	De Stavola et al.	2011	American Journal of Epidemiology	Snowballed from Gigante et al. 2015	N/A
Biology as Destiny? Short- and Long-Run Determinants of Intergenerational Transmission of Birth Weight	Currie & Moretti	2007	Journal of Labor Economics	Snowballed from Robertson & O'Brien 2018	N/A

Appendix A: Retrieval of included articles with asterisks indicating seminal articles selected for inclusion despite having been published more than 15 years ago.



## Appendix B

### Summary of Included Articles

Title	Data set	LBW data	SES data	Methods	Key findings
Birth Weight and Income: Interactions across Generations  Conley & Bennett, 2001	Panel Study of Income Dynamics	Birth weight data for both mothers and infants	Income data from mothers	Ordinary least squares and family-fixed effects models	Among those with a family history of LBW, higher income during pregnancy is associated with decreased odds of infant LBW.
Biology as Destiny? Short- and Long-Run Determinants of Intergenerational Transmission of Birth Weight  Currie & Moretti, 2007	California birth certificate data	Birth weight data for both mothers and infants	Poverty rate at zip code of hospital where mother was delivered, and where infant was delivered	Simple regression with added controls	Among low SES mothers, the association between maternal LBW and infant LBW is stronger, and LBW mothers were more likely to be exposed to neighborhood poverty when their infant was born.
Transgenerational effect of neighborhood poverty on low birth weight among African Americans in Cook County, Illinois  Collins et al., 2009	Illinois transgenerational birth file	Birth weight data for infants	Census tract data for both mothers and grandmothers of infants	Stratified and multilevel logistic regression	Among Black women, maternal grandmother's exposure to neighborhood poverty during pregnancy is a risk factor for LBW grandchildren. This risk factor is independent of the mother's risk.

Title	Data set	LBW data	SES data	Methods	Key findings
Low Birth Weight Across Generations: The Effect of Economic Environment  Collins et al., 2010	Illinois transgenerational birth file	Birth weight data for both mothers and infants	Census tract data for both mothers and grandmothers of infants	Stratified and multilevel logistic regression	Maternal LBW is a risk factor for infant LBW independent of transgenerational neighborhood environment. However, the proportion of LBW infants born to non-LBW Black mothers attributable to neighborhood environment is six times that of non-LBW white women.
Intergenerational Correlations in Size at Birth and the Contribution of Environmental Factors: The Uppsala Birth Cohort Multigenerational Study, Sweden, 1915–2002  De Stavola et al., 2011	Uppsala Birth Cohort Multigenerational Study	Birth weight data for both grandmothers and infants	Social class data for both grandparents (determined by maternal grandfather's occupation) and parents (from census)	Multivariable linear regression and biometric models	Biometric models found that the transgenerational economic environment contributes to the transgenerational pattern of LBW. Regression models found that economic environment was not a mediator in transgenerational LBW.
Small-for-Gestational Age and Preterm Birth Across Generations: A Population-Based Study of Illinois Births	Illinois transgenerational birth file	SGA data for both mothers and infants	Census tract data for both mothers and infants	Stratified and multivariable binomial regression	For both non-Latino white and Black women, maternal SGA is an independent risk factor for infant SGA. These findings were unchanged when transgenerational

Title	Data set	LBW data	SES data	Methods	Key findings
Castrillio et al., 2014					neighborhood income was adjusted for.
Health Endowment at Birth and Variation in Intergenerational Economic Mobility: Evidence From U.S. County Birth Cohorts	County-by-birth Vital Statistics and cohort economic mobility data	Rates of LBW by county from the National Center for Health Statistics	Income tax records of children linked to tax records of parents (from the Equality of Opportunity Project) by county	Pooled cross-sectional ordinary least squares models	Incidence of LBW by county is strongly associated with that county's transgenerational economic mobility, with higher rates of LBW associated with lesser economic mobility across generations.

Appendix B: Summary of articles selected for inclusion in the literature review.