

Downward Economic Mobility and Preterm Birth: An Exploratory Study of Chicago-Born Upper Class White Mothers

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Abstract A paucity of published data exists on the factors underlying the relatively poor birth outcome of non-Hispanic White women in the United States. To determine whether downward economic mobility is a risk factor for preterm birth (<37 weeks, PTB) among upper class-born White women. Stratified and multilevel logistic regression analyses were performed on an Illinois transgenerational dataset of non-Hispanic White infants (1989–1991) and their women (1956–1976) with appended US census income information. The study sample was restricted to singleton births of Chicago-born upper-class (defined by early-life residence in affluent neighborhoods) non-Hispanic White women. Upper class-born White women ($n = 4,891$) who did not experience downward economic mobility by the time of delivery had a PTB rate of 5.4 %. Those women who experienced slight ($n = 5,112$), moderate ($n = 2,158$), or extreme ($n = 339$) downward economic mobility had PTB rates of 6.5, 8.5, and 10.1 %, respectively; RR (95 % CI) = 1.2 (1.0–4.0), 1.6 (1.3–1.9), and 1.9 (1.3–2.6), respectively. Maternal downward economic mobility was also associated with an increased prevalence of biologic, medical, and behavioral risk

factors. Interestingly, the relationship between moderate to extreme downward mobility and preterm birth was stronger among former low birth weight (<2500 g, LBW) than non-LBW women: 2.8 (1.4–5.8) versus 1.6 (1.3–1.9), respectively. In multilevel logistic regression models, the adjusted odds ratio of preterm birth for former LBW and non-LBW women who experienced any downward mobility (compared to those women with lifelong upper class status) equaled 2.4 (1.1–5.3) and 1.1 (1.0–1.1), respectively. Downward economic mobility is associated with an increased risk of preterm birth among upper class-born White urban women; this phenomenon is strongest among former low birth weight women.

Keywords Preterm birth · Infant mortality · Class · Downward economic mobility

Introduction

Infant mortality in the US has two disturbing characteristics which contribute to its long standing dismal international ranking among developed countries [1]. First, the infant mortality rate (<365 days, IMR) of non-Hispanic Whites exceeds that of twenty-five developed nations [1, 2]. Second, stark racial and ethnic group disparities exists with the first year mortality rate of African-American infants more than twice that of non-Hispanic White and Mexican-American infants [2–4]. An extensive literature has focused on the later while a paucity of published data exists on the factors underlying the relatively poor birth outcome of the majority population.

Preterm birth (<37 weeks, PTB) is a major determinant of infant mortality [5]. Most pertinent, the PTB rate of non-Hispanic White women in the US exceeds that of European

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White women [6]. A better understanding of the mechanisms contributing to the elevated PTB rate of non-Hispanic White women may help us improve our international ranking in IMR and attain the *Healthy Peoples 2020* goal of an overall IMR of 6/1,000 [7].

An expanding literature supports a life-course conceptual model of female reproductive outcome [8–13]. In this conceptual model, US-born women's reproductive potential reflects the balance between pre-pregnancy exposure to contextual protective and risk factors [8, 9]. An exploratory study found that lifelong residence in affluent Chicago neighborhoods was associated with low PTB rates independent of age, parity, and the adequacy of prenatal care utilization among non-Hispanic White but not African-American women, suggesting a protective effect of lifelong exposure to favorable residential, social, and economic conditions associated with upper class status on the reproductive outcome of White women [10].

Although lower class status at the time of delivery is a well-known risk factor of adverse birth outcome [14–17], few studies have examined the relationship between deterioration in class status and preterm birth among US-born White women. An incidental finding in a prior study revealed that White women with early-life residence in higher income neighborhoods and adulthood residence in lower income had modestly greater PTB rates than their counterparts with a lifelong residence in higher income areas [11]. Notwithstanding the lack of a priori hypothesis and the exclusion of women who resided in moderate income neighborhoods, this observation uncovered a natural experiment to more fully examine the extent to which maternal downward economic mobility is associated with preterm birth among the majority population.

Given our nation's recent economic downturn, the association between maternal early-life exposure to affluence and preterm birth has public health relevance. The limited available data suggest that aspects of woman's social environment may subject her to influences during fetal life that facilitates her growth and therefore avoids the programming of her reproductive physiology via an epigenetic mechanism to have a preterm infant [18, 19]. The extent to which impaired in utero growth modifies the impact of maternal downward economic mobility on PTB rates is unknown.

We, therefore, undertook an analysis of Illinois vital records and US census income data to (1) determine the extent to which upper class-born (defined by early-life residence in affluent neighborhoods) non-Hispanic White women' downward economic mobility is a risk factor for preterm birth; and (2) ascertain the degree to which maternal birth weight modifies the relationship of downward economic mobility and PTB rates. We hypothesized that upper class-born White woman's downward economic

mobility is a stronger risk factor for preterm birth among women who were themselves low birth weight (<2500 g, LBW) compared to non-LBW.

Methods

Illinois Transgenerational Birth-File (TGBF)

A detailed description of the Illinois TGBF has been previously published [20]. Briefly, the Illinois Department of Vital Records provided data tapes for the index years, 1989–1991. The data tapes included approximately 583,600 infants. The state also provided over four million birth files for the parents of the index births who were born between 1956 and 1976. There were approximately 328,000 singleton infants in the 1989–1991 cohort with women born in Illinois between 1956 and 1976. On the basis of each woman's maiden name (first and last) and exact date of birth, we successfully linked 267,303 (79 %) maternal birth records to infant records. Failure to match usually arose from minor spelling errors in the woman and infant records. In both generations, White race was defined by woman's race and origin (non-Latina) listed on the infant's birth certificate. The study population was limited to Illinois-born singleton infants of Illinois-born non-Latina White women aged 14–35 years. The institutional review board of Children's Memorial Hospital (now called the Ann and Robert H. Lurie Children's Hospital of Chicago) institutional review board approved the study.

For the 1989–1991 birth cohort born in the Chicago metropolitan area (Cook County, IL), we appended 1990 US census income information to each birth record based on census tract of residence recorded on the birth certificate within the city of Chicago and town or village of residence in the surrounding suburbs. For the 1956–1965 birth cohort born in Chicago, we appended 1960 US census income to each birth record by community area (1956–1960) or census tract for years where valid tracts were available (1961–1965); for the 1966–1975 birth cohort born in Chicago, we appended the 1970 US census income to each birth record by census tract.

Census tracts are small areas designed to follow natural urban boundaries such as railroad grades and highways, thus approximating real neighborhoods. In Chicago, 873 census tracts exist. They typically contain fairly homogeneous populations ranging from 1,500 to 8,000 in number [18]. Most pertinent, with few exceptions the census tract geography has remained constant. Demographers at the University of Chicago, in cooperation with the City of Chicago, created the system of community areas, meant to reflect naturally occurring neighborhoods, in the 1920s [18]. The 77 community areas are made up of approximately 11 census

tracts (range 1 and 36). These geographic units, although a cruder reflection of the neighborhood in which the family resided, provide approximate information on social context where census tract level coding was not available (i.e. 1956–1960).

Study Sample

Woman’s class status was empirically defined using quartiles of census tract or community area median family income. The study was restricted to singleton births of upper-class born (defined by early-life residence in the highest quartile of neighborhood income) non-Hispanic White women who gave birth while residing in Chicago or the surrounding Cook County suburbs (n = 12,498).

Downward Economic Mobility

Upper-class born women’ downward economic mobility was defined as: none (residence in the fourth quartile of neighborhood income at the time delivery), slight (residence in the third quartile of neighborhood income at the time delivery), moderate (residence in the second quartile of neighborhood income at the time delivery), and extreme (residence in the first quartile of neighborhood income at the time delivery). For comparison purposes with regard to PTB rates, women with lifelong lower class status (defined as residence in the lowest quartile of neighborhood income at birth and at the time delivery) were also examined.

The median income (adjusted for inflation to 1989 dollar amounts) of economic environment at birth for the fourth quartile ranged from \$31,423 to \$104,964. The median income of economic environment at the time of delivery for (1) the fourth quartile ranged from \$45,872 to 150,000, (2) the third quartile ranged from \$35,428 to \$45,871, (3) the second quartile ranged from \$23,426 to \$35,427, and (4) the lowest quartile ranged from \$4,999 to \$23,425.

Statistical Analyses

Preterm birth (<37 weeks, PTB) and infant mortality (death <365 days) rates were calculated within each stratum of the four categories of maternal downward economic mobility. PTB rates were also examined among women with lifelong lower class status. Confounding variables examined included maternal birth weight, age, parity, month of prenatal care initiation, number of prenatal care visits, and cigarette smoking status. The adequacy of prenatal care received by each woman during the pregnancy was categorized according to the Adequacy of Prenatal Care Utilization Index [21].

The distribution of traditional biologic (birth weight, age, parity), medical (prenatal care utilization), and behavioral

(cigarette smoking) characteristics were calculated for each category of downward mobility. Next, PTB rates were computed by downward economic mobility and traditional individual level characteristics. We calculated relative risks (RR) and 95 % confidence intervals (CI) for the relationship between upper class-born women’s downward economic mobility and PTB rate, using women with lifelong upper class status as the common reference group [22].

Lastly, crude and multivariable (controlling for factors maternal birth weight, age, parity, adequacy of prenatal care utilization, and cigarette smoking) models were constructed to examine the association between slight, moderate and extreme downward mobility (each compared to women with lifelong upper class status). Multilevel multivariable logistic regression models were constructed to account for the nesting of individual births (level 1) within adulthood neighborhood (level 2) [23]. The adjusted odds ratios (OR) and 95 % CIs were generated from the final models by taking the antilogarithm of the Beta-coefficients for each independent variable and the CIs for those coefficients [22].

Results

Upper class-born White women (n = 4,891) who did not experience economic mobility by time of delivery had a PTB rate of 5.4 %. The Fig. 1 illustrates that PTB rates rose as the degree of maternal downward economic mobility increased, however, none equaled the 17.4 % for the small subgroup of women with lifelong lower class status. Because relatively few white women experienced extreme downward economic mobility, they were combined with the moderate downward mobility subgroup for the bivariate and stratified analyses. Infants born to women who experienced moderate to extreme downward mobility had a 2.7-fold greater mortality rate than infants born to

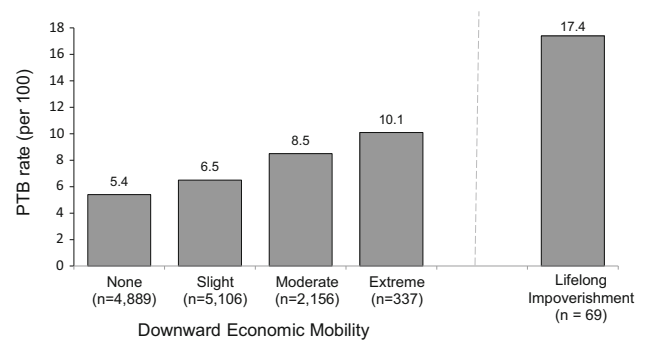


Fig. 1 Preterm birth rates (per 100) according to downward economic mobility for non-Hispanic White women born (1956–1976) into affluent Chicago neighborhoods and delivered (1989–1991) while living in Cook County, and for those women experiencing lifelong impoverishment

Table 1 Distribution of individual level risk factors according to downward economic mobility for Chicago-born (1956–1976) upper class non-Hispanic White women who delivered (1989–1991) while residing in Cook County, IL

Maternal characteristic	Downward economic mobility		
	None (n = 4,891)	Slight (n = 5,111)	Moderate or extreme (n = 2,496)
Birth weight (g) ^a		Percent	
<2,500 gm	4.8	5.8	7.0
2,500 or greater	95.2	94.2	93.0
Age (years) ^a			
<20	3.3	8.0	20.8
20–29	59.9	69.8	68.6
30–35	36.8	22.2	10.6
Parity ^a			
High (3+ prev)	10.2	10.3	12.7
Low (1–2 prev)	49.9	49.4	46.8
zero	39.9	40.3	40.5
Prenatal care ^a			
None/inadequate	5.8	9.5	20.3
Intermediate/adequate	70.7	62.6	57.5
Adequate+	23.4	27.9	22.2
Cigarette smoker ^a			
Yes	12.9	21.5	29.0
No	87.1	78.5	71.0

^a *p* value <0.05 for the Chi square test of association between each characteristic and downward economic mobility

women with a lifelong upper class status, 14.0/1,000 versus 5.1/1,000, respectively; RR = 2.7 (1.7–4.6).

The percentage of women with high-risk biologic, medical, and behavioral risk factors at the time of delivery tended to rise as downward economic mobility increased (Table 1). Women who experienced moderate or extreme downward mobility had the greatest prevalence of high-risk characteristics (Table 1).

Table 2 shows PTB rates for each category of downward economic environment and stratum of selected covariates. The association between downward economic mobility and preterm birth was stronger among former LBW (compared to non-LBW) women. While low-risk (as defined by selected co-variables) women who experienced slight downward mobility tended to have PTB rates similar to their counterparts who did not experience downward mobility, the vast majority of point estimates for preterm birth associated with moderate to extreme downward mobility exceeded unity across measured co-variables. Among women who received intermediate or adequate prenatal care, those women who experienced moderate to extreme downward mobility had a PTB of 3.5 % compared to only 1.9 % for those women who did not experience downward economic mobility; RR = 1.8 (1.2–2.6).

Table 3 shows the results of our multilevel logistic regression models. In both the crude and adjusted models, interaction terms suggested that maternal former LBW status was a significant effect modifier of the relationship between extreme downward mobility (compared to lifelong

upper class status) and preterm birth. The *p* values for the interaction terms between maternal LBW status and moderate downward mobility were also suggestive of effect modification, though not statistically significant. Therefore, final models were presented separately for former LBW and non-LBW women.

Among former LBW women, those women experiencing any level of downward mobility had an approximately threefold increased odds of preterm birth than their counterparts experiencing lifelong upper class status. After controlling for selected maternal factors at the time of delivery, women experiencing any level of downward mobility had approximately a twofold increased odds of PTB; OR = 2.4 (1.1–5.3). For the moderate and extreme downward economic mobility, OR approximate two, however, the 95 % CI were relatively wide and included one. Among former non-LBW women, those women experiencing slight, moderate and extreme downward mobility (compared to those women with lifelong upper class status) had a 1.2, 1.6, and 1.8 greater odds, respectively. This finding suggests a possible dose–response relationship; however, adjusting for covariates resulted in ORs that approximated unity (Table 3).

Discussion

The present population-based study presents new information on the relation of upper class-born (defined by

Table 2 Preterm birth (PTB) rates according to downward economic mobility and selected individual level risk factors for Chicago-born (1956–1976) upper class non-Hispanic White women who delivered (1989–1991) while residing in Cook County, IL

Maternal characteristic	Downward economic mobility			RR (95 % CI) ^a	
	PTB rates (per 100 live-births)			Slight	Moderate or extreme
	None	Slight	Moderate or extreme		
Birth weight (grams) ^b					
<2,500	4.3	10.2	12.1	2.4 (1.2, 4.7)	2.8 (1.4, 5.8)
2,500 or more	5.4	6.3	8.5	1.2 (1.0, 1.4)	1.6 (1.3, 1.9)
Age (years)					
<20	10.5	11.7	9.5	1.1 (0.7, 1.9)	0.9 (0.5, 1.5)
20–29	5.2	5.9	8.8	1.1 (0.9, 1.4)	1.7 (1.4, 2.1)
30–35	5.2	6.5	6.8	1.2 (0.9, 1.7)	1.3 (0.8, 2.1)
Parity					
High (3+ prev)	4.6	8.0	9.8	1.7 (1.1, 2.8)	2.1 (1.3, 3.6)
Low (1–2 prev)	5.3	5.5	9.0	1.0 (0.8, 1.3)	1.7 (1.3, 2.2)
zero	5.6	7.3	8.0	1.3 (1.0, 1.6)	1.4 (1.1, 1.9)
Prenatal care					
None/inadequate	8.2	9.6	9.6	1.2 (0.7, 1.9)	1.2 (0.7, 1.9)
Intermediate/adequate	1.9	1.5	3.5	0.8 (0.5, 1.1)	1.8 (1.2, 2.6)
Adequate+	14.5	16.4	20.6	1.1 (0.9, 1.4)	1.4 (1.1, 1.8)
Cigarette smoker					
Yes	6.8	8.5	10.8	1.2 (0.9, 1.8)	1.6 (1.1, 2.3)
No	5.2	5.9	7.9	1.1 (1.0, 1.4)	1.5 (1.2, 1.9)

^a Referent group = Lifelong resident in affluent neighborhoods

^b Relative risks are heterogeneous ($p < 0.05$) for slight downward mobility across categories of maternal characteristics

Table 3 Results of crude and adjusted multilevel logistic regression models stratified by maternal LBW for the association between downward economic mobility and infant preterm birth among non-

Hispanic White women born (1956–1976) into affluent Chicago neighborhoods and delivered (1989–1991) while living in Cook County, IL

Downward economic mobility ^a	Crude OR (95 % CI)			Adjusted OR ^c (95 % CI)		
	LBW women	Non-LBW women	p value ^b	LBW women	Non-LBW women	p value ^b
Slight	2.8 (1.3, 6.0)	1.2 (1.0, 1.4)	0.55	2.4 (1.1, 5.4)	1.0 (0.8, 1.2)	0.38
Moderate	3.3 (1.4, 7.6)	1.6 (1.3, 2.0)	0.095	2.4 (1.0, 6.1)	1.3 (1.0, 1.6)	0.08
Extreme	3.0 (0.6, 15.3)	1.8 (1.2, 2.7)	0.03	2.7 (0.5, 15.3)	1.3 (0.8, 2.0)	0.02

PTB preterm birth

^a Referent Group = Lifelong residence in affluent neighborhoods

^b p value for interaction terms between downward mobility category and maternal LBW

^c Adjusted Odds Ratio, controlling for maternal age, parity, prenatal care utilization, and cigarette smoking

early-life residence in neighborhoods in the highest income quartile) non-Hispanic White woman’s downward economic mobility to PTB rates. We found that women who experience moderate or extreme downward economic mobility have approximately twofold greater rates of preterm birth and infant mortality than their counterparts with lifelong upper class status. Most striking, our stratified and multilevel logistic regression analyses strongly suggest that upper class-born white woman’s downward economic mobility is a stronger risk factor for preterm birth among women predisposed to adverse outcomes as measured by their birth weight. These findings strongly suggest that deterioration in woman’s class status across their life-

course is indeed a risk factor for preterm birth among the majority population.

Our data support the use of a life-course conceptual model to address the relatively poor birth outcome of non-Hispanic White women. In Cook County IL, only a very tiny percentage of White women experience lower class status across their lifetime as measured by their lifelong residence in impoverished neighborhoods and their PTB rate of 17.4 % approximates that of African-Americans [3, 4]. In contrast, a large percentage of white women experience lifelong upper class status across their lifetime as measured by a lifelong residence in affluent neighborhoods and their PTB rate of 5.4 % is actually less than that of European White women

nationally [6]. Most pertinent, nearly 60 % of upper class-born White women experience downward economic mobility across their life-course and their PTB rate falls between these extremely disparate values. Recent trends in the US suggest that the potential adverse effect of a worsening economic environment for women entering their childbearing years remains a concern for the majority of American families. As such, we suspect that downward economic mobility among the majority population contributes to the United States relatively poor international ranking in IMR.

Few studies have examined the impact of maternal downward economic mobility on birth outcome [11]. The present study shows that even a modest deterioration in economic environment across the life-course of upper class-born White women is detrimental to birth outcome. Moreover, the association between upper class-born White woman's moderate or extreme downward mobility and increased PTB rates tends to persist across biologic, medical, and behavioral characteristics at the time of delivery. An extensive literature shows that maternal exposure to neighborhood poverty during adulthood is a modest risk factor for poor birth outcome [11, 12, 23]. However, reflecting the hypersegregation residential pattern in the Chicago metropolitan area, White women in our study rarely reside in or near impoverished African-American neighborhoods [20]. As such, our data suggest that the association between upper class-born White woman's moderate or extreme downward economic mobility and preterm birth is a contextual process independent of urban impoverishment per se. We speculate that exposures to chronic and acute stressors secondary to deterioration in class status underlie the association of downward economic mobility and PTB rates.

The developmental origins of health and disease (DOHaD) hypothesis focuses on fetal programming for adult life disease via epigenetic modifications due to limiting in utero environments [19, 24]. The Weathering Hypothesis conceptualizes the physical consequences of lifelong exposure to social hardships on female reproductive outcome [25, 26]. Consistent with both theories and therefore a life-course perspective, our exploratory data show that former LBW upper class-born White women who experience downward economic mobility are more susceptible to preterm birth than their former non-LBW peers. We encourage researchers to take both DOHaD and weathering into account when examining the mechanisms underlying the relatively poor birth outcome US-born women.

The Illinois transgenerational birth-file (TGBF) is an extremely rare US-derived population-based dataset with two generations of vital records and appended US census income information. Although the Illinois TGBF allows for the investigation of the life-course of childbearing women within a social and economic context, it has certain intrinsic limitations. First, a small but demonstrable skew toward

more educated women occurred compared to the general birth population of Illinois, which could limit the generalizability of the study's findings [20]. However, the rates of infant outcome in the file are virtually identical to the state as a whole, so the impact of this distortion is minimal [20]. Second, woman's early-life upper class status was empirically defined by residence in the highest quartile of the neighborhood income distribution [10]. This definition resulted in a relatively broad definition of upper class status. A narrower criterion may have impacted the findings, but we were not able to assess this possibility in our study due to very small sample sizes among women who were very affluent in early life and experienced downward mobility. Additional objective markers of early-life upper class status such as family wealth, maternal grandparent education levels and marital status may have also affected our findings. Third, maternal downward economic mobility was empirically defined based on the quartile of woman's neighborhood income distribution at the time of delivery [23]. With the exception of the "extreme" subgroup, these cut-points resulted in adequate sample sizes for multivariate analyses; however, different cut-off points may have led to different findings. Fourth, maternal downward economic mobility was defined by place of residence at birth and at time of delivery. The Illinois TGBF contains no information on duration of residence. Notwithstanding, the database is an improvement over prior research because it allows for measurement of downward economic mobility not possible with indicators measured only at the time of delivery. Fifth, there were too few upper class-born African-American and Hispanic women to calculate meaningful PTB rates according to downward economic mobility [11, 12, 20]. Lastly, approximately 11 % of women in the present study had more than one birth represented in the sample; however, a three-level multilevel model of births within women within neighborhoods did not converge, likely due to very little evidence of clustering at the neighborhood level. In a sensitivity analysis of births clustered within women, ignoring neighborhood clustering, model estimates were not meaningfully different from the final results reported (data not shown).

In summary, downward economic mobility among upper class-born White woman's is associated with an increased risk of preterm birth; this phenomenon is more robust among former LBW (compared to non-LBW) women.

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