The Association Between Maternal Work Precarity and Infant Low Birth Weight in a Nationally Representative Cohort of Women in the United States

Divya Patil

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Public Health

University of Washington

2018

Committee:

Anjum Hajat

Daniel A. Enquobahrie

Program Authorized to Offer Degree:

Epidemiology

University of Washington

Abstract

The Association Between Maternal Work Precarity and Infant Low Birth Weight in a Nationally Representative Cohort of Women in the United States

Divya Patil

Chair of the Supervisory Committee:

Anjum Hajat

Department of Epidemiology

As a larger proportion of women enter and remain in the workforce, consideration should be given to how work characteristics can affect pregnancy outcomes. We investigated the association between maternal work precarity and delivery of a low birth weight infant. Data on work characteristics and covariates were collected from 2,871 women enrolled in the National Longitudinal Survey of Youth 1979 and outcome information was obtained from the National Longitudinal Survey of Youth Children Cohort. Work precarity was characterized as a composite measure of four work characteristics (material rewards [score 0-2], working time arrangements [score 0-2], collective organization [score 0-1], and employability opportunities [score 0-1]) and was categorized into three groups labeled low (0-2), medium (3), and high (4-6) based on the number of characteristics that a participant had. Low birth weight was defined as weight less than 2500 grams at birth. Logistic regression models were fit to calculate odds ratios and 95% confidence intervals adjusted for maternal age, race/ethnicity, educational attainment, pre-pregnancy body mass index, infant year of birth, alcohol consumption, and smoking during pregnancy. We also assessed effect modification by maternal race/ethnicity and infant sex using stratified analyses. Women with high work precarity tended to have less than a high school education and to smoke. They were also less likely to consume alcohol. Women with medium

(OR:1.40, 95%CI: 1.00-1.96) and high (OR: 1.57, 95%CI: 1.13-2.16) work precarity were more likely to have a low birth weight delivery compared to women with low work precarity. The association between medium work precarity and low birth weight was significant among Non-Hispanic Black women (OR: 2.10; 95%CI: 1.05-4.21) but was not significant among Non-Hispanic White women (OR: 1.40; 95%CI: 0.90-2.17) or Hispanic women (OR: 0.96; 95%CI: 0.41-2.24). High work precarity was associated with low birth weight among female infants (OR:1.78; 95%CI: 1.14-2.76) but not among male infants (OR:1.35; 95%CI: 0.83-2.18). Findings of this study can be used to better inform antenatal care and identify women with potential adverse pregnancy outcomes.

Introduction

Low birth weight (LBW) is associated with a number of chronic conditions in later life, including obesity, hypertension, and coronary heart diseases (1,2). Infants born with LBW are at a higher risk of death in the first year of life (3). The incidence of LBW deliveries in the United States has remained stagnant for more than two decades, with rates recorded at about 7% in 1990 and 8% in 2016 (4). In addition, LBW disparities have also been recorded between racial/ethnic groups, where 13.7% and 7.3% of infants born to Non-Hispanic Black and Hispanic women, respectively, were LBW compared to 7.0% of those born to Non-Hispanic White mothers in 2016 (4). While some exposures, such as socioeconomic status, maternal chronic conditions before and during pregnancy, and behavioral factors including smoking, have been established as predictors of LBW, the increased rates over time and observed disparities in LBW suggest that further examination of potential risk factors should be considered (5).

In 2016, 74,432,000 women, including nearly 75% of women ages 25-34, the prime reproductive age, held a paid job in the United States and made up 46.8% of the labor force (6,7). With a large proportion of women making up the labor force, maternal work precarity is beginning to gain more attention as a possible risk factor for LBW. Precarious employment can be defined as instable, insecure, or employment that lacks protections. Work precarity can influence birth outcomes because of its close association with maternal stress. Perinatal stress is thought to impact the hypothalamic pituitary adrenal (HPA) axis and affect fetal growth during pregnancy (10–12). The work precarity—LBW association can also operate through physical demands of a work, with the literature showing significant associations between these factors and the outcome (13–15). Furthermore, the distribution of precarious work is not equal across the population; low socioeconomic status (SES) and minority women are more likely to hold a precarious work compared to high SES or Non-Hispanic White women (8,9). This is especially relevant given the racial inequity in low birth weight deliveries.

A growing number of studies have investigated maternal employment during pregnancy and birth outcomes (16–24). In these studies, the exposure was defined as atypical or insecure work, which refers to employment that is unusual or short-term, or as work strain, which is a matrix that characterizes work demand and control (19–22,25). Many did not consider other characteristics of work across different dimensions and instead focus on one aspect of work. The few available studies were conducted outside of the United States, where different labor laws and social safety nets exist (23,24). Further, few studies considered potential differences by racial/ethnic groups despite disparities in LBW (26,27). While studies have reported associations between maternal social factors, such as stressful life events and socioeconomic status, and LBW differ for male and female infants, to prior study to our knowledge has investigate the role of infant's sex on the relationship between work precarity and LBW (28,29).

This study examined the association between maternal work precarity during and/or one year prior to pregnancy and infant LBW using a large, nationally representative cohort in the United States. It also investigated differences in associations among racial and ethnic groups as well as the role of offspring sex in the association.

Methods

The National Longitudinal Study of Youth (NLSY79), conducted by the United States Bureau of Labor Statistics, is a nationally representative longitudinal cohort (N=12,686) of individuals born between 1957 and 1964 and living in the United States at the start of the survey in 1979 (30). Each participant is provided a sampling weight to account for oversampling of racial/ethnic minority groups and provide a nationally representative estimate of the United States population in 1979. Data collection began in 1979 and is ongoing. Several other cohorts have begun based on the original cohort, including the NLSY79 Children (N=11,521). The NLSY79 Children cohort began in 1986 and surveyed all children born to female respondents in the original cohort. The

NLSY79 Children is linked to the original NLSY79 Cohort using the mother's ID to allow studies across mother-infant pairs.

At the start of data collection, 50% of the NLSY79 Cohort was female, 59.2% were Non-Hispanic White, 25.0% were Non-Hispanic Black, and 15.8% were Hispanic. As of 2014, the retention rate for the entire cohort is 71.0%.

This analysis included women enrolled in the NLSY79 Cohort and had a child enrolled in the NLSY79 Children cohort. Women were excluded if they did not have a first child born between 1978 to 2014 (N=1,353), did not list at least one job in the interview cycle during the birth year of their first child (N=1,982), did not have a birth weight listed for their infant (n=30), or had missing information (three or more) on work characteristics that were used to calculate the exposure (N=47). The final sample included in the analysis was 2,871 participants (**Figure 1**). Because the last birth of a first-born child occurred in 2007 for women in the NLSY79, we believe that this is likely a complete cohort. The Institutional Review Board at the University of Washington deemed this study to be non-exempt.

Exposure: The primary exposure was maternal work precarity reported in the interview cycle preceding infant birth. This was operationalized by using work-related characteristics based on the framework proposed by Van Aerden et al, which builds off earlier multidimensional concepts of work precarity (31,32). While the framework is comprised of seven components, this study included four due to availability of data. These four components were material rewards, working time arrangements, employability opportunities, and collective organization (**Table 1**). *Material rewards* was scored as high, medium, or low (0-2) based on two criteria: having employer-provided insurance (yes/no) and income in the last year after adjustment for inflation to 1979 dollars (upper 50% of sample or lower 50% of sample). Those who had both employer-provided insurance and an income in the upper 50% of the sample were categorized as high (0), those with either employer-provided insurance or an income in the upper 50% of the sample were

considered medium (1), and those with no employer-provided insurance or an income in the lower 50% of the sample were considered low (2). *Working time arrangements* was categorized as normal (0), somewhat normal (1), and not normal (2) determined by participants' working hours per day (<=8 hours, >8 hours), and time of day working (day time, non-day time). Participants working <=8 hours a day and during the day were considered to have normal working times (0), those either working >8 hours or a non-day time shift were considered somewhat normal (1), and those working both >8 hours and a non-day time shift were considered not normal (2). *Employability opportunities* was a binary variable based on whether employers provided training or education to participants and scored as 0 if training or education was provided and 1 if it was not. *Collective organization* was also a binary variable determined by membership in a union or a union setting wages, with membership scored as 0 and no membership scored as 1. These four characteristics of work during the interview cycle prior to infant birth year were summed to create a work precarity index, with higher scores reflecting greater work precarity. Participants were then categorized into three groups based on their work precarity index score, which could take values from 0 to 6. Low precarity works scored 0-2, medium scored 3, and high scored 4-6. We also evaluated a continuous specification of the precarity index and we evaluated each component of the precarity index separately.

Outcome: The outcome of interest was maternal-reported infant LBW defined as a birth weight of less than 2500 grams (5 pounds, 8 ounces), as determined in the NLSY79 Children Cohort. An infant with a weight at birth of 2500-4500 grams was considered normal birth weight.

Other Variables: Covariates included in the analyses were maternal race/ethnicity, maternal age, maternal educational attainment at time of pregnancy, infant year of birth, infant sex, maternal pre-pregnancy body mass index (BMI), maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy. Sex of the infant was included as an effect modifier, while race/ethnicity was considered a confounder and an effect modifier. All other

covariates were included as confounders in the work precarity—LBW relationship. Maternal race/ethnicity was categorized as Non-Hispanic White, Non-Hispanic Black, and Hispanic. Maternal age and pre-pregnancy BMI were treated as a continuous variable. Maternal educational attainment was categorized as less than high school, high school degree, or more than high school. Infant sex was a binary variable of male or female. Smoking was dichotomized as smoked at least once versus no smoking during pregnancy. Similarly, alcohol consumption during pregnancy was also dichotomized as any versus no alcohol consumption.

Statistical Analysis: Descriptive statistics were used to compare sociodemographic and behavioral characteristics across work precarity groups. To assess the relationship between maternal work precarity and infant LBW, a series of logistic regression models were fit to estimate odds ratios and their corresponding 95% confidence intervals. We evaluated the exposure, precarious work, in three different ways. First, the association between each individual work precarity component (material rewards, working time arrangements, employability opportunities, and collective organization) and LBW was examined. Second, we evaluated the precarity index, as described above, by specifying the index as a categorical variable (low, medium, and high) and lastly the index was specified as a continuous variable. For all three analyses, we used a staged modelling approach, where Model 1 was an unadjusted logistic regression. Model 2 was adjusted for maternal age, maternal race/ethnicity, maternal educational attainment, and infant year of birth and Model 3 was adjusted for maternal pre-pregnancy BMI, and maternal smoking and alcohol use during pregnancy in addition to the variables adjusted for in Model 2 and was considered our primary model.

We examined potential effect modification by race/ethnicity and infant sex in two ways: first using stratified models and second using the approach recommended by VanderWeele and colleagues (2014) which creates a composite variable that combines the effect modifier and the exposure (33). The reference group for these models was low work precarity in Non-

Hispanic White women and low work precarity in women who had a male infant. Both the continuous and categorical specifications of the precarity index were used to explore effect modification and odds ratios and corresponding 95% confidence intervals were calculated using fully adjusted logistic regression models. Analyses were conducted using SAS 9.4 and statistical significance was determined using the $p<0.05$ cut-off.

Results

Among study participants, 45% (N=1,305) had low work precarity, 21% (N=607) had medium work precarity, and 33% (N=959) had high work precarity. Women with high or medium work precarity were more likely to be younger and Non-Hispanic Black or Hispanic compared to women with low work precarity (**Table 2**). They were also more likely to have less than a high school education, and more likely to smoke. Women with high work precarity were less likely to consume alcohol compared to women with low work precarity. Overall, 88% (N=2547) of participants delivered normal birthweight infants and 12% (N=348) delivered LBW infants.

In the unadjusted analyses, individual work precarity characteristics were not associated with LBW, except for a higher risk of LBW among those with somewhat normal working times compared to those with normal working times (1.37, 95%CI:1.07-1.75) (**Table 3**). In the fully-adjusted Model 3, women reporting medium and low levels of material rewards had a higher risk of LBW compared to those with a high level of material rewards (OR: 1.46, 95%CI: 1.02-2.09 and OR: 1.55, 95%CI: 1.07-2.25 respectively). Similarly, women with somewhat normal working time arrangements had a 1.34 (95%CI: 1.10-1.77)-fold higher odds of having a LBW infant compared to women with normal working times after complete adjustment.

The association between the precarity index and low birth weight was not significant before adjustment but became significant after including confounders in the model (**Table 4**). Women with medium (score 3) and high (score 4-6) work precarity were more likely to have a LBW

infant compared to low (score 0-2) work precarity, after adjustment for all covariates (medium: 1.40, 95%CI: 1.00-1.96; high: 1.57, 95%CI: 1.13-2.16, model 3). There was little difference between the odds ratios for Model 2 and Model 3 of the precarity index and LBW association.

In the race/ethnicity stratified model, medium work precarity was associated with higher odds of LBW among Non-Hispanic Black women (OR: 1.39; 95%CI: 1.10-1.75) when compared to low work precarity, but the association was insignificant for Non-Hispanic White women (OR: 1.11; 95%CI: 0.94-1.31) and Hispanic women (OR: 1.15; 95%CI: 0.87-1.51) (**Table 5**). When maternal race/ethnicity and work precarity were included in a composite exposure variable, Non-Hispanic Black women saw elevated odds across all work precarity levels compared to Non-Hispanic White women low work precarity (Non-Hispanic Black low precarity: 1.79, 95%CI: 1.08-2.95; medium precarity: 3.69, 95%CI: 1.99-6.82; high precarity: 3.14, 95%CI: 1.89-5.20) (**Table 6**). Hispanic mothers also saw higher odds of the outcome when compared to Non-Hispanic White low precarity (Hispanic low precarity: 1.73, 95%CI: 1.03-2.92; medium precarity: 1.64, 95%CI: 0.77-3.50; high precarity: 2.52, 95%CI: 1.43-4.44).

In the infant sex stratified model, high work precarity was associated with a 1.78 (95%CI: 1.14-2.76) fold higher odds of LBW for female infants, but the association in male infants was not significant (OR: 1.35; 95%CI: 0.83-2.18) (**Table 7**). When compared to maternal low precarity in male infants, elevated odds ratios were seen for all other categories but only maternal high precarity in female infants had a significant odds ratio (2.03, 95%CI: 1.33-3.12) (**Table 8**).

Discussion

In this study, we found that women who have high and medium work precarity prior and/or during pregnancy had higher odds of giving birth to an LBW infant than women with low work precarity. Of the individual work characteristics examined, low material rewards and non-normal working time arrangements were strongly related to risk of LBW. In addition, we found potential

effect modification by maternal race/ethnicity and infant sex. In the stratified analysis, associations were observed among Non-Hispanic Black women, but not among Non-Hispanic White women and Hispanic women. Female infants of mothers with high work precarity also had higher odds of LBW, but male infants with high work precarity did not have higher odds of LBW, compared with their respective comparison groups with low work precarity.

When the association between work precarity and LBW was stratified by race/ethnicity, elevated odds were seen with higher work precarity within racial/ethnic groups, although many estimates were insignificant. However, when effect modification by maternal race/ethnicity was assessed using a single reference group (Non-Hispanic White women with low work precarity), many estimates were significant and reflected higher odds of LBW. The differences in findings for the two methods of assessing effect modification are likely due to the choice of reference group and highlights the importance of selecting a comparison group that is meaningful for a study's aim. Using a reference group within each racial/ethnic group provided estimates that more effectively adjust for race as women of the same race/ethnic group are being compared to each other. This approach could be used for identifying groups that may benefit from greater attention for intervention, such as Non-Hispanic Black women with medium work precarity in this study. Alternatively, using a single reference group includes race/ethnicity in the assessment of the association and allows for estimating health inequities between groups by comparing every subpopulation to a single comparison to see if there are any differences. This approach more accurately reflects the role of race in the labor market. In our study, there are elevated odds of LBW in all work precarity groups in Non-Hispanic Black women and the low and high work precarity groups in Hispanic women when compared to Non-Hispanic White women with low precarity. This suggests that health inequities exist between these subpopulations and could be a result of different internalizations of stressors from work precarity or possibly a combination of

workplace stressors and additional life stressors, such as racism and discrimination, that women of color experience that Non-Hispanic White women may not.

Our study is the first to investigate the association between maternal work precarity and infant LBW. Findings were similar to studies examining other work characterizations, such as job demand/control and psychosocial job stress, that showed higher risk for adverse birth outcomes, such as LBW and preterm birth, in those with poorer quality jobs (20,22,23). It contrasts with older studies and studies conducted outside of the United States that did not find increased risk for preterm birth and small for gestational age, suggesting that national and temporal contexts may influence the work—pregnancy outcome association (18,19). This study adds to a growing body of literature that aims to characterize multiple facets of employment quality which extends the more traditional models of work control and demand as being the only relevant features of work that may impact health (31,32). Additionally, this study adds to the literature on inequities in birth outcomes between racial/ethnic groups in the United States and emphasizes the choice of reference groups when conducting research in regards to inequities (26,27,34,35).

One drawback of this study is the incomplete ascertainment of precarity as laid out by Van Aerden et al (31). Many of the survey years did not include questions on three components of the precarity index, employment stability, interpersonal power relations, and workers' right and social protections; thus, they were not included when creating the construct of work precarity. Additionally, some precarity variables included in the analyses were not asked every year. If this was the case, we used a carry forward method, in which we pulled the datapoint from the year previous to the exposure period of interest. This could introduce misclassification of the exposure into our analysis. Another source of potential misclassification lies in the self-report aspect of the information collected in the NLSY79. A past study found high correlation between maternal report of infant birthweight and weight listed on birth certificate (36). In regard to the

exposure, we do not believe that validity of self-reported work characteristics would differ between outcome groups. A third limitation in this study is residual confounding, both from heterogeneity in variable categories and variables not measured in the survey that should have been included in the analysis. These sources of residual confounding could bias our results. Our study was underpowered to assess effect modification by maternal race/ethnicity and infant sex, leading to insignificant estimates and large confidence intervals. Finally, sampling for this study was based on the population residing in the United States in 1979 and may not be representative to today's sociodemographic distribution.

Future research should focus on further elucidating the work precarity—LBW relationship through a more complete ascertainment of the exposure, which includes all seven components of the index. Researchers interested in work precarity and birth outcomes may also consider adding variables, such as availability of paid family leave to the precarity index, as these types of policies are of particular relevance to women. Investigating the role of paternal work precarity as an exposure for adverse birth outcomes may also be a fruitful avenue of research.

The findings from our study may better inform prenatal care for working women. Clinicians treating women who plan to work during their pregnancy should consider asking their patients about their work and recommend resources that may mitigate the effects of work precarity. These findings may also inform potential workplace adjustments, such as altering working times, that can be made by employers to better support women who work during their pregnancy. Our findings support greater examination of the work precarity and health, especially as a larger proportion of women enter and remain in the workforce.

References

1. Wang S-F, Shu L, Sheng J, Mu M, Wang S, Tao X-Y, et al. Birth weight and risk of coronary heart disease in adults: a meta-analysis of prospective cohort studies. J Dev Orig Health Dis. 2014 Dec;5(6):408–19.

2. Zarrati M, Shidfar F, Razmpoosh E, Nezhad FN, Keivani H, Hemami MR, et al. Does low birth weight predict hypertension and obesity in schoolchildren? Ann Nutr Metab. 2013;63(1–2):69–76.

3. McCormick MC. The Contribution of Low Birth Weight to Infant Mortality and Childhood Morbidity [Internet]. http://dx.doi.org/10.1056/NEJM198501103120204. 2010 [cited 2017 Nov 8]. Available from: http://www.nejm.org/doi/full/10.1056/NEJM198501103120204

4. Martin J, Hamilton B, Osterman M, Discoll A, Drake P. Births: Final data for 2016. 2018.

5. Bernabé JV de, Soriano T, Albaladejo R, Juarranz M, Calle ME, Martínez D, et al. Risk factors for low birth weight: a review. Eur J Obstet Gynecol Reprod Biol. 2004 Sep 10;116(1):3–15.

6. Women's Bureau (WB) - Women in the Labor Force [Internet]. [cited 2017 Nov 8]. Available from: https://www.dol.gov/wb/stats/NEWSTATS/facts/women_lf.htm#one

7. Mathews TJ, Hamilton B. Mean Age of Mothers is on the Rise: United States, 2000-2014 [Internet]. U.S. Department of Health and Human Services; 2016. Available from: https://www.cdc.gov/nchs/data/databriefs/db232.pdf

8. Landsbergis PA, Grzywacz JG, LaMontagne AD. Work organization, job insecurity, and occupational health disparities: Work Organization and Occupational Health Disparities. Am J Ind Med. 2014 May;57(5):495–515.

9. Highlights of women's earnings in 2016 : BLS Reports: U.S. Bureau of Labor Statistics [Internet]. [cited 2018 Mar 13]. Available from: https://www.bls.gov/opub/reports/womens-earnings/2016/home.htm

10. Sandman CA, Wadhwa PD, Dunkel-Schetter C, CHICZ-DeMET A, Belman J, Porto M, et al. Psychobiological Influences of Stress and HPA Regulation on the Human Fetus and Infant Birth Outcomesa. Ann N Y Acad Sci. 1994 Oct 1;739(1):198–210.

11. O'Donnell K, O'Connor TG, Glover V. Prenatal Stress and Neurodevelopment of the Child: Focus on the HPA Axis and Role of the Placenta. Dev Neurosci. 2009;31(4):285–92.

12. Sandman CA, Wadhwa PD, CHICZ-DeMET A, Dunkel-Schetter C, Porto M. Maternal Stress, HPA Activity, and Fetal/Infant Outcomea. Ann N Y Acad Sci. 1997 Apr 1;814(1):266–75.

13. Homer CJ, Beresford SAA, Jarnes SA, Siegel E, Wilcox S. Work-related physical exertion and risk of preterm, low birthweight delivery. Paediatr Perinat Epidemiol. 1990 Apr 1;4(2):161–74.

14. Govarts E, Nieuwenhuijsen M, Schoeters G, Ballester F, Bloemen K, de Boer M, et al. Birth Weight and Prenatal Exposure to Polychlorinated Biphenyls (PCBs) and

Dichlorodiphenyldichloroethylene (DDE): A Meta-analysis within 12 European Birth Cohorts. Environ Health Perspect. 2012 Feb;120(2):162–70.

15. Whyatt RM, Rauh V, Barr DB, Camann DE, Andrews HF, Garfinkel R, et al. Prenatal Insecticide Exposures and Birth Weight and Length among an Urban Minority Cohort. Environ Health Perspect. 2004 Jul;112(10):1125–32.

16. Bell JF, Zimmerman FJ, Diehr PK. Maternal work and birth outcome disparities. Matern Child Health J. 2008 Jul;12(4):415–26.

17. Snijder CA, Brand T, Jaddoe V, Hofman A, Mackenbach JP, Steegers EAP, et al. Physically demanding work, fetal growth and the risk of adverse birth outcomes. The Generation R Study. Occup Env Med. 2012 Aug 1;69(8):543–50.

18. Larsen AD. The effect of maternal exposure to psychosocial job strain on pregnancy outcomes and child development. Dan Med J. 2015 Feb;62(2).

19. Homer CJ, James SA, Siegel E. Work-related psychosocial stress and risk of preterm, low birthweight delivery. Am J Public Health. 1990 Feb;80(2):173–7.

20. Katz VL. Work and Work-related Stress in Pregnancy. Clin Obstet Gynecol. 2012 Sep 1;55(3):765–73.

21. Bell JF, Zimmerman FJ, Diehr PK. Maternal Work and Birth Outcome Disparities. Matern Child Health J. 2008 Jul 1;12(4):415–26.

22. Dooley D, Prause J. Birth Weight and Mothers' Adverse Employment Change. J Health Soc Behav. 2005 Jun 1;46(2):141–55.

23. Casas M, Cordier S, Martínez D, Barros H, Bonde JP, Burdorf A, et al. Maternal occupation during pregnancy, birth weight, and length of gestation: combined analysis of 13 European birth cohorts. Scand J Work Environ Health. 2015;41(4):384–96.

24. Larsen AD, Hannerz H, Juhl M, Obel C, Thulstrup AM, Bonde JP, et al. Psychosocial job strain and risk of adverse birth outcomes: a study within the Danish national birth cohort. Occup Env Med. 2013 Dec 1;70(12):845–51.

25. Karasek RA. Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. Adm Sci Q. 1979;24(2):285–308.

26. Lu MC, Halfon N. Racial and Ethnic Disparities in Birth Outcomes: A Life-Course Perspective. Matern Child Health J. 2003 Mar 1;7(1):13–30.

27. Cramer JC. Racial and Ethnic Differences in Birthweight: The Role of Income and Financial Assistance. Demography. 1995;32(2):231–47.

28. Wainstock T, Shoham-Vardi I, Glasser S, Anteby E, Lerner-Geva L. Fetal sex modifies effects of prenatal stress exposure and adverse birth outcomes. Stress Amst Neth. 2015 Jan;18(1):49–56.

29. Bublitz MH, Vergara-Lopez C, O'Reilly Treter M, Stroud LR. Association of Lower Socioeconomic Position in Pregnancy with Lower Diurnal Cortisol Production and Lower Birthweight in Male Infants. Clin Ther. 2016 Feb;38(2):265–74.

30. The NLSY97 Sample: An Introduction | National Longitudinal Surveys [Internet]. [cited 2017 Nov 2]. Available from: https://www.nlsinfo.org/content/cohorts/nlsy97/intro-to-the-sample/nlsy97-sample-introduction-0

31. Aerden KV, Moors G, Levecque K, Vanroelen C. Measuring Employment Arrangements in the European Labour Force: A Typological Approach. Soc Indic Res. 2014 May 1;116(3):771–91.

32. Tompa E, Scott-Marshall H, Dolinschi R, Trevithick S, Bhattacharyya S. Precarious employment experiences and their health consequences: Towards a theoretical framework. Work. 2007 Jan 1;28(3):209–24.

33. VanderWeele TJ, Knol MJ. A Tutorial on Interaction. Epidemiol Methods. 2014;3(1):33–72.

34. Braveman PA, Kumanyika S, Fielding J, LaVeist T, Borrell LN, Manderscheid R, et al. Health Disparities and Health Equity: The Issue Is Justice. Am J Public Health. 2011 Nov 28;101(S1):S149–55.

35. Carter-Pokras O, Baquet C. What is a "health disparity"? Public Health Rep. 2002;117(5):426–34.

36. Cammack AL, Hogue CJ, Drews-Botsch CD, Kramer MR, Pearce BD, Knight BT, et al. Test-retest reliability of retrospective self-reported maternal exposure to childhood abuse and neglect. Arch Womens Ment Health. 2015 May 14;1–7.

Figures and Tables

Table 1. Precarity Measures for Quality of Employment in the NLSY79 Cohort (1979-2007)

Precarity Variable	Survey Question	Categories	Year(s) asked
Material Rewards	Insurance provided through employer	Yes No	1979-1980; 1982-2004; 2008
	Income in the past calendar year	Upper 50% of sample Lower 50% of sample	1979-2008
Working Time Arrangements	Hours per day or per week worked	<=8 hours/day >8 hours/day	1979-2008
	Shift usually worked	Day time shift Non-day time shift	1979-1981; 1983-1985; 1988-2008
Employability Opportunities	Attended vocational/technical program or on the work training	Yes No	1979-1986; 1989-2008
Collective Organization	Part of a union or employee association	Yes No	1979-2008

* These variables were included in a precarity index that ranged in values 0-6. Work precarity was categorized into three groups labelled as low (0-2), medium (3), and high (4-6).

Figure 2. Exclusion Criteria for Participants in the NLSY79 Cohort (1979-2007)

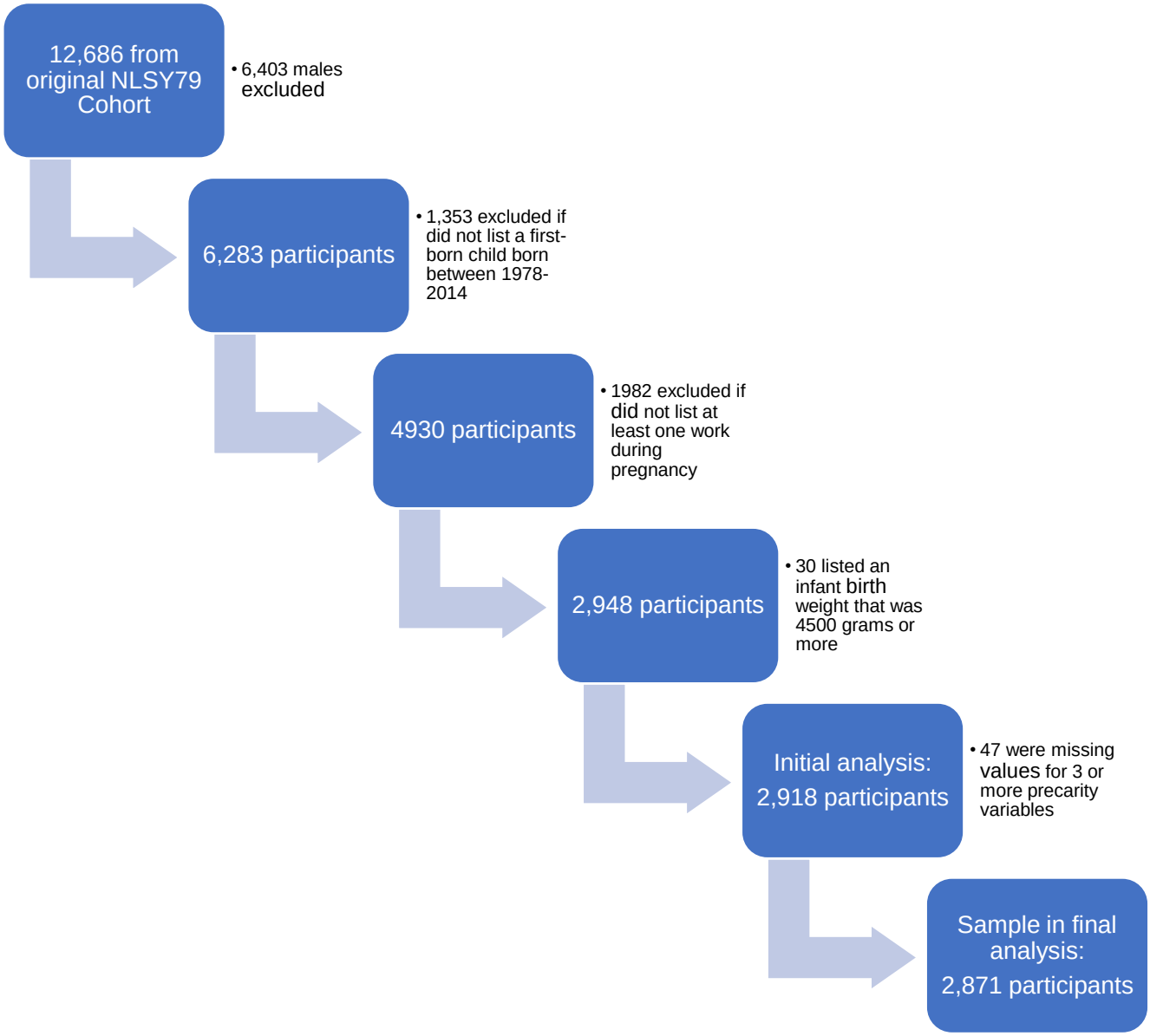

Table 2. Selected Sociodemographic Characteristics of Study Participants from the NLSY79 Cohort (1979-2007)

		Entire Sample (N=2871)	Low Work precarity (N=1305)	Medium Work precarity (N= 607)	High Work precarity (N=959)
Mean Maternal Age (SD)		24.2 (5.2)	26.0 (5.5)	24.5 (4.9)	21.7 (3.8)
Maternal Race/Ethnicity (N, %)					
	Non-Hispanic Black	600 (20.9)	262 (20.1)	106 (17.5)	232 (24.2)
	Hispanic	495 (17.2)	212 (16.2)	95 (15.7)	188 (19.6)
	Non-Hispanic White	1776 (61.9)	831 (63.7)	406 (66.9)	539 (56.2)
Maternal Educational Attainment (N, %)					
	Less than High School	479 (16.7)	144 (11.0)	78 (12.9)	257 (26.8)
	High School	1231 (42.9)	503 (38.5)	272 (44.8)	456 (47.6)
	More than High School	1161 (40.4)	658 (50.4)	257 (42.3)	246 (25.7)
Infant Sex (N, %)					
	Male	1420 (49.5)	670 (51.3)	294 (48.4)	456 (47.6)
	Female	1451 (50.5)	635 (48.7)	313 (51.6)	503 (52.5)
Mean Maternal Pre-pregnancy BMI (SD)		23.8 (5.4)	24.0 (4.6)	23.9 (7.6)	23.5 (4.6)
Maternal Smoking (N, %)					
	Smoked at Least Once	811 (29.7)	317 (25.8)	174 (29.9)	320 (35.0)
	Did Not Smoke	1916 (70.3)	913 (74.2)	409 (70.2)	594 (65.0)
Maternal Alcohol (N, %)					
	Consumed at Least Once	1336 (49.0)	633 (51.4)	300 (51.6)	403 (44.0)
	Did Not Consume Alcohol	1392 (51.0)	598 (48.6)	282 (48.5)	512 (56.0)

* Means and standard deviations were calculated for maternal age and maternal pre-pregnancy BMI; counts and proportions were calculated for maternal race/ethnicity, maternal educational attainment during pregnancy, infant sex, maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 3. Odds ratios and 95%CIs for the Association Between Individual Work Precarity Variables and Low Birth Weight in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity Variables		N	Model 1 (95% CI) [a]	Model 2 (95%CI) [b]	Model 3 (95% CI) [c]
Material Rewards	High	1123	Ref	Ref	Ref
	Medium	546	1.07 (0.78-1.46)	**1.51 (1.09-2.10)**	**1.46 (1.02-2.09)**
	Low	891	0.99 (0.75-1.29)	**1.82 (1.31-2.53)**	**1.55 (1.07-2.25)**
Working Time Arrangements	Normal	1971	Ref	Ref	Ref
	Somewhat Normal	731	**1.37 (1.07-1.75)**	**1.30 (1.01-1.67)**	**1.34 (1.01-1.77)**
	Not normal	65	0.96 (0.43-2.13)	0.80 (0.36-1.79)	0.99 (0.41-2.38)
Employability Opportunities	Yes	263	Ref	Ref	Ref
	No	2491	0.79 (0.54-1.14)	0.87 (0.60-1.27)	0.80 (0.53-1.22)
Collective Organization	Yes	233	Ref	Ref	Ref
	No	2496	0.76 (0.52-1.12)	0.84 (0.57-1.24)	0.86 (0.56-1.34)

[a] Unadjusted logistic regression of work precarity and low birthweight

[b] Logistic regression of work precarity and low birthweight adjusted for maternal age, maternal race/ethnicity, maternal educational attainment, and infant year of birth

[c] Logistic regression of work precarity and low birthweight adjusted for maternal age, maternal race/ethnicity, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI, maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 4. Odds ratios and 95%CIs for the Association Between Work Precarity and Low Birth Weight in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity	N	Model 1 (95% CI)[a]	Model 2 (95%CI)[b]	Model 3 (95%CI)[c]
Continuous Measure of Work Precarity	2871	1.02 (0.92-1.12)	**1.15 (1.03-1.27)**	**1.19 (1.06-1.34)**
Low Precarity (0-2)	1305	Ref	Ref	Ref
Medium Precarity (3)	607	1.07 (0.80-1.44)	1.26 (0.93-1.70)	**1.40 (1.00-1.96)**
High Precarity (4-6)	959	1.03 (0.80-1.34)	**1.40 (1.05-1.87)**	**1.57 (1.13-2.16)**

* Work precarity was categorized based on scores from an index of individual work characteristics; low: 0-2, medium: 3, high: 4-6

[a] Unadjusted logistic regression of work precarity and low birthweight

[b] Logistic regression of work precarity and low birthweight adjusted for maternal age, maternal race/ethnicity, maternal educational attainment, and infant year of birth

[c] Logistic regression of work precarity and low birthweight adjusted for maternal age, maternal race/ethnicity, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI, maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 5. Odds Ratios and 95%CIs for the Work Precarity—LBW Relationship Stratified by Maternal Racial/Ethnic Groups in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity	N	Non-Hispanic White	N	Hispanic	N	Non-Hispanic Black
Continuous Measure of Precarity	1776	1.11 (0.94-1.31)	495	1.15 (0.87-1.51)	600	**1.39 (1.10-1.75)**
Low Precarity	831	Ref	212	Ref	262	Ref
Medium Precarity	406	1.40 (0.90-2.17)	95	0.96 (0.41-2.24)	106	**2.10 (1.05-4.21)**
High Precarity	539	1.52 (0.97-2.38)	188	1.45 (0.70-3.03)	232	1.74 (0.93-3.22)

[α] All odds ratios are adjusted for maternal age, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 6. Odds Ratios and 95%CIs for the Relationship Between the Composite Variable of Work Precarity and Maternal Race/Ethnicity and LBW in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity	Non-Hispanic White	Hispanic	Non-Hispanic Black
Low Precarity	Ref	**1.73 (1.03-2.92)**	**1.79 (1.08-2.95)**
Medium Precarity	1.39 (0.90-2.16)	1.64 (0.77-3.50)	**3.69 (1.99-6.82)**
High Precarity	1.53 (0.99-2.35)	**2.52 (1.43-4.44)**	**3.14 (1.89-5.20)**

[γ] All odds ratios are adjusted for maternal age, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI, maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 7. Odds Ratios and 95%CIs for the Work Precarity—LBW Relationship Stratified by Infant Sex in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity	N	Male	N	Female
Continuous Measure of Precarity	1420	1.16 (0.97-1.39)	1451	1.21 (1.03-1.43)
Low Precarity	670	Ref	635	Ref
Medium Precarity	294	1.49 (0.92-2.43)	313	1.28 (0.80-2.04)
High Precarity	456	1.35 (0.83-2.18)	503	**1.78 (1.14-2.76)**

[A] All odds ratios are adjusted for maternal age, maternal race/ethnicity, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy

Table 8. Odds Ratios and 95%CIs for the Relationship Between the Composite Variable of Work Precarity and Infant Sex and LBW in a Sample from the NLSY79 Cohort (1979-2007)

Work Precarity	Male	Female
Low Precarity	Ref	1.23 (0.82-1.84)
Medium Precarity	1.54 (0.95-2.50)	1.58 (0.98-2.53)
High Precarity	1.44 (0.91-2.28)	**2.03 (1.33-3.12)**

[C] All odds ratios are adjusted for maternal age, maternal race/ethnicity, infant year of birth, maternal educational attainment during pregnancy, maternal pre-pregnancy BMI maternal smoking during pregnancy, and maternal alcohol consumption during pregnancy