

Work-Related Psychosocial Stress and Risk of Preterm, Low Birthweight Delivery

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Abstract: We investigated whether work-related psychologic stress—defined as work characterized by both high psychologic demands and limited control over the response to these demands—increases a woman's risk of delivering a preterm, low birthweight infant.

We studied 786 employed pregnant women included in the National Longitudinal Survey of Labor Market Experience, Youth Cohort (NLSY), a nationally representative sample of 12,686 young adults. Data concerning work status, job title, and other factors affecting pregnancy outcome were obtained from the NLSY. Assessment of job experience was based on job title, using an estab-

lished catalogue of occupation characteristics.

After accounting for the physical exertion entailed in a job, occupational psychologic stress as measured by job title was not associated with preterm, low birthweight delivery for the sample as a whole (Relative risk = 1.16, 95% confidence interval .45, 2.95). For those women who did not want to remain in the work force, work-related stress increased their risk of experiencing this outcome (RR = 8.1, 95% CI 1.5, 50.2). Personal motivation toward work, as well as the physical effort of work, should be considered in evaluating the impact of a job's psychologic characteristics on pregnancy outcome. (*Am J Public Health* 1990; 80:173-177.)

Introduction

A greater proportion of pregnant American women now work outside the home for pay than ever before.¹ Whether certain types of work adversely influences the outcome of pregnancy therefore has substantial import for maternal and child health.

Although a number of studies have examined the broader question of the influence of life stress on pregnancy outcome,² relatively little research exists in the specific area of work-related stress.³ Fox, *et al*, compared low birthweight and perinatal mortality rates among active duty military women with a control group matched for race and parity. He found both outcomes significantly more frequent among the active duty group.⁴ Mamelle, *et al*, also investigated the combined effects of psychological and physical stressors. She found that women with high levels of occupational fatigue—defined as work with a combination of prolonged standing, excessive routine, exposure to vibrating machinery, exposure to cold, heat or chemicals, and lifting—experienced higher risk of preterm delivery.⁵ These studies both exhibit major limitations, including inadequate control for confounding factors and, in Mamelle's study, the possibility of recall bias.⁶

We evaluate here the impact of job related psychologic stress on pregnancy outcome for a national sample of young mothers.

Methods

Study Design, Population

We included in this study those women in the ongoing National Longitudinal Survey of Labor Market Experience, Youth Cohort (NLSY) who met study criteria.¹⁰ The NLSY consists of a national probability sample of 12,686 youth who

ranged in age from 14-21 years when selected in 1979. The survey intentionally oversampled Blacks, Hispanics, and economically disadvantaged Whites. The use of NLSY sample weights in analyses corrects for this oversampling and allows for generalization to the entire US population for this age group. All analyses presented here incorporate sample weights.

Criteria for inclusion in the study population included: female sex, having had a singleton live birth prior to the 1983 interview, and having worked during the most recent pregnancy. Additional technical criteria necessary for including an NLSY respondent in the analyses were availability of a US Census Bureau occupational and industry code for the job held during pregnancy, of job characteristic information for that job code, and of birth outcome data—birthweight and gestation—for the particular pregnancy (see below). Of the initial 12,686 NLSY respondents, 772 women met all criteria (see Appendix).

Pregnancy Outcome and Risk Factors

The survey respondents provided detailed information concerning family background, social, and educational factors, as well as a thorough job history, at the initial interview in 1979. Since that time, the survey youth have answered an extensive in-person questionnaire annually. Women respondents first gave information concerning their reproductive experiences in 1982, retrospectively describing pregnancy experiences in all previous years. The 1983 interview updated this information and included the weight and number of weeks early or late for the most recent live birth. Only the most recent pregnancy was used for these analyses. The NLSY sample diminished less than 5 percent from 1979 through 1983, with little variation among race or sex groupings.¹¹

Using the interview data available from 1979 through 1983, we ascertained information concerning many of the factors known or suspected to influence risk of preterm or low birthweight delivery.² Specifically, we abstracted information concerning maternal race (Black, Hispanic, other), maternal age at the time of the infant's birth, maternal federal poverty status during the year of infant birth, maximum grade completed by the mother prior to the infant's birth, grade completed by the infant's maternal grandmother as of 1979, maternal marital status at the time of the infant's birth, smoking during pregnancy, alcohol use during pregnancy,

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month began prenatal care, height, prepregnancy weight, weight gain during pregnancy, prior induced abortions, prior total pregnancy failures, parity, and prior low birthweight delivery. Fertility and obstetric data were obtained from the 1982 or 1983 interviews; sociodemographic data were obtained in most cases from the interview most closely following the infant's birth.

Job Characteristics Data

The yearly NLSY interview obtains a detailed job history, including stop and start dates for all jobs. The NLSY staff provide a US Census Bureau occupation and industry code for each job worked for 20 hours per week for longer than nine weeks. Through the use of this history, the child's birth date, and the estimated gestation, we identified those jobs held during pregnancy. Job codes were available for some women working at a lesser level of intensity during pregnancy, provided that the woman worked over 20 hours for nine weeks in the same job prior to the pregnancy. We also derived a measure of the intensity of work during pregnancy, which encompassed both the proportion of pregnancy worked and the hours worked per week.

We used the Job Characteristics Scoring System developed by Robert Karasek to determine job control, job demands, and work-related physical exertion.¹² This system is based on analyses of the pooled responses to the three Quality of Employment Surveys of 1969, 1972, 1977 by a large, representative national samples of workers.¹³ Karasek and colleagues derived several scales by factor analysis of these survey responses. Scales were developed separately for men and women, and apply to most US Census Code Occupational/Industry codes.

High values for job control reflect both the skill and creativity required to perform a job (skill discretion), as well as the freedom to make decisions about the work (decision authority). The measure is both reliable and valid.¹²

The psychologic workload measure reflects a job's pace and pressure (e.g., job requires working very hard). Although somewhat less reliable, this measure maintains face validity.¹²

The physical exertion measure is based on one question asked in two of the three Quality of Employment Surveys, specifically, "Does your job require lots of physical effort?" The measure has both face and concurrent validity.^{12,*}

Attitudes Toward Working

All respondents were asked in 1979 and 1982 about their aspirations at age 35 ("What would you like to be doing at age 35?": same job, different job, or having a family). If a woman responded "Having a family," she was then asked "would you like to work in addition to having a family?" For these analyses, we classified a woman as uncommitted toward paid work if she responded in the 1979 survey that she did not want to work at age 35 in addition to having a family.

Analysis

We defined each demand/control quadrant by dichotomizing demand and control at the median level of each among NLSY working pregnant women. We considered three related outcome measures:

- preterm, low birthweight, defined as gestation less than 38 weeks and birth weight 2500 grams or under (5.5 pounds);
- low birthweight itself, i.e., birthweight 2500 grams or under;
- birthweight viewed as a continuous value.

We compared the frequency of preterm, low birthweight delivery, frequency of low birthweight, and mean birthweight between women in job characterized by both high demand and low control ($n = 262$) with women in jobs with all other combinations of demand and control ($n = 510$).

We dichotomized the physical exertion measure into high and low exertion groups at the median value among NLSY working pregnant women for those analyses incorporating this measure.

We undertook weighted multiple logistic regression to determine the effect of job-related stress on risk of delivering a preterm/low birthweight or low birthweight infant.¹⁴ In these regressions, we adjusted for the potentially confounding influence of: maternal race (Black, Hispanic, other), maternal age, maternal federal poverty status during the year of infant birth, maximum grade completed by infant's mother prior to birth, education of maternal grandmother of 1979, marital status at time of birth, smoking during pregnancy, alcohol use during pregnancy, month began prenatal care, prepregnancy weight, prior induced abortions, prior total pregnancy failures, parity, and prior low birth weight delivery, as well as work-related physical exertion and our measure of work intensity. Similar weighted multiple linear regression analyses were used to determine the effect of exertion on birthweight.

We explored whether the relationship between stressful work and preterm low birthweight varied among those more or less motivated towards work through stratification and through specification of interaction terms (stress \times motivation) in the logistic and linear models.

We weighted all analyses with NLSY Sample Weights, which reflect the probability of selection relative to the US population for this age group, and also reflect non-response in any given year.¹⁵ Design effect factors in the NLSY are generally small (less than 2), and are not included in the analyses presented here.**

With the sample size of 780, we could detect a relative risk associated with job stress on the likelihood of delivering a preterm, low birthweight infant of 1.8 with a power of 90 percent.

Results

Sample Attrition and Missing Data

Among women who worked during pregnancy, several differences existed between those women included in the final sample and those excluded due to missing information (either no Census job code or job characteristic score) (Table 1). Most of the exclusions were due to the absence of a job code, in turn due to these women having worked for limited hours. Excluded women were as a group socioeconomically disad-

*Homer CJ, Beresford SAA, James SA, Siegel E, Wilcox S: Work-related physical exertion and risk of preterm, low birthweight delivery. Paediatric and Perinatal Epidemiology (in press).

**Unpublished technical documentation, Center for Human Resources Research, Ohio State University.

TABLE 1—Comparison of Study Women and Excluded Working Women

Measure	Worked, No Census Code n = 207	Worked, Coded, No JCSS Score n = 54	Final Sample n = 786	All NLSY Mothers n = 2375
Maternal				
% Black	16.7	27.3*	15.7	21.9
% Hispanic	10.7	5.7	7.3	8.9
Height (in)	64.0	64.0	64.1	63.9
Weight (lbs)	128.6	122.0	126.9	127.0
Weight gain (lbs)	31.7	29.7	31.6	31.0
Education (years)	11.0*	12.0	11.9	11.2
Prior pregnancy failures (mean)	.15	.09	.15	.13
% Prior LBW	3.3	3.9	2.4	4.0
% Less than federal poverty level	36.9*	36.4	15.9	29.0
% First trimester prenatal care	74.8*	82.0	84.5	80.0
% Smoked	50.3*	32.2	40.1	43.0
Infant				
Birthweight (grams)	3245	3145	3295	3304
% LBW	7.1	5.1	6.25	8.3
% Preterm/LBW	4.3	1.7	3.4	4.7

*Excluded group differs from final sample at $p < .05$, by chi-square or T-test

vantaged relative to other working women, and were more similar to the population of non-working women.

Validation of Measures

The mean birthweight of the infants in the NLSY was 3304 grams. Preterm infants were smaller than term infants, with a mean weight of 2697 grams versus 3389 grams for term infants. Of the 2375 infants included in this study, 8.3 percent weighed less than 2500 grams. Just under 5 percent (4.7 percent) of the NLSY infants were both low birthweight and preterm. NLSY data consistently confirmed those factors well known to influence pregnancy outcome.***

Prominent within the high stress group are jobs of stitchers and sewers in the apparel industry, waiters and food counter workers, nursing aides and orderlies, and cashiers, especially in grocery stores. Low demand, high control work included accountants, mail order salesmen, and bookkeepers. Low demand, low control workers included typists, a variety of cleaning personnel, and household child care workers. High demand, high control occupations included nurses, receptionists, and restaurant managers.†

Impact of Job Characteristics

Women working during pregnancy in jobs characterized by high psychologic demands and low job control were two times as likely to deliver a low birthweight, preterm infant as women working in low exertion jobs (5.1 percent vs 2.6 percent). Similarly, the frequency of low birthweight infants was 1.67 times higher among high stress workers and the mean birthweight of their infants was lower by 78 grams.

Women in high stress jobs were less well educated, had lower prepregnancy weight, and higher smoking frequency***; moreover, almost three-fourths of them in psychologically stressful jobs were also in jobs with high amounts of physical exertion, and physical exertion itself was strongly

associated with increased frequency of preterm, low birthweight as well as with the other outcomes (Table 2).

After taking into account the potential confounding effect of job related exertion and other maternal characteristics, we found that the association of job related psychologic stress with preterm, low birthweight, or with any of the other pregnancy outcomes for the sample of women viewed as a whole was no longer important (Table 3).

For those 70 women who stated they did not want to working outside the home after age 35, however, stressful work significantly worsened pregnancy outcomes.

On average their birthweights were almost 500 grams less than infants born to women in less stressful occupations. These differences remained significant when exertion and other maternal factors were considered (Table 4).

Discussion

We found in this study that young women working in jobs characterized by high levels of psychologic demand with little control over the pace and style of response to those demands were somewhat more likely to deliver a preterm, low birthweight infant than women in other jobs, if they were not motivated to continue working.

We considered practically all those factors outside the work experience that are thought to influence pregnancy outcome, and by using an occupational title-based system of job characteristic description, we avoided the possibility of recall bias in determining work stress. The construct of stressful work as being comprised of work with high demands and low control is intellectually appealing; moreover, it, together with the specific instrument used in this study, has been supported in the field of cardiovascular research.^{9,16,17}

Despite these strengths, this study does present potential drawbacks in a number of areas. These areas include the nature of the study population, the characteristics of the measures of occupational stress and motivation, and the source of outcome information.

The population used for this study is not representative of all American mothers, but rather represents only those women bearing children during the earlier portion of their potential reproductive years. Such a sample necessarily includes more socioeconomically disadvantaged, unmarried, and minority women than a sample drawn from the entire maternal population. Compared with the women included in the National Family Growth Survey, NLSY mothers are more likely to be Black (21.9 vs 14.1 percent), to have dropped out of high school (29 vs 24.5 percent), and to be unmarried (22.1 vs 17.2 percent).¹⁸ The youthfulness of the sample likely accounts for the somewhat increased preva-

TABLE 2—Pregnancy Outcomes for Women in Jobs of Differing Levels of Exertion (by quartile)*

Job Exertion Level	N	%Preterm/LBW	%LBW	Birthweight (mean in grams)
Quartile 4 (High Exertion)	n = 196	5.07	9.05	3281
Quartile 3	n = 180	7.01	8.83	3232
Quartile 2	n = 232	1.25	4.35	3423
Quartile 1 (Low Exertion)	n = 164	1.03	3.04	3440

*Results not adjusted for differences between workers at different levels of exertion. Singleton births only.

***Data available on request to the author

†A more complete listing of jobs is available on request to the author

TABLE 3—Impact of Stressful Work on Pregnancy Outcomes*

Outcome	Crude Estimate of Effect	Adjusted Estimate of Effect	95% Confidence Interval
Preterm/LBW	Relative Risk = 2.0	Relative Risk = 1.3	.6,3.1
LBW	Relative Risk = 1.7	Relative Risk = 1.4	.75,6.8
Birthweight	Difference = -78 grams	Difference = .1 grams	-81,+81 grams

*Singleton births only; adjusted estimates based on regression models without interaction.

TABLE 4—Impact of Stressful Work on Pregnancy Outcomes, Accounting for Maternal Motivation to Work

Outcome	Crude Frequency of outcome	Adjusted Estimate of Effect (95% CI)
Preterm/Low Birthweight		
Does not aspire to work outside home (n = 70)	Low Stress 0% High Stress 8.3%	Relative Risk = 8.4 (1.4,50.2)
Does aspire to work outside home (n = 716)	Low Stress 2.8% High Stress 3.85%	Relative Risk = .64 (.23,1.7)
Low Birthweight		
Does not aspire to work outside home	Low Stress 0% High Stress 18.7%	Relative Risk = 8.0 (1.3,37)
Does aspire to work outside home	Low Stress 5.7% High Stress 6.3%	Relative Risk = .86 (.39,1.89)
Birthweight		
Does not aspire to work outside home	Low Stress 3561 grams High Stress 3062 grams	mean effect = -295 grams
Does aspire to work outside home	Low Stress 3300 grams High Stress 3262 grams	mean effect = +38 grams

lence of low birthweight relative to concurrent national figures of 6.6–7.6 percent.² These demographic characteristics may also explain the decreased frequency of maternal work during pregnancy (66 percent of married primigravidas in the sample worked during pregnancy, compared with contemporary national figures of 85 percent).¹ Nonetheless, while not reflecting the entire age spectrum, the NLSY's emphasis on this younger child-bearing population is important in its own right. Almost half (47 percent) of all births occur to women less than 25 years old.¹⁸

Concerning the measure of occupational stress, problems may exist relating to both the precision of the measure and its validity among this young population. The use of an occupational title-based system leaves open the possibility that the job experience of the particular women in this study may not be accurately reflected in the job characteristics measure. The indicator of job demand is particularly suspect on this score. Although these measures are unlikely to be biased in any particular direction, use of any imprecise system makes identification of an association difficult.¹⁹

Moreover, the construct of high demand/low control work as constituting work-related psychologic stress may not fully encompass factors resulting in work stress for young women at early stages of their work careers. Other factors, such as salary, shift worked, flexibility in hours, or availability of maternity and sick leave, may play an equally important role for this population.

The measure of maternal motivation toward work used in this study is not intended to validly predict a woman's

employment status at age 35; rather, this measure is used to indicate the woman's current attachment to working. This measure, unfortunately, is not stable even over short periods. Although 9 percent of women in 1979 and 10 percent in 1982 were classified as not intending to remain in paid work, the correlation between these two groups is low ($r = .15$, $\kappa = .15$).

Finally, all of the outcome measures in this study are based on maternal recall. Although this defect is not found in other studies relating to work and pregnancy outcome, we found the maternal responses very plausible. Mean White and Black birthweights in the NLSY sample, for example, are extremely close to the estimates from the National Natality Survey (3374 grams and 3095 grams for White and Black infants, respectively, in the NLSY, compared with 3391 grams and 3099 grams for White and Black infants in the NNS).²⁰ Moreover, these data support most of the well known associations with birthweight, low birthweights, and prematurity, such as race, smoking, maternal weight gain, and prior pregnancy experience.

Assuming that our findings are not simply accounted for by these methodologic limitations, why should the impact of high demand/low control work be so strong among women not intending to remain in the paid work force? We can speculate that such women may feel compelled to work, resent it, and that a demanding and restrictive job provides the "last straw." Conversely the over arching desire to remain a part of the gainfully employed population may limit the influence of high demand/low control work on the majority of women who are motivated to remain workers.

Maternal work during pregnancy is likely to be a balance between helpful aspects, such as financial remuneration and social contact, and harmful components. This study sought to determine whether work-related psychosocial stress is one of these harmful aspects. We found that for those relatively few women not desiring to remain in the paid work force, jobs characterized by high demand/low control were independently associated with adverse pregnancy outcome. This finding, based on small numbers, must be considered preliminary pending confirmation in larger studies.

For the remainder of working women, high demand/low control work did not seem to influence the outcomes examined. Due to the limitations in the measures used, however, this study does not preclude an important role for work-related psychologic factors in influencing the outcome of pregnancy for these women. Further research is necessary to clarify which aspects of work are stressful for young women, how these interact with the woman's motivation to work, and how these factors together may influence pregnancy outcome.

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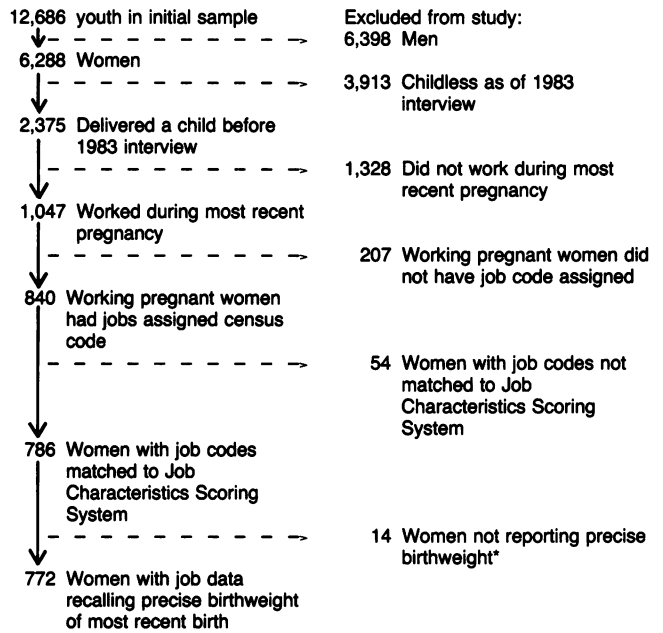
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APPENDIX

Derivation of Study Sample from National Longitudinal Survey of Youth



*12 of these women do report whether their infant weighed more or less than 5.5 pounds.

Qualitative Health Research Conference: Call for Abstracts

An international, interdisciplinary conference is being planned for next year to explore issues and developments in qualitative methods and to examine the latest qualitative health research. The conference will be held February 22-23, 1991 at West Edmonton Mall, Edmonton, Alberta, Canada.

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