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Author

Gardin, Susan K.

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PHYSICAL ACTIVITY ON THE JOB:
EFFECTS ON BIRTH OUTCOMES AND IMPLICATIONS FOR PUBLIC POLICY

Susan K. Gardin

ABOUT THE AUTHOR.

Susan K. Gardin received masters degrees in Physical Therapy and Health Education from the University of Southern California and the University of California, Los Angeles, respectively. She is currently pursuing her doctorate in Public Health at UCLA.

The first serious attempts at scientific examination of the relationship between maternal employment and birth outcomes occurred in the 19th century. In 1896, L. Letourneur published a study based on 627 deliveries in Paris, and concluded that physical work at the end of pregnancy was a stronger determinant of birth weight than maternal morphology. He reported that "robust" women engaged in strenuous work (e.g., housemaids) delivered infants of lower birth weight than thinner women involved in less demanding work (e.g., florists) (Artal and Gardin 1986). Current scrutinization of Letourneur's data reveals a distribution of birth weights and a relationship between birth weight and parity which is consistent with current knowledge and suggestive of good reliability. However, modern statistical analysis reveals that physical activity on-the-job was not the critical variable contributing to poor outcome--infants born to women engaged in work which was not "physically demanding" had only a nonsignificant 15 gram average increase in birth weight over infants born to women in physically demanding jobs. The critical factor, rest before delivery (>8 days), resulted in a statistically significant 202 gram increase in birth weight (Briend 1980). Furthermore, while Letourneur's resting and non-resting groups differed in socioeconomic status, marital status and gravidity, the distribution of these differences should have increased negative birth outcomes in the resting group, and therefore bias his findings towards the null.

In the early 1900s, attention became focused on particular postures chronically assumed during maternal employment. Two studies in India comparing non-workers, standing and sitting workers found that standing workers consis-

tently delivered light infants, especially when work was continued beyond the sixth month of pregnancy. A German study published in 1927 found a higher stillbirth rate among standing workers as compared with sitting workers.

Recent studies from less developed countries have confirmed many of these early associations. In 1980, Tafari et al. reported that Ethiopian women engaged in heavy physical labor during pregnancy had significantly lower gestational weight gains and lighter newborn infants than less active mothers. Similarly, Manshande, in a letter to the British Medical Journal (1979), reported that women in a subsistence farming community in Zaire who spent the last weeks of pregnancy in a "lying-in village" where they were relieved of their usual agricultural and domestic chores, had a "strikingly lower still-birth rate" than women who did not use the village.

Difficulties in the interpretation of both the early studies of the 20th century and the recent studies from less developed countries are multiple. First, both the working and general living conditions of subjects in these studies are unique to the era and/or place of the study, thus reducing the external validity and generalizability of the findings. For example, all subjects in the study by Tafari et al. were on subsistence diets corresponding to only 70 percent of WHO/FAO recommended standards. Additionally, current working conditions for women in developed countries are exceedingly different from conditions in less developed countries and turn-of-the-century "developed" countries. The distribution of socioeconomic status of those women who work in developed countries is also changed from the early 20th century. Such secular trends would be expected to affect associations between maternal employment and birth outcomes.

Second, these studies fail to control for a variety of well-established confounding variables. A recent publication by the Committee to Study the Prevention of Low Birth Weight (19 5) reports associations between the following factors and low birth weight[1]:

1. Demographic factors such as low socioeconomic status, low level of education, nonwhite race, extreme maternal age (<17 or >34) and unmarried status;
2. Medical risks predating pregnancy such as poor obstetric history[2], genitourinary anomalies or surgery, extreme parity (<0 or >4), low maternal weight-for-height, selected diseases such as diabetes or chronic hypertension, and maternal genetic factors such as low maternal weight at own birth;
3. Medical risks in the current pregnancy such as multiple pregnancy, poor weight gain, short interpregnancy interval, hypotension, hypertension/pre-eclampsia/toxemia, selected infections such as rubella or cytomegalovirus, first or second trimester bleeding, anemia, placental problems such as placenta previa or abruptio, hyperemesis, oligohydramnios/polyhydramnios, isoimmunization, fetal anomalies, incompetent cervix and spontaneous premature rupture of membranes;
4. Behavioral and environmental risks such as smoking, poor nutritional status, alcohol or other substance abuse, DES or other toxic exposures and high altitude;
5. Health care risks such as absent or inadequate prenatal care and iatrogenic prematurity; and
6. "Evolving concepts of risk" such as physical and psychosocial stress, uterine irritability, events triggering uterine contractions, cervical

changes detected before the onset of labor, selected infections such as mycoplasma and chlamydia trachomatis, inadequate plasma volume expansion and progesterone deficiency.

After the turn of the century surge of interest in the relationship between maternal employment and low birth weight, interest in the relationship declined until the period following World War II when women began to enter the workforce in great numbers. A more detailed examination of studies during this period will further demonstrate the variability in both findings and conclusions resulting from failures to account for both secular trends and confounding.

In 1955, Stewart reported findings from a study of 1,318 singleton births in Northhamshire (England) which suggested a correlation between maternal employment and increased incidence of low birth weight and perinatal mortality. Among employed women, those who stopped work before 28 weeks had better obstetrical outcomes. While the title of Stewart's article--"A Note on the Obstetric Effects of Work During Pregnancy"--clearly implies causation, she wrote in her conclusion that: "[o]ccupations of mothers with dead babies did not appear to be either exceptionally dangerous or unusually exacting even when compared with housework." Furthermore, Stewart reported that both the perinatal death rate and incidence of low birth weight were more than three times higher among wives of semi-skilled and unskilled manual laborers as compared to wives of professional men and business executives. Not surprisingly, there was a higher proportion of housewives in the latter group. When the author stratified the sample according to social class, the significant difference in incidence of low birth weight between employed and unemployed women persisted only in Social Class III. Despite this obvious evidence of confounding by social class, the author concluded that "attempts to combine housework and paid work increase the risk of prematurity and consequently of stillbirth and neonatal death." [3]

Two additional studies of the 1950s found no relationship between the duration of employment and either low birth weight or prematurity. The first, a study of births at two maternity hospitals in Edinburgh between 1953 and 1955, examined every case of low birth weight, stillbirth and neonatal death, along with an equal size random sample of full-term infants surviving discharge from the hospital (Drillien 1957). The lack of relationship between maternal employment and low birth weight persisted with stratification based on parity and duration of employment.

Unfortunately, this study suffered from other significant methodological flaws, rendering its conclusions suspect. First, the investigator and one additional social worker interviewed subjects presumably with a full knowledge of birth outcomes (interviewer bias). Second, since only 75 percent of Edinburgh births occurred in the hospital at the time of the study, employed women from the lower social classes probably represented a majority of the 25 percent delivering outside the hospital, and hospital births may have been associated with improved perinatal outcomes. Such a sample bias would theoretically bias the study results toward the null. Third, the power of the study to detect differences is suspect since only 3 percent of the sample was employed during the eighth or ninth month of pregnancy. Finally, despite the fact that associations were reported between various confounders (e.g., husband's social class, social class of woman's father, inadequate diet, etc.) and low birth weight, these confounders were not controlled during the analysis of the effects of maternal employment on birth weight. [4]

In a slightly more sophisticated analysis, Illsley examined the births of 103 low birth weight (<5.5 lbs) and 103 "normal" weight (6.5 -- 8.5 lbs) infants delivered at Aberdeen Maternity Hospital (Scotland) between 1952 and 1953 (Illsley and Billewicz 1955). Illsley found no relationship between the

duration of maternal work and low birth weight, after controlling for husband's social class, maternal age at delivery, height, occupation (divided into five categories), marital status at conception and complications of pregnancy.

Unfortunately, Illsley failed to distinguish between women who were not employed for any period of the pregnancy and women who stopped work by 20 weeks. Such categorization could precipitate misclassification bias, i.e., bias toward the null. The issue of power is also suspect in that 74 percent of Illsley's sample did not work or stopped work prior to the 27th week of pregnancy. Finally, Illsley failed to report any tests of statistical significance.

In summarizing the studies of the 1950s, it is clear that controversial results were reported, in a large part, because of variations in design and analysis. Absence of knowledge about risk factors and inadequacies of statistical technique did not permit researchers of this era to control for the many confounders identified by the Committee to Study the Prevention of Low Birth Weight in 1984.

After the social upheaval of the 1960's, as opinions about women and work began to change, so did the conclusions of the studies. Since study conclusions in this "modern" era (1960-present) appear to vary geographically, foreign studies will be discussed separately from American studies.

Utilizing data from the Cardiff Births Survey (1965-1979), Murphy et al. (1984) examined the relationship between maternal employment, low birth weight, prematurity and perinatal mortality in 69,617 births. The data revealed that a significantly higher proportion of preterm births (<37 weeks) occurred among women who were not employed during their pregnancies as compared to those who were employed. Similar findings suggested a negative relationship between maternal employment and duration of maternal employment, and both low birth weight and perinatal mortality. However, these relationships failed to achieve significance when mothers with adverse medical histories and/or histories of abortion(s) were excluded from the analyses. There were no differences in birth outcomes for women engaged in sedentary versus non-sedentary work. In explaining their results, Murphy et al. suggested that either (1) healthy mothers who are more likely to experience good perinatal outcomes selectively enter the work force, (2) employment itself is beneficial to pregnant women, or (3) non-employed women are "disadvantaged" in some manner.

Saurel and Kaminski (1983), examining a representative sample of 4,685 births in the 1976 French National Survey, reported that preterm deliveries were significantly less frequent among working women, and that "differences in level of education, parity, or social class did not completely explain" this difference (Danforth 1967). A separate analysis of immigrant women demonstrated a similar relationship, despite the fact that immigrant workers were employed in "generally heavy work." While employed women were more often primiparous, and smokers had lower pre-pregnancy weights, Saurel and Kaminski found no relationship between maternal employment and either low birth weight or intrauterine growth retardation.

Gofin (1979) reported findings from a study of 708 births occurring in West Jerusalem between 1970 and 1972. Unlike Saurel and Kaminski, Gofin found no effect of maternal employment on length of gestation. However, he did report that housewives had a significantly higher rate of low birth weight than employed women, even when separately controlling for individual pregnancy complications, smoking, and parity. Utilizing a log-odds model which simultaneously examined the independent and interactive effects of maternal employment, region of birth, social class, complications of pregnancy, smoking, and parity on birth weight, Gofin reports that there was no effect of maternal employment. The strongest predictors of poor outcome were smoking, pregnancy

complications, and region of birth.

Despite their consistent findings, all three of these foreign studies suffer from serious threats to internal and external validity. While several confounding variables were measured and found to be distributed differently among employed and nonemployed subjects, the investigators consistently failed to stratify the data on these factors during their analyses. For example, employed women in the French studies were typically younger, more likely to be of French origin, had smaller and more well-spaced families, were less likely to be married to men in unskilled manual occupations, were more likely to see an obstetrician during their pregnancies and had more prenatal visits as compared to their unemployed controls (Chamberlain and Garcia 1983). In the British study by Murphy et al. (1984), the unemployed women were more likely to be at the extremes of age (<20 or >35), have a history of previous abortion or other medical problems and attend antenatal clinics less frequently than their employed counterparts. Additional important confounding variables were not even recorded in the data. For example, both Gofin and Murphy et al. failed to distinguish between full and part-time work, and work continuing for the duration of the pregnancy versus work terminated prior to term.

The primary difficulty in interpreting these studies derives from the fact that maternal employment, is treated as a single "entity"; these studies fail to delineate what specific elements of maternal employment are responsible for either positive or negative effects on birth outcomes. For example, Gofin reports that "moderate" abnormalities of delivery are more prevalent among employed women while "severe" abnormalities are more prevalent among the unemployed. In the usual epidemiologic search for a dose-response relationship, this report is perplexing. On closer examination, however, one finds that within each graded category of abnormalities, there are complications with widely disparate physiologic mechanisms. For example, both premature rupture of the membranes and hyperemesis gravidarum are included in the "moderate" category, while both ectopic pregnancy and eclampsia are included in the "severe" category. It is difficult to hypothesize what specific element of work could be responsible in "small" doses for hyperemesis gravidarum, and in "large doses" for ectopic pregnancy.

Both Murphy et al. (1984) and Gofin (1979) reported interaction effects between maternal employment and social class. Gofin reported that the excess rate of low birth weight associated with non-employment diminished with social class and reversed itself in the lowest social classes. Murphy et al. reported similar findings for perinatal mortality: higher rates were associated with unemployment in higher social classes and employment in lower social classes. Gofin's findings did not achieve statistical significance, and Murphy et al.'s results became non-significant when previous medical history and history of abortions were taken into account. Regardless, these interactions are suggestive--perhaps more significant than maternal employment status is the reason why a pregnant woman is employed or unemployed. Perhaps pregnant women in the upper social classes are unemployed because of previous poor obstetric outcomes; perhaps employed pregnant women in the lower social classes have certain social and economic advantages that unemployed lower class women do not share. In other words, while maternal employment may have certain negative physiologic effects on birth outcomes, these may be counteracted by certain social and economic benefits. Depending on one's social class, the physiologic effects may outweigh the socio-economic effects, or vice versa.

One recent French study (Mamelle, Laumon and Lazar 1984) attempts to identify elements of maternal employment that predispose women to premature delivery. Between 1977 and 1978, Mamelle, Laumon and Lazar interviewed 1,928 working women immediately after delivery as to their "way of life" and occupational activities during pregnancy. Concerning the occupational data, the authors "carried out an analytical breakdown of the job into its diverse

components" and thus defined five sources of occupational fatigue: posture, work on industrial machine, physical exertion, mental stress, and environment. As the sources of fatigue increased from 0 to 5, the authors reported that the rate of premature births rose from 2.3 percent to 11.1 percent. The investigators also reported a combined effect between fatigue and working more than 40 hours per week. In a multiple logistic analysis involving medical, social, and occupational risk factors, Mamelle found that the only significant risk factors for prematurity were the fatigue index, previous premature birth, and parity. These relationships persisted in a 1:3 subsample matched for age, ethnic origin, socioeconomic class, parity, previous antenatal problems, and pathology during pregnancy.

Despite the "water-tight" presentation of Mamelle, Laumon and Lazar, this study fails to identify clear etiologic pathways and is not convincing from an epidemiologic viewpoint. First, single sources of fatigue contain widely disparate elements. For example, included in the category of "environment" are both "manipulation of chemical substances" and "wet atmosphere." Second, the fact that the same individuals who developed the index also interviewed the subjects about highly subjective material and with (presumed) full knowledge of the birth outcomes, threatens the validity of the index. The predictive value of the index can only be demonstrated in a future study. Third, the study failed to control for a variety of important risk factors (e.g., smoking habits and alcohol intake). Finally, the utility of the index is questionable in that it is (a) complicated, (b) subjective, and (c) fails to identify specific occupational categories at risk.

The conclusions of these work studies from Europe and Israel are not readily transferable to the United States because of national variations in maternity leave policy. In France, most employed pregnant women are guaranteed six weeks prenatal and eight weeks postnatal paid leave, the right to change jobs on medical grounds without a change in salary, and job reinstatement following maternity leave (Saurel and Kaminski 1983). In England, most employed women stop working at approximately 28 weeks of pregnancy, and are entitled to 17 weeks of paid maternity leave (Chamberlain 1985). In Israel, pregnant women are granted 12 weeks paid leave and job reinstatement (International Labour Office 1984). In contrast, the United States has no national maternity policy (Kamerman, Kahn and Kingston 1983).

As with the other studies discussed thus far, American studies focus primarily on two birth outcomes--low birth weight and prematurity. A well-known study by Naeye and Peters (1982) utilizing data on 7,722 singleton births from the U.S. Collaborative Perinatal Project, reported an association between maternal employment and both decreased birth weight and increased incidence of placental infarcts. Birth weights of full term infants were progressively lower when mothers worked outside the home after 28 weeks. Gestations were not shortened, but newborns of women who worked in the third trimester weighed 150 to 400 grams less than newborns of mothers who remained at home. Growth retardation was exacerbated when women were underweight pregravid and had a low pregnancy weight gain, when they were hypertensive or when the work required standing. The frequency of placental infarcts progressively increased when women continued stand-up work into late gestation. The incidence of infarcts in women at home was 53/1000, versus 250/1000 for women employed in standing work until the 37th week of gestation. The associations between maternal employment, birth weight, and placental infarcts persisted when the data were stratified separately for gestational age at birth, maternal pregnancy weight gains, pregravid body weights, maternal blood pressure during pregnancy, maternal age, maternal education, and family income. The investigators hypothesized that inadequate uterine blood flow exacerbated by upright posture in late pregnancy was responsible for decrease in birth weight and increase in placental infarcts among women employed in standing occupations.

Although Naeye and Peter's (1982) study is cited frequently in reviews of this subject, their study suffers from serious threats to internal and external validity. First, the study involved only a select group of occupations; occupations which the researchers could not categorize as predominantly sitting or standing were excluded. Second, the sample contained an unusually low proportion of employed women (15-20 percent), as compared with the national employment rate (>30 percent) during this period (Chamberlain 1985). Third, Figures 1 and 2 of Naeye and Peter's 1982 article seem to imply that all birth weights were greater than 3000 grams. Since the definition of low birth weight is 2500 grams or less, birth weights of 3000 grams or more are within acceptable healthful limits. Fourth, although the researchers stated in their "Patients and methods" section that the data were stratified for a variety of confounders, including smoking habits, they failed to report the results of the smoking stratification in their "Results" section.[5] Considering the established association between smoking and low birth weight, this omission is conspicuous. Fourth, an examination of interaction effects was not possible since confounders were controlled individually via one-way analysis of variance; multivariate analysis allowing simultaneous control of multiple confounders would have been a more appropriate statistical technique. Finally, data for this study were gathered from 1959-1966, i.e., a different era with regard to the proportion of women in the workforce, conditions of work for female employees, prenatal care, obstetrical technology, etc.

Using a more sophisticated multiple regression analysis, Zuckerman et al.

(1986) examined birth outcomes in 1,507 low income women delivering at Boston City Hospital between 1977 and 1979. In an obvious attempt to disprove Naeye and Peter's findings, subjects were divided into three groups: (1) women who were neither attending school nor engaged in paid work outside the home during pregnancy, (2) women who worked for pay outside the home in standing occupations during all or part of the third trimester, and (3) women with other work histories (including attending school, working for pay in sitting occupations, and working in standing occupations during the first and second trimester). After controlling for 16 confounders (including maternal age, race, alcohol use, smoking habits, marijuana use, education, marital status, nutritional status, medical history, history of abortions and miscarriages, hospitalization during pregnancy, number of young children at home, and gestational age at delivery[6]), Zuckerman et al. reported no significant relationship between mother's work history and either duration of gestation, birth weight, or head circumference.

Unfortunately, Zuckerman et al.'s study also suffers from threats to validity. Since only 7 percent of the women sampled were employed in standing occupations during the third trimester, there is some question about the power of the study to detect significant differences. Second, as evidenced by their lower rates of hospitalization and fewer medical illnesses, women in standing occupations during the third trimester were "self selected survivors." Third, only 67 percent of mothers were interviewed, and no attempt was made to evaluate the possibility of systematic differential response among those interviewed versus those not interviewed. Finally, while sufficiently useful for disproving Naeye and Peter's findings, Zuckerman et al.'s unusual classification system contributes little to a theoretical understanding of those elements of work which are responsible for positive or negative influences on birth outcomes.

In a theoretically more palatable case control study, Meyer and Daling (1985) examined 5,822 subjects selected from the 1981 State of Washington birth certificate records. Subjects were classified into groups based on their primary activities: housewife, sitting work, mixed work, or active work. In an innovative attempt to test the hypothesis that physical activity is the criti-

cal component of work, Neyer and Daling used their sitting work group as the reference group, and found no relationship between mother's usual activity and the incidence of low birth weight. Unfortunately, while Neyer and Daling did control for maternal age, race, marital status, gravidity, parity, prior fetal deaths, and month during which prenatal care was initiated, they did not control for key confounders such as maternal smoking and alcohol habits, socioeconomic status and prepregnancy weight. Furthermore, by failing to classify subjects according to the duration of paid employment, they may have precipitated a misclassification bias toward the null.

In another case control study, Berkowitz et al. (1983) also reported no association among premature delivery and maternal employment, the extent of "standing or moving around" on the job, the proportion of women with jobs requiring lifting or carrying and the number of hours of work per week by trimester. Despite the fact that various confounders were differentially distributed among the cases and controls, the authors report only having controlled for race and socioeconomic status during their examination of the effects of maternal employment.

Perhaps the most methodologically sound examination of the effects of employment on birth weight involves a study of 7,155 employed women and 4,018 housewives participating in the Delivery Interview Program at Boston Hospital from 1977 until 1980 (Marbury et al. 1984). This study found no differences between cases and controls for risk of premature birth, perinatal death, low birth weight, and use of the special care nursery or malformations. When working women were divided into those who left employment during the first eight months ("early leavers") and those who worked until term ("term leavers"), early leavers had the highest incidence of preeclampsia, while term leavers had the lowest. Early leavers and primiparous term leavers demonstrated an increased risk for prolonged gestational age as compared to housewives. Early leavers had a 43 gram decrease in birth weight and term leavers had a (nonsignificant) 11 gram decrease in birth weight as compared to housewives. However, utilizing a multiple regression equation involving 14 variables, maternal employment had the least significant impact on birth weight. The 43 gram decrease among early leavers was most likely due to premature deliveries in this group.

In explaining the results, the investigators suggested that early leavers were composed of those who chose to leave work and those who were forced to leave because of problems relating to pregnancy. Therefore, this group would be expected to have a higher rate of adverse outcomes than housewives, even absent of working effect. In contrast, term leavers were "survivors" with expected best outcomes. Therefore, any outcomes which showed no overall difference between housewives and the total group of working women could be interpreted as lack of association between the outcome and maternal employment, even if there was a difference between housewives and early leavers.

Most importantly, the results of this study persisted when controlling for various confounding variables, including preeclampsia, gestational age, maternal age, race, parity, smoking, alcohol and marijuana habits, obstetric history, pregnancy events, and delivery characteristics. In addition to the absence of confounding bias, certain facts (such as high response rate and expected distributions of birth weight) eliminate the likelihood of either selection or misclassification bias. Overall, this study confirms the absence of any negative effects of maternal employment on birth outcomes. The one puzzling result is an association between maternal employment and prolonged gestational age. Since little is currently known about risk factors for prolonged gestational age, this finding cannot be readily explained.

In summarizing the results of the United States' studies, it appears that the more methodologically sound the study, the less likely a conclusion of association between maternal employment and poor perinatal outcome. Further-

more, as women's participation in the workforce and the importance of the female contribution to the family's income have increased over time, reports of adverse effects of maternal employment on perinatal outcomes have decreased. While this may be partially attributed to improvements in working conditions, it may also be attributable to a more sophisticated search for facts to support a growing social phenomenon.

In summarizing the many European and American studies reviewed in this article, it can only be said that (1) the relationship between maternal employment and decreased or low birth weight is unclear, and (2) there is insufficient evidence at this time to restrict employment or require prenatal leave for pregnant working women.

Future research addressing the relationship between maternal employment and infant birth weight should utilize advanced multivariate analytic techniques and better confounder control. The role of confounders in the analysis of this relationship is critical. Control for confounding variables is appropriate when the confounding variable is differentially distributed among cases and controls, and the variable has a known impact on the outcome of interest. A recent study utilizing the 1980 National Natality and Fetal Mortality Surveys (Shilling and Lalich 1984) clearly demonstrates the presence of the differential distribution.[7] As compared to nonemployed mothers, a larger proportion of employed mothers had a college education, a total family income over \$21,000, received early prenatal care, had no previous pregnancies, drank alcohol, and were 20-29 years of age.

In addition, future scientific studies must refrain from treating maternal employment as a single entity, and clearly delineate specific elements of work (e.g., physical activity, postures, increased access to information) that impact negatively or positively on maternal and fetal health.

The findings and conclusions of these future studies will be of critical importance to the approximately one million American working women who become pregnant each year. Currently, 42 percent of all pregnant women and 90 percent of primiparous women between the ages of 30 and 34 years are employed (Entman 1982). Considering the magnitude of the population involved, the United States cannot require resolution of the relevant scientific questions as a prerequisite to establishing a comprehensive maternity policy for its female working population. In most advanced industrialized countries other than the United States, maternity leave, job protection, and cash benefits equivalent to a portion of the working woman's normal wage are normative (Kamerman, Kahn and Kingston 1983). Similarly, in a study of 202 traditional societies, 55 percent were found to favor lightening of work at some time during pregnancy, or permitted only light to moderate duties throughout the pregnancy. A full 97 percent had postpartum disruption of duties, although the amount of time varied according to culture (Jimenez and Newton 1979).

The fact that both traditional societies and industrial societies with varying prenatal outcomes both allow for "maternity leave," would imply that it is not maternal work itself which is either favorable or unfavorable, but the interaction of maternal work with a variety of social, economic, and cultural factors.

National policies governing maternal employment leave represent social opinion about the importance of motherhood, children, and the next generation. The World Health Organization (WHO) places great importance on mothering activities and maternity support (International Labour Office 1984). Noting that the "few weeks before and after birth are one of the most critical and vulnerable periods of human life," WHO has stated that:

[Maternity] protection is a right of women and children, not a social welfare benefit or an act of "charity." Its enactment and enforcement is a national responsibility. Bearing children is an important contri-

bution to the continuation of future generations. Responsibility for maternity protection involves more than just favoring mother and infant dyad investing in health promotion and protection for women and children

is a direct entry point to improved social development, productivity and better quality of life (International Labour Office 1984).

During the past 25 years, the equality movement, the increased financial necessity of female contributions to family income, the decreasing birth rate and the subsequent decreased "visibility of pregnancy," have all resulted in a decline in the status of the mother role in the United States. Currently, "motherhood" and maternity support are not popular "American" concepts. Thus, while the suggestions for future research discussed earlier can no doubt improve the understanding of the relationship between maternal employment and negative birth outcomes, the establishment or failure to establish an enlightened national maternal employment leave policy in the United States will probably depend more on economic, social, and political influences than on the conclusions of these future scientific studies. When the American people perceive that parenting and paid employment are both necessary stimulants for (1) individual growth and development of males and females, parents and children and (2) a necessary requirement for the perpetuation of a humane society, then issues of employment restrictions for pregnant workers and the failure to legitimize pregnancy and parenting leaves will become public policy issues of the past. Until that time, there is a long and difficult road ahead for all those interested in perfecting the world for this and future generations.

1. Low birth weight is defined as birth weights <2,500 grams resulting from either prematurity or intrauterine growth retardation.
2. Examples of poor obstetric history include previous pregnancy(ies) culminating in premature delivery or fetal death and previous delivery of live born infant(s) weighing less than 2,500 grams (Van Den Berg and Oechsli 1984).
3. "Prematurity" in this article refers to infants of low birth weight(<5.5 lbs.).
4. It should be noted that an accusation of "sloppy" research technique is not intended in this criticism. Techniques for sophisticated control of confounders were not in use in the 1950s.
5. The impact of each of the other confounding variables--maternal age, years of education, income, pregravid body weight, net pregnancy weight gain, peak diastolic blood pressure during pregnancy and the number of children at home--was reported.
6. Gestational age at delivery served as a control variable for birth weight and head circumference only.
7. This information is presented only to indicate that differential distributions must be suspected and tested in studies examining the relationship between maternal employment and birth outcomes in the United States. The differential distribution must be existent in the particular sample under investigation in order to meet the criteria requiring control for confounding during analysis of the data.

REFERENCES

- Artal, R. and S.K. Gardin
1986 Historical perspectives. In R. Artal and R.A. Wiswell, editors,
Exercise in Pregnancy. Baltimore: Williams and Wilkins.
- Berkowitz, G.B., J.L. Kelsey, T.R. Holford and R.L. Berkowitz
1983 Physical activity and the risk of spontaneous preterm delivery. The
Journal of Reproductive Medicine 28:581-588.
- Briend, A.
Maternal and physical activity, birth weight and perinatal
mortality.
medical Hypotheses 6:1157-1170.
- Chamberlain, G.
1985 After office hours: effect of work during pregnancy. Obstetrics and
Gynecology 65:747-750.
- Chamberlain, G. and J. Garcia
1983 Pregnant women at work. The Lancet 1:228-230.
- Committee to Study the Prevention of Low Birthweight
1985 Preventing Low Birthweight. Division of Health Promotion and
Disease
Prevention. Institute of Medicine. Washington, D.C.: National Aca-
demy Press.
- Danforth, D.N.
1967 Pregnancy and labor from the vantage point of the physical
therapist. American Journal of Physical Medicine 46:653-658.
- Drillien, C.M.
1957 The social and economic factors affecting the incidence of
premature
birth. The Journal of Obstetrics and Gynecology of the British
Empire 64:161-184.
- Entman, S.S.
1982 Obstetrical considerations for the working woman. Journal of the
Tennessee medical Association 71:318-230.
- Gofin, J.
1979 The effect on birth weight of employment during pregnancy. Journal
of Biosocial Science 11:259-267.
- Illsley, R. and W.Z. Billewicz
1955 Prematurity and paid work during pregnancy. British Journal of
Prevention and Social medicine 9:159-161.
- International Labour Office
1984 Protection of working mothers: an ILO global survey (1964-1984).
Women at Work 2. Geneva: International Labour Office.
- Jimenez, M.H. and N. Newton
1979 Activity and work during pregnancy and the postpartum period: a
cross-cultural study of 202 societies. American Journal of

Obstetrics and Gynecology 135:171-176.

Kamerman, S.G., A.J. Kahn and P. Kingston

1983 Maternity Policies and Working Women. New York: Columbia University Press.

Mamelle, N., B. Laumon and P. Lazar

1984 Prematurity and occupational activity during pregnancy. American Journal of Epidemiology 119:309-322.

Manshande, J.P.

1979 Fetal malnutrition: the cost of upright posture? (letter). British Medical Journal 2:317-319.

Marbury, M.C. et al.

1984 Work and pregnancy. Journal of Occupational Medicine 26:415-421.

Meyer, B.A. and J.R. Daling

1985 Activity level of mother's usual occupation and low infant birthweight. Journal of Occupational Medicine 27:841-847.

Murphy, J.F. et al.

1984 Employment in pregnancy: prevalence, maternal characteristics, perinatal outcome. The Lancet 1:1163-1166.

Saurel, M.J. and M. Kaminski

1983 Pregnant women at work. The Lancet 1:475.

Shilling, S. and N. Lalich

1984 Maternal occupation and industry and the pregnancy outcome of U.S. married women, 1980. Public Health Reports 99:152-161.

Stewart, A.

1955 A note on the obstetric effects of work during pregnancy. British Journal of Prevention and Social Medicine 9:159-161.

Tafari, N., R.L. Naeye and A. Gobezie

1980 Effects of maternal undernutrition and heavy physical work during pregnancy on birth weight. British Journal of Obstetrics

and

Gynecology 87:222-226.

Van Den Berg, B.J. and F.W. Oechsli

1984 Prematurity. In M.B. Bracken, editor, Perinatal Epidemiology. New York: Oxford University Press.

Zuckerman, B.S. et al.

1986 Impact of maternal work outside the home during pregnancy on neonatal outcome. Pediatrics 77:459-464.

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