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"WELL-GROWNESS" OF THE NEWBORN AND FACTORS
CONTRIBUTING TO LOW BIRTH WEIGHT

by

Diane Buck Kruse

A dissertation presented to the
FACULTY OF THE PHILIP Y. HAHN SCHOOL OF NURSING
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requirements for the degree
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ABSTRACT

The problem of determining risk factors and antecedents of birth weight is multifactorial. The purpose of this study was to examine the effect of pre-pregnancy health status, prenatal care, stress, negative lifestyle practices, nutritional status during pregnancy, and placental perfusion on the well-grownness of the newborn (birth weight) in five time orderings and to examine the interaction of these variables on each other. The theoretical framework was a physiologic one centering on the effects of the proposed variables on the well-grownness outcome. This prospective study used a correlational design with path analytic techniques. A sample of 160 pregnant women and their subsequent newborns was recruited from a large, urban, hospital clinic. Interviews were conducted during prenatal visits, followed by chart reviews of mother and baby.

Following data reduction techniques to establish independence of the variables or to form composites, the revised model had fourteen variables, namely the antecedent variables of height, height/weight, gravida/para status, life events stress and support; mediating variables of abuse, bother, smoking, pregnancy weight gain, calories, hematocrit; and outcome variables of birth weight, physical maturity, and neuromuscular maturity. These variables accounted for 3% of the variance in birth weight, 8% in physical maturity, and 3%

in neuromuscular maturity. Several of the hypotheses were partially supported. The mother's height had a direct, positive effect on physical maturity of the newborn, while the height/weight status had a direct, positive impact on the birth weight of the newborn. The height/weight status of the mother also indirectly affected the neuromuscular maturity of the newborn through the stress variable of bother. Life stress had a direct, positive effect on abuse, while support was negatively related to it and to body image (botheredness). Abuse also had a direct, positive effect on physical maturity, while body image (bother) had an indirect effect on neuromuscular maturity through admission hematocrit. Smoking had a direct, positive effect on calorie intake but had no effect on the other proposed relationships. Lastly, admission hematocrit had a direct positive effect on neuromuscular maturity. This study needs to be repeated with a sample that would include low birth weight babies. The prospective nature of this study must be retained.

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DEDICATION

This work is dedicated to my family: Robert, Denny,
Matthew, Barry, and my mother, Mildred Smith Buck.

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CHAPTER I

INTRODUCTION

Infant Mortality

The high infant mortality rate in the United States is one of our nation's most serious problems. In 1985 the United States ranked 19th, compared to other industrial nations, in international infant mortality rates. A child born in Japan, Finland, Hong Kong, Ireland, Australia, Canada, Singapore or any of 12 other industrial nations has a better chance of surviving to his or her first birthday than a child born in the United States (Chiles, 1988).

Neonatal Mortality

The majority of infant deaths occur during the first month of life and thus are a major part of the infant mortality rate. Neonatal mortality refers to the infant deaths that occur in the first 28 days of life. The primary cause of neonatal mortality has been found to be problems related to low birth weight (Koops, Morgan, & Battaglia, 1982; McCormick, 1985). The risk of mortality increases with decreasing birth weight and babies born with very low birth weight (less than 1,000 gs) are 200 times more likely to die in the first month than infants of normal weight (Chiles, 1988). For example, infants

born weighing 2,500 gs or less account for 96% of neonatal deaths, while those weighing over 2,500 gs account for the other 4% (Shapiro, McCormick, Starfield, Krischer, & Bross, 1980).

In another study, using the 1980 birth cohort (The National Infant Mortality Surveillance Study), it was determined that birth weight was the single, most important predictor of infant survival. Of all infants born in 1980 who died within a year, 60% were of low birth weight, under 2,500 gs (Monthly Morbidity & Mortality Report, 1989).

Low Birth Weight

However, low birth weight (LBW) encompasses more than just the measurement of weight at birth (Wilcox, 1983). There are two groups of low birth weight infants that are of concern. They are those newborns who did not have enough time to grow (preterm) and those who are born near or at term but did not grow appropriately inside the uterus (intrauterine growth retardation, IUGR). Low birth weight, therefore, is defined as those babies completing less than 37 weeks of gestation and those babies weighing less than 2,500 gs (5.5 lbs.) at birth (Institute of Medicine, 1985).

In one study, the distinction was made between term LBW infants and preterm LBW infants. The greatest mortality and morbidity was found in the preterm LBW group (Michielutte et al., 1992).

The issue of low birth weight poses many problems. Not only are low birth weight babies 40 times more likely to die in the first month of life, but survivors are twice as likely to suffer one or more handicaps, such as cerebral palsy, chronic lung problems, epilepsy, delayed speech, blindness, deafness, or mental retardation (Chiles, 1988). Another problem is the cost of caring for LBW infants. The overall lifetime costs for special care of handicapping conditions facing many of these children can be as high as \$400,000 (Chiles, 1988).

Arizona and LBW

Beginning in 1970, Arizona experienced a decrease in infant mortality, but in 1982 this trend reversed. The rate at that time was 9.3 per 1,000 and remained relatively unchanged through 1987. LBW babies in Arizona accounted for 59% of the infant mortality rate in 1987. The rate of LBW increased 11% between 1982 and 1986. Maricopa County, including metropolitan Phoenix, had the highest rate (Caldwell & Zipsnis, 1988). The LBW rate for Arizona in 1990 was 7.8% (Gersten & Mrela, 1992).

Need For Further Research

The problem of determining the risk factors and antecedents of low birth weight is very complicated. The causes are multifactorial, interact in complex ways (Michielutte, 1992), and require sophisticated statistical analyses. Frequently, significant factors have been left out or only a small amount of the birthweight variance

explained.

Gaziano, Freeman, and Allen (1981) were able to correctly classify 73.5% LBW babies using a prenatal risk assessment tool that identified age, maternal height and weight, perception of own parenting, uterine anomalies, bleeding, multiple gestation, and prior LBW or preterm history as pertinent factors.

Chenoweth, Esler, Chang, Keeping, and Morrison (1983) conducted a path analysis of variables leading to preterm labor. However, there were limitations in this study. The study was retrospective and did not examine the significant factors of social class, drug abuse, smoking, nutritional status, and stress. In addition, data were grouped into categories and binomial forms not appropriate for regression and path analytic techniques.

Cnattingius, Axelsson, Eklund, and Lindmark (1984) could account for only 10% of the variance in birth weight for gestational age in their study. The four factors they found having a significant, negative influence on birth weight, were: smoking, previous birth of a LBW infant, low pre-pregnancy weight, and addiction. In contrast, Metcalf, Sandstead, and Bidwell (1984) were able to explain 34% of the variance in LBW in their study. They identified nutritional status and smoking as the significant factors.

Kramer (1987) conducted a meta analysis of the English and European literature and identified 43 well

established, causal impacts on intrauterine growth. In developed countries, these factors, in order of importance, were: smoking, low calorie intake or weight gain, low pre-pregnancy weight, primiparity, female sex of the baby, short stature, race, and maternal LBW or prior history of a LBW infant.

Michielutte et al. (1992) also identified some of the same factors as being related to LBW. The factors of interest that they identified were: age, race, primiparity, smoking, previous LBW, and maternal weight under 100 lbs.

In summary, there have been numerous attempts, with varied methodologies, to determine the antecedent and mediating factors affecting low birth weight babies. However, few studies have included psychosocial factors along with the physiological factors. Most of the studies in the literature have been done by physicians with a medical perspective. There has been no broad-based nursing approach that has as the ultimate focus, prevention and education.

Purpose of the Study

A better understanding of the antecedents and mediating processes of a well-grown newborn will provide a more complete picture of the variables that may contribute to low birth weight. Therefore, the purpose of this study was to examine the effect of pre-pregnancy health status,

prenatal care, stress, negative lifestyle practices, nutritional status during pregnancy, and placental perfusion on the outcome of the well-grownness of the newborn in five time orderings and to examine the interaction of these variables on each other at each time ordering. In this way, the problem of low birth weight can be better examined.

Theoretical Framework

The theoretical framework for this study was a physiologic one centering on the placenta. It is the placenta that is the major mediating force for the growth of the fetus. There are antecedent and mediating forces that affect the placenta and subsequently affect the birth weight of the newborn.

Placental Physiology

The placenta has 15 to 20 subdivisions called cotyledons (Langman, 1981). These cotyledons are finger like projections into the myometrium of the uterus. The area among these projections is called the intervillous space. This space serves as the depot from which materials are transferred actively or passively through the chorionic epithelium to the fetal cells. During the third trimester, only one layer separates the maternal and fetal blood streams (Spence & Mason, 1987). Maternal blood, rich in oxygen and nutrients, spurts from the spiral uterine arteries into the intervillous spaces. These spurts are produced by the maternal blood pressure.

This spurt of blood is directed outwards into the chorionic villi spaces, then, as the blood loses pressure, it falls downwards, bathing the fetal arteriole and so entering the fetal circulation by way of the umbilical cord.

The maternal blood is then drained into the maternal venules and uterine and pelvic veins. Fetal blood flows through two umbilical arteries to the capillaries of the villus and back through the vein into the fetus (Dilts, 1981).

The maternal blood flow through the placenta is critical to fetal development in two ways. The volume of the blood must be at a level that adequately fills the intervillous space. This maternal flow can be affected by blood pressure and nutritional status during pregnancy.

In addition, the components of the maternal blood flow are important. There must be adequate nutrients and oxygen for fetal growth. Noxious elements, such as smoking, must also be absent for a well-grown infant.

Variables Affecting Placental Physiology

There are hints in the medical literature that many traditional variables studied in relation to LBW are actually mediated through the placenta. Gruenberger, Leodolter, and Parschalk (1979), Verma, Tejani, Chatterjee, and Weiss (1980), and Poland, Ager, Olson, and Sokol (1990) have demonstrated linkages of maternal blood pressure to birth weight. Naeye (1981) related

nutritional status as a mediating factor through the placenta and subsequent infant birth weight. Perkins (1981) showed an association of pregnancy hematocrit, a measure of blood volume, and subsequent birth weight. Miller et al. (1993) summarized:

...the medical community actually finds itself on the threshold of an explosion of nutritional issues associated with pregnancy. As these concerns are not only for the progeny but also for the mother, it is essential that the placenta and its multiple capabilities for controlling maternal physiology and pregnancy, for transferring substances and for anchoring the placenta into the endometrium, be considered in evaluating and instituting new therapies for prevention of birth defects, low-birthweight children and maternal disease. (p. 100)

The Proposed Causal Model

Causal modeling is a graphic approach to theory building that can facilitate clearer hypotheses and additional insights (Asher, 1983). Causal modeling or path analysis is a model building, heuristic tool that is focused on the structure and function of relationships.

The term causal is not meant as cause and effect but more as a statement encompassing the probability of relationships, i.e., the likelihood of a change in a second event given a change in a preceding event (Stember, 1986). A model is created that specifies relationships

among variables of interest with arrows that indicate direction and a positive or negative relationship.

The causal model portrays structural equations among the variables. A straight, single headed arrow represents a direct, causal connection between variables. Models in which causation flows in only one direction are called recursive models. Each arrow between latent variables represents a theoretical framework for proposed hypotheses. These structural relationships are called paths which may be direct or indirect. The dependent variables are designated as endogenous. They are the variables that are explained by the other antecedent variables in the model. Exogenous variables are caused by factors outside the model and therefore are not explained (Boyd, Frey, & Aaronson, 1988; Byrne, 1989).

The study used a correlational design with a path analytic model for data analysis. The proposed, overidentified model (see Figure 1) was based on defined relationships with the variables identified for the study.

There were seven variables in the proposed model (see Figure 1). The exogenous variables in Time 1 were pre-pregnancy health status (X1) and prenatal care (X2). Stress (X3) was the endogenous variable for Time 2 and negative lifestyle practices (X4) in Time 3. Nutritional status during pregnancy (X5) and placental perfusion (X6) were variables in Time 4. The variable well-grownness of the newborn (X7) was the outcome variable in Time 5.

Figure 1. Original Proposed Model

Theoretical Definitions

Pre-pregnancy Health Status

Pre-pregnancy health status was defined as the physical health resources with which the mother starts the pregnancy. It was created as a composite variable comprised of three selected indicators. These indicators were: (1) the mother's height; (2) pre-pregnancy weight status; and (3) gravida/parity status. The mother's pre-pregnancy weight ("How much did you weigh RIGHT BEFORE you got pregnant?") and height was obtained by self report from the Data Profile Sheet (question #10 and #12) in Appendix E. Gravida status was defined as the number of pregnancies that reached viability (24 weeks) and parity status was defined as the number of children born alive. This information was recorded on the Admission Status Record (Appendix D), Section IIB Previous Pregnancy Outcome, by the admitting resident.

Prenatal Care

Prenatal care was defined as the medical supervision of the pregnancy and was measured by the number of visits completed prior to delivery. This number was determined by the admitting resident from the prenatal record and recorded on the Admission Status Record.

Stress

Stress was defined as the emotional upheaval experienced during pregnancy and was created as a composite variable comprised of four indicators:

(1) pregnancy botheredness score; (2) abuse/battering score; (3) life events stress score; and (4) social support score. The pregnancy botheredness score was obtained from the subscale of the Kruse Body Image in Pregnancy Scale (1989) and was defined as the degree of bother the pregnant woman experienced with her mirror image reflected back to her by her significant other, family, friends and society. The scale is found in Appendix D.

The abuse/battering indicator was derived from question #25 that dealt with physical and emotional abuse and is found in the Data Profile Sheet (Appendix D). These questions examined whether the pregnant woman was in a relationship with a man who: (1) threatened to hurt her; (2) hit, slapped or kicked her; (3) physically hurt her; (4) hurt her before she became pregnant; (5) had increased hurting her since she became pregnant; and (6) used harsh words, was cruel or sarcastic.

Life events stress was defined as the score obtained from the modified life events stress scale found in Appendix D. The social support indicator was defined as the score from the Brown (1986) Shortened Social Support Inventory found in Appendix D.

Negative Lifestyle Practices

Negative lifestyle practices was defined as the extent to which the pregnant woman engaged in negative lifestyle behaviors and was created as a composite

variable comprised of three indicators: smoking, alcohol, and drug use during pregnancy. Smoking was defined as the number of cigarettes smoked in one day. This information was determined by self report on the Data Profile Sheet (Appendix D, question 9). Alcohol use was determined by question #16, "On the average, how many glasses or cans do you drink NOW (per week, per day)?" Drug usage was determined by questions #18 and #19 (Data Profile Sheet, Appendix D). The first question was a check off of drug names and the other was, "On the average how much do you use of the above drugs in one day/week?"

Nutritional Status During Pregnancy

Nutritional status during pregnancy was defined as the nutritional resources of the pregnancy and was created as a composite variable comprised of four indicators: (1) 24 hour calorie intake; (2) 24 hour protein intake; (3) pregnancy weight gain; and (4) admission hemoglobin. Calorie and protein intake was determined by computer analysis from the Food Record found in Appendix D. The subject was instructed to list everything that she had to eat or drink in the last 24 hours, including a breakfast, lunch, dinner, and any snacks. Pregnancy weight gain was determined by computation. The pre-pregnant weight status was determined by question #12 from the Data Profile Sheet (Appendix D) and then subtracted from the admission weight determined by the nurse in labor and delivery. This figure was obtained from the Admission Status Record

(Appendix D). Admission hemoglobin was determined by lab reports found in the mother's chart.

Placental Perfusion

Placental perfusion was defined as the adequacy and quantity of blood flow through the placenta and was created as a composite variable comprised of three indicators: (1) admission systolic blood pressure; (2) admission diastolic blood pressure; and (3) admission hematocrit. Admission blood pressures were determined by the nurse upon admission to the Labor and Delivery Unit and recorded on the Admission Status Record (Appendix D). Admission hematocrit results were found in the mother's chart.

Well-grownness of the Newborn

The well-grownness of the newborn was defined as a descriptive term for a newborn who had reached the potential for growth in the uterus and who had completed the required period of development within the uterus. This was considered a composite variable and was comprised of five indicators: (1) newborn length; (2) newborn weight; (3) neuromuscular maturity; (4) physical maturity; and (5) menstrual gestation.

The newborn length and weight were determined by the nursery nurse within one hour of birth. The measurement for length was in centimeters and the measurement for weight was in grams. This information was recorded on the Ballard Gestational Assessment Sheet (Appendix D). The

subscales of the Ballard Assessment, the neuromuscular maturity scale, and the physical maturity scale are also displayed on this form.

Hypotheses

A total of eight implied direct hypotheses were derived from the causal model in Figure 1. The arrows in the model symbolized direction and the signs (plus or minus) indicated the proposed type of relationship. The direct hypothesis included:

- H1: Pre-Pregnancy health status had a direct, positive effect on nutritional status during pregnancy, stress, and the well-grownness of the newborn.
- H2: Prenatal care had a direct, negative effect on stress and negative lifestyle practices.
- H3: Prenatal care had a direct, positive effect on nutritional status during pregnancy, placental perfusion, and the well-grownness of the newborn.
- H4: Stress had a direct, positive effect on negative lifestyle practices.
- H5: Stress had a direct, negative affect on nutritional status during pregnancy, placental perfusion, and the well-grownness of the newborn.
- H6: Negative lifestyle practices had a direct, negative effect on nutritional status during pregnancy, placental perfusion, and the well-grownness of the newborn.

H7: Nutritional status during pregnancy had a direct, positive effect on placental perfusion and the well-grownness of the newborn.

H8: Placental perfusion had a direct, positive effect on the well-grownness of the newborn.

In addition, complex, indirect hypotheses were explored among the variables and the outcome of the well-grownness of the newborn.

The indirect hypotheses were:

H9: Pre-pregnancy health status and prenatal care affected well-grownness through stress, negative lifestyle practices, nutritional status during pregnancy, and placental perfusion.

H10: Pre-pregnancy health status and prenatal care indirectly affected negative lifestyle practices through stress.

H11: Pre-pregnancy health status and prenatal care indirectly affected nutritional status during pregnancy through stress and negative lifestyle practices.

H12: Pre-pregnancy health status and prenatal care indirectly affected placental perfusion through stress, negative lifestyle practices, and nutritional status during pregnancy.

H13: Stress indirectly affected well-grownness through negative lifestyle practices, nutritional status during pregnancy, and placental perfusion.

H14: Stress indirectly affected nutritional status during pregnancy through negative lifestyle practices.

H15: Stress indirectly affected placental perfusion through negative lifestyle practices and nutritional status during pregnancy.

H16: Negative lifestyle practices indirectly affected well-grownness of the newborn through nutritional status during pregnancy and placental perfusion.

Significance to Nursing

Maternal and community health nurses hold a key to reducing our nation's low birth weight rate and increasing the quality of infants born (well-grownness). They give direct care and are involved in teaching, counseling, and anticipatory guidance. Their nursing interventions may assist in helping to reduce high blood pressure, increase nutritional quality and weight gain in pregnancy, and reduce stress and detrimental lifestyle practices which may directly and indirectly impact the health of the developing fetus (Heins, Nance, McCarthy, & Efrid, 1990).

For example, Piechnik and Corbett (1985) were part of a multidisciplinary team featuring certified-nurse-midwife managed care for pregnant adolescents. Their experimental group had a 9.1% LBW rate compared to the 12.7% for the control group in the study. For pregnant adolescents under age 15, the LBW rate for the nurse managed group was 8.8% compared to 21% for the control group. Therefore,

the discovery of significant paths for the problem of LBW can help mobilize nursing action on behalf of the mother and fetus and improve the well-grownness of their newborns.

CHAPTER II

LITERATURE REVIEW

Introduction

To review the pertinent studies in the literature it is best to place that review within a physiologic framework. This framework has three environments (see Figure 2): (1) the external, pre-pregnancy environment, (2) the maternal environment of the pregnancy, and (3) the fetal environment. The external, pre-pregnancy environment can be influenced by the pre-pregnancy health status of the woman as she becomes pregnant. This may include the number of previous LBW births, the number of times she has been pregnant, and the interval since her last pregnancy. In addition, the weight at which she begins a pregnancy will affect the well-grownness of the subsequent newborn.

The maternal environment of the pregnancy can be influenced by negative lifestyle practices such as smoking, alcohol abuse, and drug abuse. Physical and emotional stress also influence this environment. The prenatal care she receives during the pregnancy will influence that environment as will her nutritional status and the placental perfusion that occurs.

The fetal environment is then affected from the

Figure 2, - Proposed Underlying Framework

maternal environment and from there, the external, pre-pregnancy environment. The fetal environment is most influenced by the maternal environment at the placental/umbilical site.

The variables displayed in Figure 1 were explored as concepts or constructs. In addition, the specific linkages of the proposed model were supported on theoretical grounds from relationships described using empirical studies.

The focus of the literature review, originally, was on the well-grownness of the newborn, i.e., what made a healthy baby. However, the variables of interest were not found in the literature in relation to normal birth weight infants but only for abnormal infants. Therefore, the focus of the literature review was on the study variable concepts and their specific linkages to low birth weight and premature birth. Many studies addressed only parts of the proposed model.

Pre-pregnancy Health Status

Pre-pregnancy health status is a concept that describes the health status of the mother from which the pregnancy is created. The health of the woman prior to conception has an impact on the physical resources that support the subsequent pregnancy. If she has had several infants with no time to replenish her energy and nutrient stores she may be more likely to produce a less well-grown infant. Therefore, her gravida status (number of times

pregnant) and her parity (number of live children at home) will have an impact on her energy reserves. If she begins pregnancy in a malnourished condition, her ability to grow a healthy, well-grown infant may also be impaired.

Pre-pregnancy Weight and Low Birth Weight

There are linkages in the literature between pre-pregnancy health status and the well-grownness of the newborn (birth weight and length of gestation). Hardy and Mellits (1977) found that pre-pregnant weight had a strong association with LBW, with the largest women in their study having the highest mean birth weight. Luke, Hawkins, and Petrie (1981) found that increased pre-gravid weight had a positive correlation with newborn birth weight. Kramer (1987) found, that in developed countries, low pre-pregnancy weight was the third most important factor in the incidence of LBW.

In a study using pre-gravid body mass, Abrams, and Laros (1986) stratified a sample of 2946 women into groups according to their pre-pregnancy weight for height. Their sample was stratified into weight classifications based on the 1959 Metropolitan Life Insurance standards of ideal weight for the woman of medium frame. The classification was a percentage of that standard weight and women were either underweight, of ideal weight, moderately overweight, or very overweight. After adjusting for maternal age, race, parity, weight gain, socioeconomic status, cigarette smoking, and gestational age, the

authors found a highly significant linear relationship between pre-pregnancy weight and birth weight. A one-unit increase of pre-pregnancy weight was associated with a significant 15.9 g increase in birth weight after removing the effects of the co-variables and maternal weight gain.

In contrast, Bhatia, Tyagi, and Handa (1985) calculated a maternal weight for height ratio index and found a significant association with infant birth weight. Naeye (1979) looked at pre-pregnancy weights in his study of weight gain and pregnancy outcome. Each mother's pre-pregnancy weight for height was calculated in percentage of the mean desirable values of the 1959 Metropolitan Life Insurance Tables. Pre-pregnancy weights were from self reports of the mothers in the study. However, Naeye (1981) commented that this height-for-weight standard did not consider whether overweight conditions by the chart were due to obesity or a large frame. In his study, the best perinatal outcomes were determined from the pregnancy weight gain and pre-pregnancy weight status.

In a similar study, Taffel (1986) used the 1980 National Natality and Fetal Mortality Survey, which was a probability sample of all births and fetal deaths that occurred in the United States during the year 1980, in her study. She found that the woman's pre-pregnancy weight affected the birth weight of the infant. She found that a low pre-pregnancy weight combined with a small weight gain was associated with the highest incidence of low birth

weight. This was especially important for women weighing less than 110 lbs. at the start of the pregnancy and gaining less than 16 lbs.

Springer, Bischooping, Sampsel, Mayes, and Peterson (1992) looked at pregnancy nutritional factors, birth weight, and gestation. They found that the mother's pre-pregnancy weight was positively related to length of gestation. Of most concern, however, were the women who were underweight before pregnancy. The length of gestation was reduced 1.82 weeks ($p = -.04$) and birth weight was 457 gs lower ($p = .05$) in underweight mothers compared with average or overweight mothers.

Prenatal Care

Prenatal care is the medical supervision of pregnancy and is considered an important factor in the well-grownness of the newborn. Traditionally prenatal care should begin during the first trimester (before 12 weeks) and number nine visits or more (Kessner, Singer, Kalk, & Schlesinger, 1973). The Kessner Index (1973) is a nominal categorical classification system of prenatal care that is based on number of visits and when care was first initiated. Categories of care are then deemed adequate, intermediate, and inadequate.

Prenatal care can thus be described in terms of rate or number of visits that is translated into the Kessner Index of adequacy of care. Using this definition, in 1985, only 68.2% of all women obtained adequate prenatal

care, 23.9% had an intermediate level of care and 7.9% of all pregnant women had inadequate care. Another important component of prenatal care is the week of pregnancy that it commenced. The earlier prenatal care begins the more time medical interventions can be instituted to correct underlying or identified problems. However, adequacy of prenatal care cannot be described without an indication of when prenatal care began. In 1985, 76.2% of all U. S. infants were born to women who began prenatal care in the first trimester of pregnancy, 18.1% to women who delayed care until the second trimester, 4% to women who delayed care to the third trimester, and 1.7% to women who had no prenatal care at all. More troubling, is that since 1980, there has been an increase in the percentage of mothers who received no prenatal care (Brown, 1989). In Arizona, the rate of LBW babies was highest for mothers with no prenatal care or had under five visits (Caldwell & Zipsnis, 1988). Reasons for delaying or omitting prenatal care include inadequate insurance, inadequate maternity care systems, and lack of coordination of other social services (Brown, 1989). In addition, other social factors influence the decision to seek prenatal care.

Young, McMahon, Bowman, and Thompson (1989) conducted a study of maternal reasons for delayed care and found factors that by themselves, may account for low birth weight. They were (a) smoking during pregnancy, (b) short interconceptual periods (less than 2 years), (c) weight

gains of less than 15 lbs., and (d) under 19 years of age. They also found multiple social problems in this group, such as unemployment, single parenthood, psychological stress, interpersonal conflicts with father of the baby, family crisis, and problems of acceptance of the pregnancy. It is hard to determine if some of these social factors, rather than the number of prenatal visits, have the greatest impact on the well-grownness of the newborn and LBW.

Prenatal Care and LBW

In Kessner's study of birth in New York City in 1968, there was a strong and consistent association between adequacy of care and birth weight. Showstack, Budetti, and Minkler (1984) found an association between adequate prenatal care using the Kessner Index and infant birth weight. They defined adequate prenatal care by the number of visits compared to the length of gestation and month of start of care. They found prenatal care to be associated with an increase of 197 gs in average birth weight. The effect was greater for blacks. The variables of infant's sex, ethnicity, maternal age and education, gravidity, adequate prenatal care, and length of gestation all had significant, independent associations with birth weight. Greenberg (1983) found that women who failed to seek prenatal care had an increased risk of delivery of a LBW infant even after social factors of race and education were considered.

Poland, Ager, Olson, and Sokol (1990) conducted a path analysis, using LISREL, on quality of prenatal care and birth weight. They reported four variables with direct paths to birth weight: (a) month in which pregnancy was suspected, (b) quality of prenatal care, (c) hypertension, and (d) substance abuse which accounted for 13% of the variance. Their key finding was that the type of prenatal care and insurance had a large impact on LBW. However, the study was flawed in many ways. The manifest model, using confirmatory factor analyses to see how well the constructs of prenatal care and birth weight were determined, was not done. The Chi Square Goodness of Fit Index was .04 which is not an indicator of a good fit (Boyd, Frey, & Aaronson, 1988). The data were collected retrospectively on post partum women and these women were all poor and black. The data used were collected at the ordinal level.

Emotional Stress

Emotional stress in pregnancy may have an indirect link to birth weight and/or gestational length. This link may be related to life events that are stressful, battering or abuse during pregnancy, distress related to the physical and emotional changes of the pregnancy itself, and lack of perceived emotional support.

Oakley (1985) proposed that traditional approaches to LBW have been based on a misleading paradigm of pregnancy. This old paradigm ignores both the multifactorial nature

of the causation of LBW and the status of pregnancy as a sociobiological process. In addition, this psychosocial aspect must be studied in the environment of the pregnant woman herself and tools measuring the constructs involved must be created from pregnant women.

Life Events Stress and LBW

Norbeck and Anderson (1989) studied life stress, social support, anxiety, and substance abuse of medically normal, low income women who were white, black and Hispanic. The Revised Life Events Questionnaire was used to measure life stress. However, this tool was not created using pregnant women. Brown's (1986) work seems to indicate that social support is different in pregnancy. Nonetheless, for black women, support from the spouse or partner was the highest predictor of gestational age but accounted for only 9.1% of the variance for gestational age. For the white group, the authors found that high stress, high social support, and their interaction was predicted by smoking or drug use, and drug use was a significant predictor of pregnancy outcome. High social support and its interaction with life stress was also related to pregnancy outcome for the white group. It was speculated that the social networks of the white group may have reinforced negative health practices. But Norbeck and Anderson (1989) did not find significance for life stress and anxiety in predicting pregnancy outcomes. They

suggest that the theoretical model was not valid for this sample.

A study by Newton, Webster, Binu, Maskrey, and Phillips (1979), which incorporated a modified life events inventory, was administered during a four month period to 132 women, three to four days after birth. The sample was then grouped into three categories according to the duration of the pregnancy: (1) term, > 37 weeks; (2) preterm, 33 to 36 weeks; and (3) very preterm, < 33 weeks. The mean life events scores among these groups were then compared. Only 43% of the term mothers experienced any major life events, but 67% of the preterm groups and 84% of the very preterm groups did. The difference in life events means from the term and very preterm group was significant. These results were independent of social class. Nutritional status and cardiovascular status were not addressed. The fact that the data on life events stress was collected retrospectively is also of concern.

Norbeck and Tilden (1983) examined life stress, social support, and the emotional-state variables of anxiety, depression, and self-esteem of pregnant women. Outcomes were categorized as gestation complications, labor/delivery/post-partum complications and infant complications. Gestation complications included diastolic blood pressure over 89 mm on two occasions past the 28th week, hemoglobin less than 11 gs. between 28 and 36 weeks,

and preterm labor. Infant complications included low birth weight, less than 2500 gs.

The authors found that high life stress for the prior year predicted gestation complications and high emotional disequilibrium predicted infant complications. Although the main effects were not significant, the interaction of life stress during pregnancy and tangible support was a significant predictor of each type of complication (gestation complication and infant complication). However, the outcomes of gestation and infant complications were so embedded in the broader categories, it was hard to determine the true effects for the variables of interest for this study.

In 1983, Berkowitz and Kasl looked at exposure to life events during pregnancy and the incidence of preterm birth. Their study groups were pregnant women who spontaneously delivered before 37 weeks and a random, control group that delivered at 37 weeks or after. The Dubowitz Gestational Scale (Dubowitz, Dubowitz, & Goldberg, 1970) was used to measure infant gestation. A 27 item life events scale was used to measure psychological stress related to life changes during pregnancy and was collected during the post-partum stay. White women with a preterm delivery reported higher numbers of life events and expressed a more negative attitude toward the pregnancy than the white women who delivered term infants. However, the possibility exists

that the experience of having a preterm birth may have altered the perception or memory of these respondents.

Picone, Lindsay, Schramm, and Olsen (1982) conducted a retrospective, blind chart review of 500 pregnant women in a WIC (Supplemental Food Program for Women, Infants, and Children) Program. A sample of 84 was selected that were of average pre-pregnant height for weight, reported no drug use and minimal alcohol use, demonstrated normal hemoglobin and blood pressure, had no medical illnesses, had no college education, and began prenatal care before 13 weeks.

Psychological stress was measured using a modified life events scale. Relationships between dietary and stress data were reviewed by multiple, stepwise regression analysis. The low weight gain subjects had more problems with family members, had less acceptance of their pregnancy by family members, and felt less satisfaction with their personal life. Heavy smokers (>30 cigarettes per day) had more problems with family members. Moderate smokers (15-30 cigarettes per day) and heavy smokers also rated their personal lives more poorly. Blacks rated their steady relationships as being better than either whites or Hispanics, and they perceived their lives to have fewer psychological letdowns.

Multiple regression analysis showed stress to be the only significant predictor of both systolic and diastolic blood pressure, although both total weight gain and total

maternal weight at delivery were significantly correlated with diastolic blood pressure. Stress scores were higher in younger women, in those who lived in larger households, or without a husband or male companion. A higher stress score was associated with a lower pregnancy weight gain, and this could not be explained by a lower intake of calories or any other nutrient.

Battering/Abuse and LBW

Battering during pregnancy is a stress that may be perceived in a physical sense and/or an emotional sense. It may take the form of emotional, physical, or sexual abuse and may increase during pregnancy (McFarlane, 1993). Bullock and McFarlane (1989) define battering as a physical assault by a woman's male partner either during or before pregnancy but in the current relationship.

The incidence of physical abuse by a pregnant woman's male partner has been estimated at 10% to 23% (Hillard, 1985; Helton, Anderson, & Snodgrass, 1987). In one sample of 290 women, 36% were battered, threatened, or had responses suggestive of battering (Helton, McFarlane, Snodgrass, & Anderson, 1987). In another sample of 691 women, 17% of physical or sexual abuse was identified (McFarlane, Parker, Soekin, & Bullock, 1992).

The topic of battering and specifically battering during pregnancy is an area of new focus for nursing researchers. There are only two studies that tried to relate battering during pregnancy to infant outcome.

Hillard (1985) screened 742 women during pregnancy by asking at the first prenatal visit, "Has anyone at home hit or tried to hurt you?" Unfortunately, the authors then used the infant outcome measure of Apgar score and found no significant difference in battered and non-battered pregnant women. Apgar scores are notoriously subjective and should never be used except as a gross measure of infant distress.

However, Bullock and McFarlane (1989) reported an association between battering during pregnancy and LBW. They had a sample of 589 women from both private and public hospitals with an incidence of battering of 20%. A woman was considered battered if she said yes to any of the four questions dealing with actual abuse. This was done retrospectively, during the first 24 hours after birth.

They found that the percentage of battered women who gave birth to LBW infants was nearly twice that of non-battered women. But most surprising, the private patients who had been battered were four times more likely to give birth to LBW infants ($p < .001$).

Summary

Psychosocial stress appears to affect the well-grownness of the newborn. Poor relationships with significant others and stressful life events are linked with LBW. It seems possible that stress may affect the fetal environment indirectly through the perfusion of the

placenta and higher maternal blood pressure. Research is needed to further explore these suggestive relationships.

Social Support in Pregnancy

Brown (1986) discussed the problems of "conceptual clarity" in studying the concept of social support. She based her instrument development work on House's (1981) conceptualization of support as emotional, appraisal, informational, and instrumental but failed to find support in her data for this conceptualization in pregnancy. With further analysis of her data, she found that separating perceived support behaviors of partners from others (friends, relatives, and coworkers) was not warranted. She concluded that there was a one-dimensional, dominant construct of support in pregnant women that organizes at the broad level, as the perceived degree of experienced support during pregnancy. This is in contrast to House's (1981) conceptualization. Aaronson and Macnee (1989) studied social support on health behavior during pregnancy using a modified Personal Resources Questionnaire but found that general social support was not a significant factor in the studied health behaviors.

Social Support and LBW

Norbeck and Anderson (1989) studied life stress, social support, anxiety, and substance abuse of medically normal, low income women who were white, black, and Hispanic. The Revised Life Events Questionnaire was used to measure life stress. However, this tool was not

created using pregnant women. Brown's (1986) work seems to indicate that social support is different in pregnancy. Nonetheless, for black women, support from the spouse or partner was the highest predictor of gestational age but accounted for only 9.1% of the variance for gestational age. For the white group, the authors found that high stress, high social support, and their interaction was predicted by smoking or drug use and drug use was a significant predictor of pregnancy outcome. High social support and its interaction with life stress was also related to pregnancy outcome for the white group. It was speculated that the social networks of the white group may have reinforced negative health practices. But Norbeck and Anderson (1989) did not find significance for life stress and anxiety in predicting pregnancy outcomes. They suggest that the theoretical model may not be valid for this sample. The variables in this study of drug use, life stress, social support, race, and income may be better delineated by the author's study.

Body Image in Pregnancy

The pregnant woman exists in an environment that is both internal and external. Body image in pregnancy is experienced internally through many mechanisms that have special meaning during pregnancy. Body image is also experienced externally through the reactions of the husband or significant other, family, and friends. This social support system is also a reflector of the pregnant

woman's change in shape and appearance. Broad social and cultural aspects also impact this experience (Kruse, 1989).

There have been no studies that link body image in pregnancy to nutritional studies and infant outcome. However, one could speculate that a negative body image could impact the perceived social support and be viewed as stressful.

Negative Life Style Practices

An additional impact on the growth of the fetus is the effect of negative life style practices either directly on placental perfusion, directly on fetal tissues, or indirectly through nutritional status. The three life style practices that have been most often linked to birth weight and gestational age are smoking, alcohol, and recreational drug abuse in pregnancy.

Smoking

Smoking during pregnancy, despite media campaigns to the contrary, continues. Williams, Serdule, Kendrick, and Binkin (1989) looked at cross-sectional data from 26 states for the prevalence of self-reported smoking among pregnant and non-pregnant women. Overall, pregnant women were 70% as likely to be current smokers as non-pregnant women. Interestingly, black women showed the largest pregnancy-associated reduction in smoking. Unmarried pregnant, white women were 40% more likely to smoke than their non-pregnant counterparts. Floyd, Zahniser, Gunter,

and Kendrick (1991) reported a prevalence of 25% smoking among pregnant women. In their discussion they noted various studies that attributed 21% to 39% smoking variance in LBW studies.

Tobacco smoke is a complex composition containing hundreds of chemical compounds. Johnston (1981) summarized the possible physiologic effects of smoking during pregnancy on the fetus. Nicotine may produce placental vasoconstriction and/or may accelerate fetal metabolism and thus increase the need for added nutrients. Carbon monoxide may have direct effects on the placenta and also combines with the hemoglobin molecule in the mother, reducing the cells ability to carry oxygen and resulting in chronic fetal hypoxia. Important nutrients such as zinc and amino acids which may help detoxify the cyanide in cigarette smoke may be decreased. Maternal weight gain may be reduced due to an appetite suppressant factor and/or calorie reduction. Smokers may have an impaired immune response which may be associated with increased risk of maternal urinary tract infection which in turn could lead to premature labor. Hormones, such as pitocin, may be released during smoking, which can cause an increase in contractility of uterine smooth muscle and reduction in placental blood flow.

Smoking and LBW

Smoking in pregnancy has a direct, negative relationship to well-grownness of the newborn. There is

controversy as to whether the effect is a direct one on the placenta or one through the decreased nutritional status by appetite suppression.

Another study looked at caloric intake of smokers and birth weights. Haworth, Ellestad-sayed, King, and Dilling (1980) discovered that in all maternal weight categories, infants of smokers were lighter than those of non-smokers. Calorie intake was not related to newborn weight. The authors concluded that a simple nutritional cause for growth retardation in infants of smoking mothers is unlikely, because the smokers in this study had similar or increased caloric intake compared to non-smokers.

Luke, Hawkins, and Petrie (1981) studied pregnant women who smoked 10 to 20 cigarettes per day. Infants born to these mothers fell behind their non-smoking counterparts by a whole weight category. Picone, Lindsay, Schramm, and Olsen (1982) found that the pregnant smokers in their study consumed more calories than the non-smokers but still had infants with reduced birth weights.

Johnston (1981) summarized the known effects of smoking on perinatal outcome. Smoker's babies weighed, on the average, 170 to 200 gs less than non-smoker's babies, and about twice as many babies of smokers weighed less than 2,500 gs at birth. There is also a significant dose-response relationship with an 8-9 gs decrease for each cigarette smoked daily.

Interestingly, Wen et al. (1990) found relationships between smoking, growth retardation, and maternal age. Smoking was associated with a five fold increased risk of growth retardation in women older than 35 but less than a two fold increased risk in women younger than 17. Smoking reduced birth weight by 135 gs in younger women but by 301 gs in women older than 35. Smoking in older women was also associated with more instances of preterm delivery and a lower mean gestational age when compared to women 25 or younger.

Alcohol Abuse and Low Birth Weight

Alcohol use during pregnancy has also been linked to growth retardation and prematurity. Ethanol has far ranging physical and biochemical effects, including inhibition of protein synthesis and interference with fatty acid and prostaglandin metabolism. Acetaldehyde, a metabolite of alcohol, is a known mutagen and is also capable of altering placental transport of nutrients. Protein-calorie malnutrition or deficiencies in specific nutrients and vitamins due to malabsorption may also be contributing factors in the effects of alcohol on the fetus (Jessup & Green, 1987).

However, current studies have not explored the importance of the timing of exposure, actual amount ingested, type of beverage (beer, wine, or mixed drinks), and the practice of binge drinking on the well-grownness of the newborn. Also methodological problems with sample

size, reduction of data to categorical levels before data analysis, and lack of control for other possible intervening factors exist in many reports. Nevertheless, there are studies that link alcohol ingestion to the outcomes of birth weight and gestation.

Wright et al. (1983) observed effects of alcohol ingestion during pregnancy on birth weight among smokers and non-smokers. They found an alcohol effect, independent of smoking on intrauterine growth and even suggested that the effect of alcohol may be increased in smokers.

Mills, Graubard, Harley, Rhoads, and Berendes (1984) conducted a prospective study of over 31,000 pregnancies and found that the percentage of newborns that were born too small increased sharply with increasing alcohol intake. When controlling for other factors, a reduction of mean birth weight ranged from 15 gs for those drinking less than one drink per day to 165 gs in those drinking three to five drinks each day.

Recreational Drugs and Low Birth Weight

Recreational or street drugs also impact the developing fetus. There are linkages from cocaine, heroin, and marijuana abuse to the birth weight and gestation of the newborn.

Cherukuri, Minkoff, Feldman, Parekh, and Glass (1988) found that 4% of women delivering in a New York hospital for a four month period tested positive for cocaine.

Chasnoff, Burns, Schnoll, and Burns (1985) report that in some parts of the country one out of ten pregnant women is a cocaine abuser.

Crack (alkaloidal cocaine) delivers a large quantity of cocaine to the vascular bed of the lungs, producing an effect similar to an intravenous injection. During pregnancy, uterine blood vessels supply oxygen and nutrients to the developing fetus, are maximally dilated but readily vasoconstrict in the presence of cocaine. Cocaine abuse causes vasoconstriction, acute maternal hypertension, uterine contractions, and placental vasoconstriction (Chasnoff et al., 1985).

In 1988, Cherukuri et al. studied crack use and pregnancy outcome with a retrospective, matched cohort study of 55 women who admitted to crack use during pregnancy and 55 non-drug using women who delivered during the same period. The groups were matched for age, parity, socioeconomic status, alcohol use and presence or absence of prenatal care. A significantly larger number of women using crack delivered at 37 weeks or earlier. Crack exposed infants were more likely to be of LBW. Sixty percent of the crack using mothers received no prenatal care, and 92% of each matched group was black.

Chouteau, Namerow, and Leppert (1988) conducted a retrospective study of women who had no prenatal care and delivered in 1986. Information about drug use was obtained by toxicology from urine samples taken at the

time of admission to labor and delivery. More than one-half of these pregnancies were to black women. They found cocaine abuse to be a significant predictor of LBW and early gestational age.

Zuckerman et al. (1989) conducted a study on marijuana and cocaine use in pregnancy and infant outcome. The use of marijuana resulted in a 79 g decrease in birth weight and a .5 cm decrease in body length. Pregnant women who used cocaine had infants with a 93 g decrease in birth weight, a .7 cm decrease in length, and a .43 cm smaller head circumference. All differences were significant. However, Chasnoff (1985) did not find effects of cocaine use on gestation, birth weight, length, or head circumference.

Bingol, Fuchs, Diaz, and Stone (1987) also found reduced birth weight and reduced head circumference with cocaine use. Heroin use has also been implicated in babies born too small to their drug-abusing mothers (Kandall, Albin, Lowinson, Berle, Eidelman, & Gartner, 1976; Sussman, 1963).

Summary

Research supports the fact that smoking, alcohol, and recreational drug abuse by the pregnant woman affects the fetal environment through the placenta. The effects of these noxious substances or their by-products may directly affect the developing fetus or indirectly, by reducing the

blood flow through the placenta or by increasing maternal blood pressure.

Nutritional Status During Pregnancy

Nutritional status during the third trimester of pregnancy is a multidimensional construct. Even though there is a large body of literature about nutrition in pregnancy and the outcomes of birth weight and gestational age, many investigators have tried to simplify this broad concept by using unitary and questionable measures (Aaronson & Macnee, 1989). For instance, weight gain in pregnancy is used as an indicator of nutritional status but this weight gain may be the result of poor food choices such as excessive, empty calories rather than high quality food. The concept must have several measures to adequately determine nutritional status. Methodological and design problems of studies looking at nutritional status during pregnancy and birth outcome, have been reviewed by Worthington-Roberts (1987).

Weight Gain, Protein/Calorie Intake, and Low Birth Weight

Gaziano, Freeman, and Allen (1981) found eight discriminating variables in a study of prenatal factors and LBW. They used discriminant analysis to predict memberships in groups so they could create a set of risk predictors identifiable at 24 weeks. Using the resulting equation, 80% of the women having LBW babies were accurately classified as to category. The variables were classified into three groups: (1) maternal age and

physical characteristics, (2) social factors, and (3) past and present reproductive performance. Maternal weight gain was one of the critical factors.

Using maternal nutritional variables at mid-pregnancy, Metcalf et al. (1981) tried to predict fetal growth with a study at the University of Oklahoma of 527 pregnant women. Statistically significant correlations occurred between birth weight and maternal total weight gain. Perkins (1981) found that mothers of small babies in his study gained less weight at mid-pregnancy, had higher hematocrits (and less blood volume), lower 24 diet histories of calories and protein intakes and lower protein stores. Maternal weight gain was linearly and significantly related to the birth weight of the infant. However, when looking at growth retardation, the mothers who gained less than 10 lbs. had significantly lower incidences of LBW than those mothers who gained more than 30 lbs. Perkins proposes that unexplained antenatal stress might be responsible for this contradiction, but more likely the quality of the food and the pre-pregnancy weight status were the key factors which they did not examine.

In 1981, Vanden Berg reported findings from the California Child Health and Development Project which looked at the 15,000 women at the Kaiser Foundation Health Plan. He observed that a weekly weight gain during the second half of the pregnancy of less than .5 lb. more than

doubled the likelihood of LBW. White women with pre-pregnancy weights of 110 lbs. or less and an average weight gain of less than .5 lb. after the twentieth week had an incidence of 14% of LBW compared with a 4% incidence for the total group of women.

Williams et al. (1981) studied pregnant, black women in Alabama. They selected 32 pre-eclamptic subjects and 25 control subjects. Nutritionists examined 24 hour food recalls three times during the pregnancy and made home visits to see how the food was prepared. Their results were somewhat surprising at first glance. The infant outcomes were better for the pre-eclamptic patients! The pre-eclamptic average birth weight was 3,204 gs from an average weight gain of 24 lbs. The controls averaged 2,892 gs for birth weight with a weight gain of 19 lbs. The pre-eclamptic women obtained more dietary protein from milk, meat, eggs, and legumes than did the controls. Average intake of protein and essential amino acids was significantly greater for the pre-eclamptics than the controls and was 114% of the RDA compared to the controls' RDA of 107%. Total caloric intake of the controls was greater but was comprised mostly of carbohydrates. The higher quality of food consumed and the higher pregnancy weight gains of the pre-eclamptic women resulted in higher birth weights. Even though the experimental group was labeled pre-eclamptic, the diastolic blood pressure was not above 100 mgm. of Hg.

Picone, Lindsay, Olsen, and Ferris (1982) selected 60 subjects on the basis of weight gain. They were placed in two groups, low weight gain (less than 15 lbs.) or adequate weight gain (more than 15 lbs.). Each weight gain group contained smokers and non-smokers. A highly significant correlation between calorie intake and pregnant weight gain was found. The average calorie intake of the average weight gain group was 2,000 per day which is less than the Recommended Dietary Allowance (RDA) of 2,400. To label these women as having an average weight gain is questionable. Any weight gain of under 25 lbs. is a low weight gain.

Another study on maternal protein was conducted by Zlatnik and Burmeister (1983). They found that the mean protein ratios were correlated with total weight gain in pregnancy, but no statistically significant relationships were found with birth weight. Curiously, daily total calories and protein intakes were significantly correlated by one nutritionist but not the other, which leads one to question the inter-rater reliability of this study. Most of the women in the sample consumed less than the RDA for protein in pregnancy.

Taper, Hayes, Rogers, and Frary (1984) also found that total weight gain during pregnancy was related to birth weight for 120 mother/infant pairs. Abrams and Laros (1986) studied the effects of maternal weight gain on birth weight of 2,946 births with delivery after 37

weeks gestation. Their sample was stratified into four categories according to pre-pregnancy height and weight. Multiple regression analysis, controlled for selected covariables, was carried out on the entire sample and then on the categories. Weight gain in pregnancy was highly significant for birth weight after removing the effects of age, race, parity, socioeconomic status, cigarette smoking, gestational age, and pre-pregnancy body mass. All the variables studied explained 24% of the variance in birth weight with maternal weight gain explaining 4.6% of this variation. The maternal weight gain on birth weight was statistically significant for the underweight, ideal, and moderately overweight women.

In 1986 Taffel reported on the 1980 National Natality and Fetal Mortality Survey conducted by the National Center for Health Statistics. This was a probability sample of all the births and fetal deaths of 28 weeks or more occurring in the United States in the year 1980. One out of five white women gained less than 21 lbs. Women who gained less than 21 lbs. were 2.3 times as likely to bear LBW babies and had a fetal death rate of 1.5 times those who gained more.

Worthington-Roberts (1987), when summarizing the weight gain during pregnancy and pre-pregnancy weight status variables, indicated that both are directly related to birth weight. She feels that these factors are independent. When they vary in the same direction, the

effects of these factors are additive, but when they vary in the opposite direction, their effects tend to counter-balance each other. Thus, the combination of a high pre-pregnancy weight and a large weight gain during pregnancy tends to produce large infants. But, thin mothers with a small weight gain during pregnancy usually have small infants.

Springer, Bischooping, Sampsel, Mayes, and Peterson (1992) looked not only at pregnancy weight gain and subsequent infant birth weights but also at the pattern of weight gain during pregnancy. The weight gain at mid-point (20 weeks) was positively related to birth weight and gestation. A ten lb. increase in weight gain was associated with a 201 g increase in birth weight.

Food Supplementation and Low Birth Weight

There is extensive literature on calorie and protein supplementation during pregnancy and infant outcome.

Rush, Stein, and Susser (1980) conducted a controversial, randomized supplementation project in New York City and stated their concern about the effects of excessive protein intake in pregnancy. The study was conducted for five years with 250 women in three treatment groups: supplementation, complementation, and control. With balanced protein-calorie supplementation, length of gestation was increased, the proportion of low birth weight infants reduced, and mean birth weights were raised by 41 gs (but was not significant). Interestingly, they

found that with a high protein supplementation, there was an increase in very early premature births, growth retardation, and neonatal deaths. However, there was no logical reason given for this unexpected result.

However, there are disturbing, unexplained aspects of this study. All three groups had protein intakes of 74 to 100 gs per day. That the control group, with no supplementation, also had such a high intake of protein is highly unlikely, yet the authors have no explanation. Weight gain for the entire sample was very similar and is also surprising. In addition, the authors admit that for six months of the study the riboflavin markers were inadvertently not included in the experimental beverage.

Lechtig (1982) reviewed this study and suggested that the problem of low birth weight in this population may not be due to protein-calories malnutrition but to other variables such as short birth intervals, young age, high parity, and smoking. Other nutritional supplementation intervention studies with women suffering from protein-calorie malnutrition, whether acute or chronic, may indicate that food supplementation and increased quality of the mother's nutritional status, may indeed improve birth weight and decrease incidence of LBW infants. Worthington-Roberts (1987) makes the unfounded assumption that protein is abundant in North American diets and that concern about inadequate intake during pregnancy is unjustified.

Hemoglobin and Low Birth Weight

During pregnancy, blood volume increases approximately 1,500 ml. The red blood cell (RBC) production is also increased. The amount of the increase, however, is dependent on the amount of iron available. Abnormal values in the second and third trimester, when the major volume increases occur, are 10 g/dl or less for hemoglobin or 35% or less when measuring hematocrit. The hematocrit and hemoglobin values may indicate the status of the circulating blood volume to the placenta and fetus and also may be an additional nutritional marker for iron status (Sherwin, Scoloveno, & Weingarten, 1991).

For example, Kaltreider and Johnson (1976) studied the incidence of LBW delivery in relation to the lowest record of hemoglobin level during pregnancy. They found that the incidence of LBW was significantly higher in a group of women with hemoglobin levels less than 9 g/dl. Garn, Ridella, Petzold, and Falkner (1981) found in the National Collaborative Perinatal Project that the incidence of LBW was significantly greater for infants whose mothers had hemoglobin values of 10 g/dl or lower.

Summary

The literature shows a linkage with weight gain in pregnancy, protein and calories intake, hemoglobin, and the well-grownness of the newborn. There are additional associations with pregnancy weight gain that may have an

impact on the nutritional status of the mother during pregnancy.

Placental Perfusion and LBW

Placental Physiology and Maternal Blood Volume

The key connection between fetal and maternal environments is at the placenta (see Figure 1). The placenta must be bathed with an adequate maternal blood volume to meet fetal needs (Goodlin, Dobry, Anderson, Woods, & Quaife, 1983). Any factor that impedes or reduces blood flow through the placenta will have an effect on the well-grownness of the developing fetus. The actual blood volume and maternal blood pressure are the major factors in determining adequate placental perfusion.

The term "placenta" was derived from the Greek "plakous" meaning a flat cake. Aristotle viewed the placental function much like that of a tree (with a similar root system) that nourished the growing fetus. Magendie first showed that placental transfer of substances actually occurred by injecting camphor into a beagle dam and detecting the characteristic aroma in the blood of the delivered puppies. We now know that the placenta acts not only as a organ of transfer but also as a significant producer of a variety of important steroids, growth factors, and other substances for both the mother and developing fetus (Philipps, 1992).

The placenta has 15 to 20 subdivisions called 2cotyledons (Langman, 1981). These cotyledons (see

Figure 1) are finger like projections into the myometrium of the uterus. The area among these projections is called the intervillous space. This space serves as the depot from which materials are transferred actively or passively. During the third trimester, only one layer separates the maternal and fetal blood streams (Spence & Mason, 1987).

Maternal blood, rich in oxygen and nutrients, spurts from the spiral uterine arteries into the intervillous spaces. These spurts are produced by the maternal blood pressure. This spurt of blood is directed outwards into the chorionic villi spaces, then, as the blood loses pressure, it falls downwards, bathing the fetal arteriole. The maternal blood is then drained into the maternal venules and uterine and pelvic veins. Fetal blood flows through two umbilical arteries to the capillaries of the villus and back through the vein into the fetus (Dilts, 1981).

The maternal blood flow through the placenta is critical to fetal development in two ways. The volume of the blood must be at a level that adequately fills the chorionic space. This maternal flow can be affected by blood pressure and nutritional status during pregnancy. In addition, the components of the maternal blood flow are important. There must be adequate nutrients and oxygen for fetal growth. Noxious elements, such as smoking, alcohol, and drugs, must be absent.

Placental Perfusion and Maternal Blood Pressure

Gruenberger, Leodolter, and Parschalk (1979) found placental perfusion much lower with maternal blood pressure of 110/65 and below, than with higher pressures. In this experimental study, they increased blood pressure and placental blood flow in hypotensive pregnant patients by administering deoxycorticosterone. Average birth weight at term in this treated group was 3,308 gs compared to 2,860 gs in the untreated group, which was a significant difference.

A study conducted by Verma, Tejani, Chatterjie, and Weiss (1980) also supported this concept. They evaluated a screening test for hypertension in pregnancy to predict small-for-gestational-age newborns. They found that inadequate weight gain during pregnancy accounted for 25% of the variance for small-for-gestational-age newborns; but when the women with positive screening test scores (indicating latent hypertension) were added, 71.4% of the small-for-gestational-age babies were accounted for with their model.

Nutrition is also important. In contrast, Naeye (1981) supports the theory that the effects of maternal nutrition on fetal growth is mediated through placental perfusion. When data were examined from the Collaborative Perinatal Study, it was found that the white women's peak diastolic blood pressure increased with both pregravid weight and net pregnancy weight gain. In white women, the

relative fetal undergrowth associated with low maternal pregravid weight and low net pregnancy weight gain progressively disappeared as maternal diastolic blood pressure increased to a level of 90-99 mm Hg. Birth weight decreased only when peak diastolic pressure exceeded 99 mm. Hg. This raises the possibility that many of the fetal growth effects previously attributed to nutrition alone are mediated through maternal blood pressure and placental perfusion.

One intriguing study (Rofe' & Goldberg, 1983) looked at 5,800 pregnant Israeli women from three different communities that had varied levels of terrorist activity/war status. The investigators categorized the three environments as: high stress, medium stress, and low stress. By means of ANOVA, the independent variables of war status and stress environment were related to the blood pressure value taken at admission for labor and birth. Environmental stress and war status had a highly significant main effect for both systolic and diastolic pressures. Examining admission diastolic blood pressure, women from the low stress area had a higher percentage of subjects with low blood pressure with only 20% having high blood pressure, while in the high stress area, a relatively lower percentage of subjects had low blood pressure and a higher percentage had high blood pressure ($p < .001$). This demonstrates a possible linkage between environmental stress and placental perfusion as measured by blood pressure. This link then has possible

indirect implications for birth weight and gestational length.

Brar, Medearis, DeVore, and Platt (1989) also found support for blood pressure as an indirect measure of placental perfusion related to birth weight outcomes. In this study, ultrasound was used to measure maternal and fetal blood flow velocity waveforms. These were translated into a systolic/diastolic ratio. The sample was made up of 92 women admitted for preterm labor. There was a significant relationship between abnormal systolic/diastolic ratios and low birth weight.

Placental Perfusion and Hematocrit

Perkins (1981) found that mothers of small babies had higher hematocrits and thus less blood volume than mothers who had normal weight babies. Garn, Ridella, Petzold, and Faulkner (1981) conducted a chart review of hemoglobin and hematocrit levels during pregnancy and subsequent outcomes from the National Collaborative Perinatal Project (50,000 pregnancies). They found a curvilinear relationship between hematocrit and unfavorable pregnancy outcomes (prematurity and low birth weight). Values below 27% and above 41% had reduced favorable pregnancy outcomes. They speculated that failures in adequate plasma volume for pregnancy was responsible for the women with the lower and higher abnormal hematocrit values.

In a more recent study, Blankson, Goldenberg, Cutter, and Cliver (1993) found that high levels of maternal

hematocrits (≥ 40 mgm %) were significantly associated with intrauterine growth retardation. However, they looked at hematocrit levels of pregnant women at 31 to 34 weeks not at admission into labor and delivery. This finding does lend support to the theory that high hematocrits (which mean not enough maternal blood volume) are related to smaller babies.

Socioeconomic Factors

Socioeconomic status is described as a multidimensional construct usually composed of occupation, education, and family income. In social stratification theory the factors of race, age, and ethnic status are associated with socioeconomic status rather than as components of the construct itself (Powers, 1982).

Socioeconomic factors have traditionally been controlled in sampling designs. However, in the voluminous research on LBW, socioeconomic factors have been implicated as having significant, direct effects on LBW or having effects through intervening variables. The demographic variables in question are: race, ethnic status, age, educational attainment, and income levels.

Race/Ethnic Status and LBW

In 1986, the U.S. LBW rate for whites was 56 births per 1,000 and the rate for blacks was 125. In Arizona in 1987, the LBW rate for whites was 63.5, the black rate 129.8, and the Hispanic rate 61.6 (Caldwell & Zipsnis, 1988). The fact that the LBW rate is double for black

women at the national and many local levels has intrigued many researchers.

Garn, Shaw, and McCabe (1977) studied 45,000 live singleton births and three population groups: black, Hispanic, and white. They examined educational level, categories, per capita income categories and U.S. Census Bureau categories. Their component socioeconomic variables were not only intercorrelated but were also age dependent. For instance, a low income grouping may include more younger women. Also, in the United States, black women usually have lower income and work in lower status occupations. Poor and uneducated women, both black and white, tend to be fatter while more affluent women tend to be leaner. They looked specifically at prematurity (born too soon). For all three racial groups, income level was significantly related to prematurity. Short gestation lengths were twice as common in Puerto Ricans and blacks than in the white sample.

In Garn's study the prevalence of LBW was higher in blacks than whites and higher in Puerto Ricans than whites in each income group. The prevalence of LBW was highest in blacks at each occupational grouping. The higher the education level, the lower the prevalence of LBW in all three racial groups. The authors concluded that the LBW and apparently shorter gestation length in blacks and Puerto Ricans could not be statistically supported by income, education, or occupation.

Struening et al. (1973) looked at the distribution of LBW over defined geographic areas of New York City and described the characteristics of each of the areas. The six independent variables they identified were overcrowded housing, poverty income, divorce, separation, black status, and Puerto Rican status. Each of these variables demonstrated a substantial relationship with LBW. Collectively they accounted for 84% of the variance of LBW in New York City as a whole, 60% when only white geographic areas were considered, and 71% when only ethnic areas were studied. The black sub-sample had large correlations with the LBW rate in all analyses even when other variables were controlled and remained the largest independent relationship with LBW.

Gould and LeRoy (1988) found that the rate of increase in percentage of LBW in response to the socioeconomic decline of a neighborhood was similar for black and white groups. There was, however, a racial gap of 5% for LBW that remained constant across all income areas.

Another study looked at the intervening variable of smoking and LBW among blacks. Singleton, Harrell, and Kelly (1986) re-evaluated data from six investigations to determine if racial differentials existed in the impact of maternal cigarette smoking during pregnancy on LBW and infant mortality. The risk of mortality was significantly greater for infants of black mothers who smoked than black

mothers who did not smoke but the same relationship was not evident for whites.

Shiono, Klebanoff, Graubard, Berendes, and Rhoads (1986) found that large differences in birth weight among babies of different ethnic groups persist even after controlling for the joint effects of maternal smoking and alcohol use during pregnancy, sex of child, parity, length of prenatal care, and maternal weight for height percentile. Compared with the whites in this study, the mean differences in birth weight was -246 gs for blacks, -210 gs for Asians, -105 gs for Hispanics, and -140 gs for others. These authors looked at the effects of 22 factors related to birth weight and concluded that the usual factors used to control for ethnic differences were not sufficient to explain the racial differences that they observed.

Lieberman, Ryan, Monson, and Schienbaum (1987) studied over 8,000 black and white women to investigate the medical and socioeconomic risk factors that would explain the high incidence of preterm births in black women. Among the medical factors only maternal hematocrit explained the increased rate.

The four economic, demographic, and behavioral predictors that they looked at were age less than 20 years, single marital status, welfare recipient, and not graduated from high school. The number of these risk factors was strongly predictive of premature birth

regardless of the specific factor. When both the maternal hematocrit level and the number of the four socioeconomic indicators were taken into account, essentially all of the racial variation in prematurity was explained. However, Liberman et al. (1987) looked at the very low birth weight (under 1,500 gs) as well as those under 2,500 gs.

Kleinman and Kessel (1987) found a threefold greater likelihood of black women having a preterm infant with LBW, which could not be attributed exclusively to maternal risk factors but was significantly related to race. Murray and Bernfield (1988) looked at prenatal care given in a health maintenance organization. They examined birth weights of black and white infants while controlling for age and education. They found that black mothers used prenatal care less than white mothers, but this use of less prenatal care accounted for less than 15% of the difference in the incidence of low birth weight. The rates of LBW, very low birth weight (VLBW), and preterm births decreased with increasing levels of prenatal care for blacks and whites. The authors concluded that prenatal care was more beneficial for blacks than whites.

Interestingly, Teberg, Settlage, Hodgman, King, and Aguilar (1989) found that the ethnic status of black and Hispanic women also seem to affect LBW. The ethnic status of a woman is described as her nationality, i.e., the country where she was born. The sample consisted of Hispanic women in California, those who were born in

Mexico, and black women. They found that the black women, who had the highest LBW rate, also had more education and more alcohol and drug abuse than the Hispanic mothers. They found by using multivariate analysis that six predictive factors accounted for only 24% of the total LBW variance. Surprisingly, they found good pregnancy outcomes for the immigrant Mexican-Hispanic women. Despite barriers to entry into the health care system and the stress of accommodating to a different society, these women consistently had lower rates of LBW compared to the black women in the study. Williams, Binkin, and Clingman (1986) also compared pregnancy outcomes among U.S. born Hispanic women, Mexican born women having Spanish surnames in California, and black women. The U.S. born Hispanic and black women had similar outcomes. Non-U.S. Hispanics, regardless of national origin, delivered the smallest percentage of LBW babies.

Therefore, a relationship appears to exist between race and LBW, specifically black women and women of ethnic status. The studies discussed have attempted to statistically control for the environmental variables of their pregnant samples. However, none of the studies examined all the variables in the causal model proposed for this study. Nutritional status during pregnancy was a particularly important missing piece. The one factor described from the maternal environment of the proposed

causal model was the maternal hematocrit, which is a measure of blood volume related to placental perfusion.

Income and Education

Social class as a construct has been used in the research literature for a long time. The construct has been operationally defined using occupational status and/or education. Hollingshead (1956) created an index that has been used extensively. However, little is documented of the psychometric properties of his scale. Green (1970) pointed out that racial bias exists in the Hollingshead index, and he created his own index (also with little psychometric information). His listing of occupations is not current with southwestern occupations.

For this proposed study, socioeconomic factors will include the social class determinants of income and education. Research has identified linkages among income, education, and the well-grownness of the newborn, specifically LBW. Greenberg (1983) studied prenatal care, birth weight, and social group. He used vital statistic records for his analysis and dichotomized the variables prenatal care (some or none), race (black or white), and education (below or above 12 years). He found that at each educational level, a greater proportion of black than white women failed to seek prenatal care. Within each racial group, a large proportion of less-educated women failed to seek prenatal care. The racial and educational effects on prenatal care were of the same magnitude. The

author concluded that efficacy of prenatal care is modified by the social situation.

In a high risk area of California, Binsacca, Ellis, Martin, and Petetti (1987) conducted a case-control study of LBW using a multiple logistic regression analysis of 13 variables. The variable labeled financial problems showed a six fold increase in the risk of LBW. This item was not routinely recorded on the medical record. It appeared only if the pregnant woman discussed it with her clinician and if the clinician felt it important enough a problem to note it on the chart. This variable may mean income level or the financial or insurance situation in the family. Possibly there was a lack of money for appropriate food. There was no mention of this in this study of Women, Infant, and Children Supplemental Program (WIC) participation, and one wonders about the role of nutrition in this surprising result.

A British researcher (Joffe, 1989) also looked at the association between birth weight and the mother's current social class as measured in terms of the husband's occupation. A social class gradient was observed in the proportion of LBW deliveries. Joffe also suggested a beneficial effect on LBW by belonging to a higher social class either in early childhood or at marriage. Social class by husband's occupation is readily available in the British National Register, created in 1950. Ounsted and Scott (1982) looked at groups of women who had small-for-

gestation infants, average-for-gestation infants, and large-for-gestation infants. They computed relative risks for women in the lower social classes for having small- and large-for-gestation infants after controlling for smoking, hypertension, age, height, weight, and weight-for-height. They stated that the large contribution of obesity in the lower classes seemed to counterbalance the factors of height, age, and smoking in the upper classes in the large-for-gestation group.

An actual evaluation of the nutritional status in this study could not have been done as it was a retrospective one. Categorizing data into gestational groups may have masked some relationships. The social class designation in this study was also based on husband occupation according to Britain's General Register and was further dichotomized into manual and non-manual workers. Maternal smoking was dichotomized into yes or no and hypertension was either above 140/90 or below. In the statistical analysis, F tests, T tests, and Chi Square were used. Relative risk alternatives were obtained by the linear logit model. These statistical approaches are not appropriate for data that have been reduced to yes/no categories. It is not surprising that the results of this study were confusing and not very helpful. This is an example of pertinent variables not studied and methodological flaws. Further research is needed that addresses these issues appropriately.

Age

Slap and Schwartz (1989) looked at mothers less than 20 years of age who delivered LBW infants and those who did not. They looked at 26 medical and sociodemographic variables in a logistic regression model. Five or fewer prenatal visits accounted for the largest proportion of LBW, but the ability of their proposed model to discriminate between the low and normal birth weight was modest. This study shows not only a relationship to birth weight by the young women but also an example of an interaction effect with prenatal care.

Scholl, Miller, Shearer, Cofskey, Salmon, Vasilenko, and Ances (1988) looked at births to mothers under 19. Births were divided into preterm LBW, term LBW, total preterm, and total LBW. The risk of preterm LBW was increased with those women 15 years or less. They also found that preterm births and total LBW occurred in nearly 25% of young multiparas 15 years or less and 17% of multiparas 18-19 years of age.

The issue of age alone versus the interaction of other effects was addressed by Lee, Ferguson, Cospuz, and Gartner (1988). They looked at Illinois birth certificates of singleton, live births at term (40 weeks gestation) to explore the independent effect of maternal age on the incidence of LBW at term. Race, education, parity, marital status, and prenatal care were separated out. The risk of LBW at term is the highest in young

teen-agers and women of advanced maternal age. The authors speculated that the high incidence of LBW infants to mothers under 17 may be a reflection of other intervening variables. Advancing maternal age may be associated with a possible decreased potential for fetal growth, possibly reflecting biologic aging of maternal tissues and systems or the cumulative effects of disease.

The issue of advanced maternal age and LBW was partially addressed by Friede, Baldwin, Rhodes, Buehler and Straus (1988) when they looked at black and white mothers who gave birth and were 25-49 years of age. The birth weights were used to calculate a risk of infant mortality. They found that the risk of infant mortality was nearly equal for infants born to mothers 25-29 and 30-34 years. Infants born to mothers 35-39 years of age were at a slightly higher risk (18%) but those born to mothers 40-49 years of age had a 69% higher risk. Interestingly, among whites, the higher mortality was due to an increased prevalence of LBW but not among blacks.

Summary

The literature for low birth weight includes linkages or theoretical associations among pre-pregnancy health status, quantity of prenatal care, stress, negative life style practices, nutritional status during pregnancy, and placental perfusion. None of the previous studies reviewed have incorporated all the variables in their design and the variance in low birth weight explained by

the various models has been low. There were varied methodologies used, many using nominal, categorical approaches. The current study attempted to use all of the pertinent variables at interval levels of measurement, using sophisticated statistical analysis to explore the interactions that have the greatest impact of low birth weight and subsequently the well-grownness of the newborn.

CHAPTER III

METHODOLOGY

For this study, a correlational design using path analytic techniques with multiple regression, was developed to provide the conceptual framework for studying the relationships between the proposed variables.

Structural Equations

After the model was visually specified, it was translated into a set of simultaneous, mathematical equations. Each variable can be defined by this mathematical equation (Stember, 1986). The paths between variables were calculated by using multiple regression analysis in which each endogenous variable was regressed on the variables that were prior to it in the specified model. It was assumed that the prior variables had a causal effect as indicated by the arrows in the model. The beta weights (b) were used for the coefficients along the paths of the proposed model (Munro & Page, 1993). In addition, the error term, e , was designated as the source of omitted variables operating in different directions, each with a small effect and each with a possible measurement error component (Asher, 1983).

The pathways of the causal model for this study (see

Figure 1) were structurally represented as:

$$\begin{aligned}
 X_1 &= e_1 \\
 X_2 &= e_2 \\
 X_3 &= b_{31}X_1 + b_{32}X_2 + e_3 \\
 X_4 &= b_{43}X_3 + b_{42}X_2 + e_4 \\
 X_5 &= b_{51}X_1 + b_{52}X_2 + b_{53}X_3 + \\
 &\quad b_{54}X_4 + e_5 \\
 X_6 &= b_{65}X_5 + b_{64}X_4 + b_{63}X_3 + \\
 &\quad b_{62}X_2 + e_6 \\
 X_7 &= b_{76}X_6 + b_{75}X_5 + b_{74}X_4 + \\
 &\quad b_{73}X_3 + b_{71}X_1 + e_7
 \end{aligned}$$

Sample

The convenience sample of pregnant women was obtained from a prenatal clinic in a large city hospital. The selected respondents filled out questionnaires and responded to an interview. Information was also obtained by chart review about the labor and delivery experience and the resulting newborn.

Sampling Criteria

The sampling criteria were:

Antepartum:

1. speaks, understands and reads English
2. 30 weeks gestation as determined by the last menstrual period (LMP) on the antepartum chart
3. no cervical cerclage, history of cervical incompetence, or diethylstilbesterol (DES) exposure

4. no previous cervical, uterine surgical procedure, or uterine anomaly
5. no concurrent medical conditions, i.e. diabetes, heart disease, cancer, or chronic hypertension
6. no multiple pregnancy

After Birth:

7. no newborns with congenital anomalies such as anencephaly

Data Collection Procedure

During the spring of 1991, a formal request was made to conduct the study in the antepartum clinic of a large, southwestern hospital. Permission was obtained from the hospital's nursing research committee and the University of San Diego Committee for the Protection of Human Subjects (see Appendix A). A courtesy presentation of the proposal was made to the medical committee that conducted the clinic.

A research assistant was hired and trained to conduct the pre-natal interviews during clinic times, which were two mornings per week. She attended the clinic for nine months to collect the 160 women willing to participate.

The subject was invited to participate in the study in the clinic waiting room. If she agreed, a private conference room was used for interviews. After the consent forms were signed, the Data Profile Sheet, 24 Hour DINE Food Form, the Brown Shortened Support Behaviors Inventory, the Life Events Stress Scale, and the Kruse

Body Image in Pregnancy Scale were presented (see Appendix D). The materials for each subject were kept in a large manila envelope by the investigator with name and due date on the outside label.

The 24 Hour DINE Food Form was coded by the investigator and entered into the DINE software system to obtain 24 hour calorie and protein intake information. The investigator then examined the delivery logs at the hospital to determine birth date and birth weights of the newborns of the women in the study. This was done by the investigator over a period of approximately one year (July 1991 through August 1992).

Charts of the women (160) and infants (160) were reviewed to gain additional data. This was done by the investigator in the medical records department during the first three months of 1994. Information was copied from the forms in the chart to the same Admission Status Record and the Ballard Gestational Assessment Form found in Appendix D.

Sample Description

The sample was comprised of 160 pregnant women and their subsequent newborns. The sample characteristics are presented in Table 1. The majority of the pregnant women interviewed were white (68%), with Hispanic women representing 23% of the sample. In comparing this distribution with the general population of metropolitan Phoenix, the sample had a higher proportion of Hispanic women. The proportion of whites in the metropolitan

Phoenix area is high (86%), while Hispanics and black account for 10% and 2%, respectively (Inside Metro Phoenix, 1988).

About half of the women had completed high school (47%) and 36% had some years of college. The majority of the sample was in the younger age groups, 18-27 years (80%). Most of the women were born in this country (90%). Surprisingly, the income levels of the family varied a great deal. All income groups were represented with the mean income being \$15,000 to \$20,000.

Instrumentation

A Data Profile Sheet (Appendix D) elicited general demographic information and other data of interest to the study. Mothers' weight for height status was determined by the Metropolitan Height/Weight Charts and the pregnancy weight gain.

In addition, six instruments were selected to measure variables in the study (see Appendix D): (a) the Kruse Body Image in Pregnancy Scale, (b) the Abuse/Battering Scale, (c) the Life Events Stress Scale, (d) Brown's Shortened Social Support Inventory, (e) the DINE analysis of calorie and protein intake, (f) and the Ballard Gestational Assessment Scale.

Data Profile Sheet

The Data Profile Sheet included questions about age, income, education, negative lifestyle practices, nutritional status, and stress.

TABLE 1

Demographics of the Sample

RACE		AGE	
White	109 (68%)	18-22	64 (40%)
Black	8 (5%)	23-27	64 (40%)
Hispanic	37 (23%)	28-32	23 (14%)
Asian	4 (3%)	33-44	9 (6%)
Native American	2 (1%)		
YEARS OF EDUCATION		ETHNIC STATUS (Mother's birthplace)	
less than 12	29 (18%)	United States	139 (90%)
High School	73 (46%)	Mexico	10 (6%)
13-14 years	33 (20%)	China	5 (3%)
15-16	25 (16%)	Other	1 (1%)
INCOME			
\$25,000-49,999	25 (18%)		
20,000-24,999	33 (24%)		
15,000-19,999	17 (12%)		
10,000-14,999	30 (22%)		
5,000- 9,999	14 (10%)		
below \$5,000	19 (14%)		

The Metropolitan Height/Weight Tables

The Metropolitan Height/Weight Tables have been updated since 1959. Included in the new 1983 charts are ranges according to small, medium, and large frame categories. The 1983 tables were derived from combined data from 25 insurance companies that followed more than four million policy holders. A range of weights was determined that were associated with the lowest mortality among the policy holders (Metropolitan Life Insurance Company, 1983; Fear of Fat, 1985).

In this study, the midpoint of the desirable weight range for height for each body frame was calculated for each subject. Then the subject's pre-pregnancy weight status was calculated as a percentage above or below that mean recommended number.

Pregnancy Weight Gain

Pregnancy weight gain was determined by a calculation. The stated pre-pregnancy weight recorded in the Data Profile Sheet (Appendix D), question #12 was subtracted from the admission weight recorded on the Admission Status Record (Appendix D).

Body Image in Pregnancy-Bother Subscale

Body image in pregnancy was measured by the Kruse Scale For Body Image in Pregnancy (Kruse, 1989). The Kruse Scale is a 20 item scale that has two subsets of responses that are reversed for negative responses (starred items), then multiplied and summed for a total

body image score (see Appendix D). The higher the score, the more positive the body image of the pregnant woman. The standardized Cronbach's alpha for this scale is .92 (see Table 2).

The total body image scale did not reveal adequate psychometric statistics. The inter-item correlated mean was only .15, the standardized alpha .78, and the variance explained 56%. However, there were two subscales that were evaluated separately. The bother scale dealt with the 20 body image items but asked the question, "Does this bother you?" The happen scale dealt with the same 20 items but asked the questions, "Does this happen to you?; Do you feel this way?".

The bother subscale was the best psychometrically of these 3 scales and was used as part of the construct of stress. The "botheredness" of these items was felt to contribute to emotional stress of pregnancy. The inter-item correlated mean for this scale was .26, and the standardized alpha was .87. The happen subscale was not usable with an inter-item correlated mean of .11 and a standardized alpha of .71.

Abuse/Battering Scale

Bullock and McFarlane (1989) found an association between physical abuse during pregnancy and LBW. Hillard (1985) developed interview questions and Helton (1987) expanded these slightly. There were no psychometric properties reported. However, these interview questions,

TABLE 2. SUMMARY OF INSTRUMENTATION

CONCEPT	MEASURE	REFERENCE	VALIDITY	ORIGINAL RELIABILITY	STUDY RELIABILITY
Bother	Kruse Body Image In Pregnancy Scale	Kruse, 1989	Factorial	.92 ^a	.87 ^a
Abuse	Item 25a to 25f of Data Profile Sheet	Hillard, 1985 Helton, 1987	Factorial		.84 ^a
Life Events Stress	Modified Life Events Stress Scale	Newton, 1979	Factorial		.78 ^a
Social Support	Shortened Social Support Behaviors Inventory	Brown, 1986	Factorial	.89 ^a	.95 ^a
24 Calorie and Protein Intake	Dine AnalysisSystem	Dennison, et.al, 1983	.85 ^b .83 ^c		
Gestation	Ballard Gestational Assessment Physical Maturity Neuro Muscular Maturity	Ballard, et.al 1979	Factorial		.30 ^a .44 ^a .34 ^a
^a Internal Consistency Coefficient Alpha ^b Content ^c Test-Retest					

slightly modified, were used in the present study and placed in the Data Profile Questionnaire. Five questions were asked and were scored "one" if the respondent indicated a positive response. "Zero" points were assigned if the response was negative. The responses were summed with a higher score indicating a greater likelihood of abuse.

These questions were not part of an official scale so there were no psychometric properties reported in the literature. In this study, the scale of five items had an inter-item correlated mean of .52. The corrected item total correlations ranged from .31 to .84, and the standardized alpha was .84.

Modified Life Events Stress Scale

Life stress was measured using a modification of the Life Events Inventory (LEI) developed by Cochrane and Robertson (1973) and modified for pregnancy by Newton et al. (1979). The LEI was developed from the original Holmes and Rahe (1967) Schedule of Recent Events with the purpose of creating a scale that was more comprehensive, more consistent with the listed events, and weighted from groups more likely to have experiences of the events.

Newton et al. (1979) revised the LEI for pregnancy to 59 items and had pregnant women from two hospitals rank the items. Both groups produced an identical list of 28 items that were considered major life events. However, item reliabilities were not reported. Fourteen of the top

ranked items were used in this study plus two additional items, "You were in contact with someone who had an infectious disease like German measles, which might affect your baby," and "You heard that something you took during pregnancy might be harmful to the baby." The subject first indicated whether the item in question occurred for her during the pregnancy and then rated the amount of distress caused by that item. This was a self-anchoring scale and was scored by summing the ratings of the items that occurred during this pregnancy for a total life events stress score.

The Modified Life Events Stress Scale did not have psychometric information reported in the literature. For this study, the mean inter-item correlation for this 16 item scale was .19 and the standardized alpha was .78. Factor analysis yielded five dimensions with one dimension having an Eigen value of almost 4. This major dimension dealt with financial stress. The three items that loaded on this factor were: "Partner becomes unemployed;" "Income drops by 25%;" and "Getting into debt beyond means to pay back." The total variance explained by factor analysis was 59%.

Shortened Social Support Behaviors Inventory

Brown's Shortened Support Behaviors Inventory (1986) was made up of 11 items that described the degree of satisfaction the pregnant woman had with the support she received. Responses were summed for a total score, with higher scores indicating greater satisfaction. Content

validity was ascertained by a small sample of pregnant couples and a panel of judges. The internal consistency reliability was .89.

The Brown (1986) Inventory had an original internal consistency (alpha) of .89, describing a single dimension of social support from all the people in the pregnant woman's environment (see Table 2). The psychometric results of the scale in the present study (see Table 2) were positive and supported the original work. The mean inter-item correlation was .64, inter-item total correlations ranged from .63 to .82, and the standardized alpha (Cohen's) was .95. Nunnally (1978) recommends that corrected item-total correlations be above .30 and alpha levels, at least .70. The Brown scale for this study met these requirements. Scale homogeneity was also important and has implications for reliability and validity. The higher the inter-item correlations, the more homogenous the scale. In other words, the more the items relate to each other, the more they measure the same attribute (Ferketich, 1991). The inter-item correlations of .63 to .82 indicate scale homogeneity in measuring social support for the pregnant women in the sample.

Factor analysis supported the construct as a unitary one. The items in this scale loaded on one factor that had an Eigen value of 7 and explained 68.7% of the variance of the scale.

The results in this study supported the concept that social support during pregnancy is a unitary construct for pregnant women, not separate for spouse, friends, and co-workers as Brown had originally hypothesized (Brown, 1986). The current study and Brown's work lends support to the practice of using instruments created and normed on this specialized sample (pregnant women). Scales created from psychiatric and student populations are not appropriate for pregnant women.

DINE Nutritional Analysis System

The calorie and protein intake for 24 hours was determined by a 24 hour diet history obtained by interview during the antepartum, waiting room contact. However, the reliability and validity of the 24 hour diet history during pregnancy has not been determined, even though it is used in many nutritional studies. There have been some attempts at reliability determination of the 24 hour diet recall with other populations.

Stunkard and Waxman (1981) reviewed the studies on accuracy of the self-reports of food intake and found a relatively high degree of accuracy. They then conducted a small study of obesity in young boys and found a correlation of $r=.96$ between the self-reports of food intake and the observed intakes. However, Carter, Sharbaugh, and Stapell (1981) conducted a study of recalled and observed calories and protein in chronically

ill children at summer camp. They found large, significant differences.

The 24 hour intake was analyzed using the DINE computer analysis system. The DINE (Diet Inventory of Nutritional Experiences) is a diet recording and analysis system that is also used as an interactive educational system. Content validity for the selected nutrients was $r=.85$ when nutrition experts analyzed sample food choices. Reliability was established by comparing DINE rankings of university students' 24 hour recalls to DINE rankings of the same 24 hour period using food models ($r=.91$), see Table 2. Construct validity ($r=.83$) was determined by interviews with scores assigned to the same diets by nutritionists (Dennison, Frauenheim, & Izu, 1983). The data base of nutrients and food choices contains more than 3,500 items of brand name and generic goods, as well as fast food, ethnic foods, and combination foods (Byrd-Bredbenner & Pelican, 1984).

Ballard Gestational Assessment

Certain external physical characteristics of the newborn which differentiate during the last month of gestation can identify newborns that are preterm or were growth retarded. These external characteristics are (a) creases on the sole of the foot, (b) size of breast nodule, (c) nature of body hair, (d) ear lobe cartilage, and (e) testicular descent and scrotal rugae (Usher, McLean, & Scott, 1966).

Dubowitz, Dubowitz, and Goldberg (1976) first developed a scoring system based on 10 neurologic and 11 external or physical characteristics, including the ones identified by Usher, McLean, and Scott (1966) in a study of 167 newborns.

Ballard, Novak, and Driver (1979) simplified the Dubowitz Scale with a sample of 252 infants. The correlation with the Dubowitz Scale was .969 ($p < 0.00001$). Gestational age was also more highly correlated with the total score than with the subscales of neurologic and physical subscales. The highest correlation with known dates was obtained when the examination was done prior to 42 hours and with a peak reliability of .87 at between 30 and 42 hours of age. No infants were examined prior to six hours of age. Therefore, the reliability of this exam from birth to six hours of age is unknown. (The hospital in the study had a policy of performing the Ballard Gestational Assessment within one hour after the baby was born.)

The Ballard Scale is a gestational assessment of the newborn that is comprised of two subscales, the neuromuscular maturity scale and the physical maturity scale. These subscales are then summed for a total maturity score. This total score is then transformed into a gestational age score (Ballard). The Ballard score was not used for this study as this transformation process is

somewhat arbitrary. The total maturity score and the two subscales were used instead.

However, the total maturity scale was not an appropriate one. The inter-item correlated mean was only .04, the standardized alpha .30, and variance explained 69%. The neuromuscular subscale was a 6 item scale. The inter-item correlated mean was .08, the standardized alpha .34, and the variance explained, 67%. The physical maturity subscale also had 6 items. The inter-item correlated mean was .14, the standardized alpha .44, with 53% of the variance explained.

Birth Weight

Birth weight was determined by the nursery personnel using an electronic scale. Reliability of birth weight is dependent on the type of scale used (Kavanaugh, Meier, & Engstrom, 1989). Electronic scales are designed to integrate infant movement and displays a calculated mean of ten automatic measurements taken in rapid succession. Electronic scales also display weight digitally so no interpretation of the value is required. Kavanaugh et al. found that intra- and inter-rater reliability were significantly higher for the electronic scales than the more traditional mechanical scales. The hospital used for data collection utilized an electronic scale in the nursery.

Data Analysis Using SPSS

Data were entered into the data entry program that is

part of the Statistical Package for the Social Sciences (version 4.0) for the Personal Computer (SPSSPC). Before data analysis was conducted, the data itself was "cleaned" according to the process suggested by Barhyte and Bacon (1985). This "cleaning" process attempts to find any possible error from the data entry process. The first step computed frequencies for all the variables to examine distributions and look for outliers and misaligned data sets. The next step selected a sample of records and examined the entire record for each subject selected. This was similar to a sampling plan for quality control (Barhyte & Bacon, 1985).

Descriptive statistics procedures were run to obtain mean, range, and standard deviations of the variables of interest (see Table 3). Next, correlation procedures were run to examine the bivariate correlations and check for multicollinearity. Extreme multicollinearity was corrected by either creating a new variable which was a composite of intercorrelated variables or by using only one of the intercorrelated variables to present the underlying dimension. For example, hemoglobin and admission hematocrit had a correlation of .975. Therefore, only hematocrit was entered into further analysis.

Regression procedures were run to analyze the effects of the dependent (endogenous) variables in a later time ordering on all the independent variables (endogenous and

TABLE 3

DESCRIPTIVE STATISTICS OF STUDY VARIABLES

Variable	Mean	Std Dev	Min	Max	N
Race	1.64	1.00	1	1	160
Education	12.54	1.93	6	16	160
Income	6.19	1.72	1	9	139
Age	24.24	4.75	18	44	160
Ethnic	1.15	.48	1	4	155
Height	64.46	2.75	59	72	154
Hghtwght %	107.69	25.71	74	217	154
Gravida	2.92	2.47	1	17	157
Smoking	2.72	6.29	0	40	160
Pregnancy Drug Use					3
Alcohol Use in Pregnancy					6
Pg. Wght Gain	35.30	17.15	-6	132	134
Protein Intake	85.04	32.23	23	201	159
Calorie Intake	2152.45	804.67	355	5179	160
Adm. Hemoglobin	11.31	1.31	6.8	13.8	122
Adm Dias.BP	69.90	13.54	40	104	143
Adm Sys. BP	123.79	15.55	90	180	138
Adm. Hematocrit	33.29	3.69	20.8	40.7	122
Birth Weight	3538.22	446.33	2013	4806	160
Length	51.45	2.38	45.6	57.8	129
Mens. Gestation	40.16	1.32	36	43	158
Social Support Scale	51.51	31.40	0	66	154
Life Events Stress	22.26	21.42	1	144	140
Body Image Scale	86.26	21.77	0	171	121
Happen Subscale	53.77	7.49	33	71	125
Bother Subscale	32.21	10.7	0	60	150
Abuse/Battering Scale	.52	.87	0	5	152
Total Maturity Scale	39.84	2.46	32	45	134
Neuromusc. Subscale	21.29	1.64	172	25	133
Physical Mat. Subsc1	18.57	1.87	13	24	134

exogenous). These regression calculations were begun with the earliest dependent variable and concluded with the final outcome variable. The original model was tested using hierarchical, multiple regression techniques. The model was then evaluated using stepwise, multiple regression techniques.

The regression analysis outputs were then examined for beta weights (path coefficients) and their significance level. The amount of variance (adjusted R^2) accounted for by the variables in the equations was determined. The beta weights were then placed on the model with outcomes only significant linkages retained. The new model will be discussed in Chapter V in terms of relationships found compared to the original, proposed model, the similarities and differences with the literature reviewed, and implications for further research.

Statistical Assumptions and Residual Analysis

Before analyzing the proposed relationships, the statistical assumptions of regression analysis were examined. The major assumptions are multicollinearity, normality, homoskedasticity, and linearity (Verran & Ferketich, 1987; Norusis, 1990; Pedhazur & Schmelkin, 1991; Munro & Page, 1993). Residual histograms and scatterplots were created to examine these assumptions.

Multicollinearity

Multicollinearity refers to the interrelatedness

among the independent variables. High multicollinearity may suggest shared variance and have an adverse effect on regression analysis (Pedhazer & Schmelkin, 1991). Munro and Page (1993) suggest multicollinearity at correlations greater than .85. But Gordon (1968) and Braden (1990) suggest the cut off point of .65. This study used the .65 delineation.

Normal Distribution

The assumption of normality refers to the normal distribution of scores for each of the variables of concern. In other words, the scores of the dependent variable should be normally distributed for each score of the independent variables (Norusis, 1990; Munro & Page, 1993). The histogram of standardized residuals for infant birth weight and the independent variables of the study showed a distribution that was normally distributed about the mean.

Homoskedasticity

Homoskedasticity (constant variance) is an assumption that the values of X and the distribution of Y scores must have approximately equal variance (Munro & Page, 1993). If this assumption is not met, significance levels of regression analysis might be in error (Pedhazer & Schmelkin, 1991). Residual analysis showed no data more than three standard deviations from the mean (Munro & Page, 1993).

Linearity

Linearity is an assumption that there is a linear relationship between the dependent variables and the independent variables. If these linear relationships are not present it is not appropriate for regression analysis. There were linear relationships between the variables of interest.

CHAPTER IV

RESULTS

This chapter will discuss data reduction, hypothesis testing, and the fit of the data with the proposed model.

Data Reduction

The first step in data reduction was the examination of the correlation matrix (see Table 4) for multicollinearity. The construct of pre-pregnancy health status retained the indicators of the mothers' pre-pregnancy weight for height, height/weight, and gravida/parity status. None of these indicators were multicollinear. Prenatal care had the single indicator of number of visits but had an insufficient number of responses and was deleted from further analysis.

The four indicators of stress (bother, abuse, life events, and social support) were retained as independent variables since correlations were low. However, the negative life style practice indicators were reduced to a single indicator, smoking. There were insufficient responses to the questions about pregnancy drug and alcohol use to retain these variables. The construct of nutritional status during pregnancy originally had the four indicators of pregnancy: weight gain, protein intake, calorie intake, and admission hemoglobin. When

Table 4
Correlation Matrix

Variables	Hgt/Wgt	Hgt	G/P	Bother	Abuse	Stress	Support	Smoking	PG Wght	Protein	Calories
Height/Weight	1.00	-.056	-.026	.182	.161	.005	-.099	-.036	.047	-.112	-.176*
Height		1.00	-.117	-.032	.134	.010	-.098	.159*	.393**	.189*	.168*
Graulda/Para			1.00	-.081	.113	-.019	.034	.225**	-.048	.065	-.005
Bother				1.00	.127	.186*	-.257**	.034	-.024	.023	.022
Abuse					1.00	.390**	-.256**	.169*	.303**	.022	-.009
Stress						1.00	-.324**	.017	.124	.117	.145
Support							1.00	-.119	-.018	.018	.031
Smoking								1.00	.140	.113	.158*
PG Wght Gain									1.00	.121	.091
Protein										1.00	.818**
Calories											1.00

*p = ≤ .05

**p = ≤ .01

Table 4
Correlation Matrix

Variables	Adm Hgb	Sys BP	Dias	HCT	Leng	Wght	PM	NM	Gest
Height/Weight	.083	.108	-.016	.074	.052	.190*	.009	-.046	.055
Height	.043	.002	.054	.054	.130	.114	-.205*	-.057	.012
Gravida/para	.058	-.216*	.080	.054	-.098	-.041	.117	-.001	-.084
Bother	.228*	.220**	.150	.220*	-.093	.011	.078	-.018	.001
Abuse	.026**	-.041	-.087	.011	-.071	.010	.201*	-.017	.072
Stress	.084	.162	.126	.081	-.072	-.038	.185*	.029	.073
Support	-.013	-.140	-.068	-.024	.180*	.052	-.038	-.020	-.109
Smoking	.018	-.075	-.047	-.007	-.030	-.029	-.031	.025	.028
Pg Wght Gain	.139	.081	.039	.144	.119	.117	.020	-.016	-.035
Protein	-.081	-.066	.024	-.086	-.134	-.139	-.087	-.072	-.009

*p = ≤ .05

**p = ≤ .01

Table 4

Correlation Matrix

Variables	Adm Hgt	Sys BP	Dias	HCT	Leng	Wght	PM	NM	Gest
Calories	-.126	-.028	.021	-.141	-.131	-.137	-.111	-.091	.066
Admit Hgb	1.00	.058	.107	.975***	-.034	-.063	.030	.225*	-.057
Admit Sys BP		1.00**	.693**	.035	-.031	.008	-.050	-.017	-.034
Admit Dias BP			1.00	.104	-.091	-.037	-.077	-.043	-.015
Admit HCT				1.00	-.018	-.059	-.017	.204*	-.077
Length					1.00	.708***	.217*	.138	.120*
Birth Weight						1.00	.150	.118	.231**
Physical Mat							1.00	-.030	.278**
Neurem. Mat								1.00	.209*
Mens Gest									1.00

*p≤ .05

**p≤ .01

Table 4 was examined, multicollinearity ($r=.813$) existed between calorie and protein intake. Theoretically, this would be expected since both are nutritional measures of the same 24 hour nutritional intake. Therefore, protein was dropped in favor of calorie intake. In addition, hemoglobin indicated multicollinearity with hematocrit ($r=.975$) and was dropped from further analysis. As a result, the construct of nutritional status during pregnancy had two indicators left, pregnancy weight gain and calorie intake.

The construct of placental perfusion had three indicators (admission systolic blood pressure, diastolic blood pressure, and hematocrit). There was multicollinearity between the diastolic and systolic blood pressures ($r=.693$). Only hematocrit was retained for later analysis.

The construct of the well-grownness of the newborn had five indicators (newborn length, birth weight, physical maturity score, neuromuscular maturity score, and menstrual gestation). Length and weight were multicollinear ($r=-.708$), and therefore length was dropped from analysis. The construct was then left with four indicators accounting for 3% of the variance.

Regression Analysis

The 14 variables used for the regression analysis were: (1) mother's height (HGHT), (2) mother's weight for height status (HGHTWGHT), (3) gravida/parity status

(GRAV/PAR), (4) life events stress (LIFE), (5) social support (SUPPORT), (6) abuse (ABUSE), (7) bother (BOTHER), (8) smoking (SMOKING), (9) pregnancy weight gain (PGWGHT), (10) calorie intake (CALORIES), (11) admission hematocrit (HCT), (12) infant birth weight (WEIGHT), (13) physical maturity score (PM SCORE), and (14) neuromuscular maturity score (NM SCORE).

Hierarchical blocking of some indicators gave a better fit. Hierarchical blocking, or variance partitioning, is a technique to partition the R^2 of a regression analysis. Instead of entering single variables, blocks of variables are entered and the increment in R^2 due to each block noted (Pedhauser & Schmelkin, 1991).

The three indicators of pre-pregnancy health status, in Time 1 (height, weight for height, and gravida/parity status) were blocked as one entity for a regression analysis in Time 1. Life events stress and social support were blocked as one entity for the regression analysis and became an antecedent variable in Time 1. Bother and abuse were also blocked together.

The variables of length, menstrual gestation, admission diastolic, and systolic blood pressures were not retained when regression analysis was performed (minimum p was set at .05). The remaining variables and their relationships are noted in Figure 3.

Testing of Hypotheses

Prior to proceeding with hypothesis testing, the

decision was made to re-examine the theoretical placement in the model of the independent indicators of the constructs. In accord with basic stress theory, the life stress and support indicators of stress were viewed as environmental antecedents and placed in the first time ordering, along with the independent indicators of pre-pregnancy health status, namely, height/weight, height, and gravida/parity status. The stress indicators of abuse and bother were then conceptualized to represent subsequent stress and were placed in the second time ordering and replaced the original construct, stress. Similarly, while remaining in the third time ordering, the variable of smoking replaced the construct of negative lifestyle practice of which it was an indicator. Likewise, the variable of hematocrit replaced its construct, placental perfusion, while nutritional health status was represented in the corrected model by two indicators, namely, pregnancy weight gain and caloric intake. These variables continued to be in the fourth time ordering. Lastly, instead of a single outcome composite of well-grownness in the fifth time ordering, there were three indicators of this construct, specifically, birth weight and physical and neuromuscular maturity of the newborn.

Figure 3 depicts the corrected theoretical model which was subjected to the regression analysis. Hypothesis testing was limited to these indicators of the

FIGURE 3. Simplified Model with Beta weights and Adjusted R^2 Coefficients

constructs they were expected to form. Therefore, only partial support is noted for most of the hypotheses which are discussed below.

Hypothesis 1 stated that pre-pregnancy health status would have a direct, positive effect on nutritional status during pregnancy, on stress, and on the well-grownness of the newborn. Partial support for this hypothesis was found in that height/weight (pre-pregnancy health status indicator) and a direct and positive effect on abuse (stress indicator) and on birth weight (well-grownness indicator). Similarly, height (pre-pregnancy health status indicator) had a direct, positive effect on physical maturity (well-grownness indicator). Contrary to expectation, neither of these pre-pregnancy health status indicators had any direct effect on the well-grownness indicator of neuromuscular maturity of the newborn. Likewise, the pre-pregnancy health status indicator of gravida/parity did not predict any of the three outcome indicators of well-grownness.

Hypotheses 2 and 3, which predicted the relationship of prenatal care to other variables in the model, were not evaluated due to an inadequate number of responses for this variable.

Hypothesis 4 stated that stress would have a direct, negative effect on lifestyle practices. This hypothesis was not supported as neither of the stress indicators

(i.e., abuse and bother) had a direct effect on smoking, the lifestyle practices indicator.

Hypothesis 5 posited that stress would have a direct negative effect on nutritional status during pregnancy, on placental perfusion, and on the well-grownness of the newborn. Although an effect was noted between abuse (stress indicator) and pregnancy weight gain (nutritional status indicator), between abuse and physical maturity (well-grownness indicator), and between body image bother (stress indicator) and hematocrit (placental perfusion indicator), the effect was direct but positive which was contrary to the negative effect predicted. Therefore, this hypothesis was not supported.

Hypothesis 6 stated that negative lifestyle practices would have a direct, negative effect on nutritional status during pregnancy, on placental perfusion, and on the well-grownness of the newborn. The only direct effect noted was a positive one between smoking (negative lifestyle indicator) and calorie intake (nutritional status). Therefore, this hypothesis was not supported.

Hypothesis 7 noted that nutritional status during pregnancy would have a direct, positive effect on placental perfusion and well-grownness of the newborn. This hypothesis was not supported as no significant relationship was noted between any of the indicators representing the three constructs.

Hypothesis 8 stated that placental perfusion would have a direct, positive effect on the well-grownness of the newborn. This hypothesis was partially supported as hematocrit (placental perfusion indicator) had a direct, positive effect on neuromuscular maturity (well-grownness indicator).

Indirect hypotheses. Since one pre-pregnancy indicator (height/weight) indirectly affected physical and neuromuscular maturity of the newborn (well-grownness indicators) through abuse and bother (stress indicators) respectively, as well as through hematocrit (placental perfusion indicator), hypothesis 9 was partially supported (see Figure 3). Hypothesis 11 was also partially supported in that height and gravida/parity status (pre-pregnancy health status indicators) indirectly affected calorie intake (nutritional status indicator) through smoking (negative lifestyle practices). Likewise, hypotheses 12 and 13 were partially supported in that height/weight (pre-pregnancy health status indicator) and bother (stress) indirectly affected neuromuscular maturity of the newborn (well-grownness) through hematocrit (placental perfusion) respectively. The remaining indirect hypotheses (numbers 10, 14 through 16) were not supported by the data.

Of the various indirect paths proposed, the most salient was that of height/weight, an indicator of pre-

pregnancy health status, through abuse, an indicator of stress, on physical maturity, an indicator of well-grownness. The current study supported the linkages in the literature. The final model in Figure 3 revealed interesting relationships that warrant further discussion, but the R^2 values for the final model for the outcome variables were low.

CHAPTER V

DISCUSSION

This chapter will discuss the results of this study in relation to the literature reviewed, instrumentation, limitations, and implications for further nursing research.

Relationship of Findings to Literature Reviewed

The most disappointing aspect of this study was the lack of newborns with low birth weights in the sample studied. This was unexpected. This clinic population in a large urban city was expected to yield at least some infants with low birth weights. It was expected that low income would describe the population of this clinic. However, there were four types of insurance payers including state supported and charity institutions. The income level reported had a wide range.

The racial mix was mostly white and Mexican-American. The sample was 68% white, 23% Mexican-American, and 5% black. In reviewing Arizona statistics on the racial make-up of the women in the state who have low birth weight babies, it is still clear that the black population is small. In 1985, the mothers who had low birth weight babies were 62% white, 22% Mexican-American, and 7% black. In contrast, in 1990 mothers who had low

birth weight babies were 50% white, 28% Mexican-American, and 7% black (Gersten & Mrela, 1992). Unfortunately, a majority of the low birth weight research reviewed in the literature was done on poor, black women. Perhaps race and social economic status have more to do with low birth weight than the other traditional factors addressed in this study.

Pre-pregnancy Weight for Height Status

One major theme in the literature is that a woman's pre-pregnancy weight status affects the subsequent birth weight of her infant. However, in this study there was only a small correlation, significant at the .05 level. Perhaps the placement on the Metropolitan Chart was not a good measure of nutritional status before the pregnancy commenced. Naeye (1979), Abrams and Laros (1986) used this measure in their studies. In contrast, Bhatia, Tyagi, and Handa (1985) calculated a maternal weight for height index and used that as a measure. Other nutritional indicators that might be used to determine nutritional status are basal metabolic rate determinations or percentage of fat in subcutaneous tissues. In addition, the pre-pregnancy weight for height status in the current study was not related to length of gestation as it was in the study by Springer, Bischooping, Sampsel, Mayes, and Peterson (1992).

Stress

Life events stress was related to abuse but not

to gestation as described by Berkowitz and Kasl (1983) or to low pregnancy weight gain as described by Picone, Lindsay, Schramm, and Olson (1982). In addition, there was no relationship of life stress with admission blood pressures or hematocrit. The new variable, bother, however, did relate to hematocrit, a measure of placental perfusion. Norbeck and Tilden (1983) found stress related to another measure of placental perfusion, diastolic blood pressure. What is needed is a better measure of placental perfusion. Indirect methods, such as placental weight at delivery and cord length, might be more useful.

Abuse was related to the outcome measure of physical maturity, which indirectly supports the work of Bullock and McFarlane (1989). Abuse was also related to pregnancy weight. This is a whole new field of inquiry, that is, the specific effects of physical and emotional abuse on infant outcomes, particularly low birth weight.

Positive social support from others in the pregnant woman's environment has a negative impact on abuse. It would be expected that the woman's partner gave her social support and not abuse. Social support in relation to infant birth weight is also a relatively new field of research. Norbeck and Anderson (1989) have done work in this area but what is needed is a better defined combination of the physiologic and emotional/psychological factors.

The concept of bother, as a descriptor of body image in pregnancy, is also a new concept, particularly in relation to infant birth weight. This study described this concept for the first time and found a relationship with the placental perfusion indicator, hematocrit.

Smoking in the current study was related to calorie intake but not birth weight. This supports the work of Haworth, Ellestad-Sayed, King, and Dilly (1980) who also found no relationship between calorie intake and birth weight but not that of other researchers who noted a dose-related decrease in birth weight in infants of mothers who smoked during pregnancy (see review by Johnston, 1981). One reason why there was no relationship found in this study may be due to the low number of smokers in the sample. The literature described an effect when the pregnant woman smoked more than 10 cigarettes per day. In the sample studied, only 14% (23 women) smoked 10 or more cigarettes. Surprisingly, pregnancy weight gain and calorie intake did not impact infant birth weight. This is a strong thread throughout the literature but not supported here. It is possible once again, that there is a measurement issue involved. The DINE computer analysis system for calories and protein may not be as accurate as assumed.

Hematocrit was related to the neuromuscular maturity of the newborn. This indirectly supports the work of

Perkins (1981) who found a relationship between high hematocrits and low birth weight babies.

Instrumentation

Social support was revealed as a strong, unidimensional scale. This study supported Brown's original work. In addition, there was strong support for this scale in contrast to measures of stress. There were significant negative associations with the bother scale and abuse scale, giving the support scale strong discriminant validity. Therefore, this scale would seem to be a better choice when measuring social support in perinatal research than the scale developed by Aaronsen and Macnee (1989). Their questionnaire was developed from a non-pregnant sample.

Stress

The bother scale and abuse scales are new scales created for this study. Stress related to body image, weight gain, and the perspective of others during pregnancy is a new area for exploration. The degree of "botheredness" with body image items is a form of emotional stress. Abuse/battering during pregnancy is a developing area for nurse researchers. Assessment tools and instrumentation are being developed. There is also an examination of infant outcomes related specifically to abuse during pregnancy and specifically to birth weight. The psychometric properties found for the abuse and bother

scales in this study, make them potential tools for further perinatal research.

Well-grownness of the Newborn

The concept of the well-grownness of the newborn was explored in this study. Further work is needed on gestational assessment scales. In particular, further psychometric exploration of the Ballard Gestational Scale is needed. In addition, inter-rater reliability for this scale in newborn nurseries is a must. Additional work on the composite construct of well-grownness from other infant physical and neurological characteristics needs to be done. Samples that include large numbers of preterm and intrauterine growth retarded newborns must also be included.

Placental Perfusion

This study did find a relationship between the bother stress scale and admission blood pressures. Higher stress raised both systolic and diastolic admission blood pressures. This supports the work done by Rofe' and Goldberg (1983) and Brar, Medearis, DeVore, and Platt (1989). However, in this sample, with no LBW infants, there was no relationship with infant birth weight. The broad construct of placental perfusion and subsequent infant birth weight is relatively new in the literature and should be further explored.

Limitations

Krathwohl (1985) described internal validity as the

linking power (LP) between the measures of the variables under study. Internal validity is also the ability of a study to reduce uncertainty that a relationship exists. External validity or generalizing power (GP) is the extent to which the relationship of a study generalizes beyond the sample. Therefore, the stronger the internal validity, the greater the validity of statements that the relationships proposed as linking the variables are the only appropriate interpretation of the evidence. The greater the external validity (GP), the wider the scope of applicability of the relationships discovered.

Internal Validity Threats

Explanation credibility refers to the credibility of the proposed linkages. Most of the linkages in the proposed model were firmly supported by the research literature and so were initially credible. Other linkages proposed new relationships. The proposed model had translation fidelity which means that the hypotheses flowed from the theoretical framework. However, the measures used may have questionable validity and reliability since the Life Events Scale in particular has been modified for this study (Krathwohl, 1985). The Ballard subscales of physical and neuromuscular maturity did not have high reliabilities and may have threatened internal validity. Reliability in data collection was obtained by having one research assistant conducting the

antepartum interviews and only the investigator examining the delivery logs and additional chart review data.

Krathwohl (1985) also discussed the importance of eliminating the basis for rival explanations. The data collection period took one year, and it is possible that external events (history) occurred and affected later subjects. There may have been a selection bias in who choose to participate since this was not a true random sampling.

External Validity Threats

Translation generality might be threatened. Even though there was a fairly large sample, the sample was a recruited one. Reactive effects may come into play, such as the Hawthorn effect. Generalizability may not be possible as the data analysis will determine only that this model is one explanation for the set of data obtained. For instance, the characteristics of the particular sample obtained for this study may be different if repeated in the same location. The sample studied had unique characteristics that resulted in the absence of low birth weight infants.

Summary

The literature reviewed gave strong support for the variables and proposed causal model. LBW is a complex and inter-related problem. This study and proposed causal model needs to be repeated with a large, random sample. It is still important to use prospective interviews and

pregnancy data and then subsequent evaluation of the newborn. This study would be an appropriate one for a multi-site, multi-investigator funded endeavor.

References

- Aaronson, L. S., & Macnee, C. L. (1989). The relationship between weight gain and nutrition in pregnancy. Nursing Research, 38(4), 223-227.
- Abrams, B. F., & Laros, R. K. (1986). Prepregnancy weight, weight gain, and birth weight. American Journal of Obstetrics and Gynecology, 154, 503-509.
- Abrams, B. (1993). Preventing low birth weight: Does WIC work? Annals of the New York Academy of Science, 678, 306-316.
- Asher, H.B. (1983). Causal modeling. (2nd Ed.). Beverly Hills, California: Sage.
- Ballard, J. L., Novak, K., K. & Driver, M. (1979). A simplified score for assessment of fetal malnutrition of newly born infants. Journal of Pediatrics, 95(5), 769-774.
- Barhyte, D. Y. & Bacon, L. D. (1985). Approaches to cleaning data sets: A technical comment. Nursing Research, 34, 62-64.
- Berkowitz, G. S. & Kasl, S. V. (1983). The role of psychosocial factors in spontaneous preterm delivery. Journal of Psychosomatic Research, 27(4), 283-290.
- Bhatia, B. D., Tyagi, N. K., & Handa, P. (1985). Relationship of low birth weight with anthropometry and maternal weight-height indices. Indian Journal of Medical Research, 82, 374-376.
- Binsacca, D. B., Ellis, J., Martin, D. G., & Petetti, D. (1987). Factors associated with low birth weight in an inner city population: The role of financial problems. American Journal of Public Health, 77(4), 505-506.
- Bingol, N., Fuchs, M., Diaz, V. & Stone, R. K. (1987). Teratogenicity of cocaine in humans. Journal of Pediatrics, 110, 93-06.
- Blankson, M.L., Goldenberg, R.L., Cutter, G. & Cliver, S. (1993). The relationship between maternal hemtocrit and pregnancy outcome: Black and white differences. Journal of the National Medical Association, 85, 130-134.

- Boyd, C. J., Frey, M. A., & Aaronson, L. S. (1988). Structural equation models and nursing research: Part 1. In Florence Downs (Ed.), Handbook of Research Methodology (pp. 97-102). New York: American Journal of Nursing Company.
- Braden, C. J. (1990). A test of the self-help model: Learned response to chronic illness experience. Nursing Research, 39 (11), 42-47.
- Boyd, C. J., Frey, M. A., & Aaronson, L. S. (1988). Structural equation models and nursing research: Part II. In Florence Downs (Ed.), Handbook of Research Methodology (pp.103-108). New York: American Journal of Nursing Company.
- Brar, H.S., Medearis, A. L., DeVore, G. R., & PLatt, L. D. (1989). Maternal and fetal blood flow velocity waveforms in patients with preterm labor: Relationship to outcome. American Journal of Obstetrics & Gynecology, 161, 1519-1522.
- Brown, M. A. (1986). Social support during pregnancy: A unidimensional or multidimensional construct? Nursing Research, 55, 1, 4-9.
- Brown, S. S. (1989). Drawing women into prenatal care. (1989). Family Planning Perspectives, 21, (2), 73-80.
- Bullock, L. F. & McFarlane, J. (1989). The birth- weight/ battering connection. American Journal of Nursing, 1153-1155.
- Byrd-Bredbenner, C. & Pelican, S. (1984). Software program reviews. Journal of Nutrition Education, 16(2), 80-116.
- Byrne, B. M. (1989). A primer of basic applications and programming for LISREL confirmatory factor analytic models. New York: Springer-Verlog.
- Caldwell, G. G. & Zipsnis, K. (1988). Arizona Perinatal Statistics: A Report on Prenatal Care, Low Birth Weight and Infant Mortality. Phoenix, Arizona: Arizona Department of Health Services, Division of Family Health Services.
- Carter, R.L., Sharbaugh, C.O., & Stapell, C.A. (1981). Reliability and validity of the 24 hour recall. Journal of the American Dietetic Association, 75, 542-547.

- Chasnoff, I. J. Burns, W. J. Schnoll, S. H., & Burns, K. (1985). Cocaine use in pregnancy. New England Journal of Medicine, 313, 666-669.
- Chenoweth, J. N., Esler, E. J., Chang, A., Keeping, J. D., & Morrison, J. (1983). Understanding preterm labour: The use of path analysis. Australian/New Zealand Journal of Obstetrics and Gynecology, 23, 199-203.
- Cherukuri, R., Minkoff, H., Feldman, J., Parekh, A. & Glass, L. (1988). A cohort study of alkaloidal cocaine ("crack") use in pregnancy. Obstetrics & Gynecology, 72(2), 147-151.
- Chiles, L. (1988). Death before life: The tragedy of infant mortality. Summary Report (P.L. 99-660). Washington, D.C.: National Commission to Prevent Infant Mortality.
- Chouteau, M., Namerow, P. B., Leppert, P. (1988). Obstetrics & Gynecology, 72(3)1, 351-354.
- Cnattingius, S., Axelsson, O., Eklund, G. & Lindmark, G. (1984). Early pregnancy screening for intrauterine growth retardation. Early Human Development, 10, 45-55.
- Cochrane, R. & Robertson, A. (1973). The life events inventory: A measure of the severity of psycho-social stressors. Journal of Psychosomatic Research, 17, 135-139.
- Dennison, D. Frauenheim, K. A., & Izu, L. (1983). The DINE microcomputer program: An innovative curricular approach. Health Education, 44-46.
- Dilts, P. V. (1981). Placental transfer. Clinical Obstetrics and Gynecology, 24(2) 555-559.
- Dubowitz, L. M., Dubowitz, V. & Goldberg, C. (1970). Clinical assessment of gestational age in the newborn infant. Journal of Pediatrics, 77(1), 1-10.
- Fear of fat: The medical evidence. (1985, August). Consumer Reports, 456.
- Ferketich, S. (1991). Focus on psychometrics: Aspects of item analysis. Research in Nursing and Health Care, 2, 165-170.

- Floyd, R. L., Zahniser, S. C. Gunter, E. P., & Kendrick, J. S. (1991). Smoking during pregnancy: Prevalence, effects and intervention strategies. Birth, 18(1), 48-53.
- Friede, A., Baldwin, W., Rhodes, P. H., Buehler, J. W. & Strauss, L. T. (1988). Older maternal age and infant mortality in the United States. Obstetrics & Gynecology, 72(2), 152-157.
- Garn, S.M., Shaw, H. A. & McCabe, K. D. (1977). Effects of socioeconomic status and race on weight-defined and gestational prematurity in the United States. In Reed, D. M. & Stanley, F. J. (Ed.), The epidemiology of prematurity (pp.119-143). Baltimore, Maryland: Urban & Schwarzenberg.
- Garn, S. M., Ridella, S. A., Petzold, A. S., & Falkner, F. (1981). Maternal hematological levels and pregnancy outcome. Seminars in Perinatology, 5, 155-62.
- Gaziano, E. P., Freeman, D. W., & Allen, T. E. (1981). Antenatal prediction of women at increased risk for infants with low birth weights. American Journal of Obstetrics & Gynecology, 140, 99-107.
- Gersten, J. C. & Mrela, C. K. (1992). Closing the decade: Arizona's health status and health statistics 1980-1990. Phoenix, AZ: Arizona Department of Health Services, Office of Planning and Health Monitoring.
- Goodlin, R. C., Dobry, C. A., Anderson, J. C., Woods, R. & Quaife, M. (1983). Clinical signs of normal plasma volume expansion during pregnancy. American Journal of Obstetrics & Gynecology, 145, 1001-1009.
- Gordon, R. (1968). Issues in multiple regression. American Journal of Sociology, 73, 592-616.
- Gould, J. B., & LeRoy, S. (1988). Socioeconomic status and low birth weight: A racial comparison. Pediatrics, 82(6), 86-904.
- Green, L. W. (1970). Manual for scoring socioeconomic status for research on health behavior. Public Health Reports, 85(9), 815-827.
- Greenberg, R. S. (1983). The impact of prenatal care in different social groups. American Journal of Obstetrics & Gynecology, 145, 797-801.

- Greunberger, W., Leodolter, S. & Parschalk, O. (1979). Maternal hypertension: Fetal outcome in treated and untreated cases. Gynecology Obstetric Investigator, 10, 32-38.
- Hardy, J. B. & Mellits, E. D. (1977). Relationship of low birth weight to maternal characteristics of age, parity education and body size. In D. W. Reed & F. J. Stanley (Eds.), The epidemiology of prematurity (pp. 105-117). Baltimore, Maryland: Urban & Schwarenborg.
- Haworth, J. C., Ellestad-sayed, J. J., King, J. & Dilling, L. A. (1980). Relationship of maternal cigarette smoking, obesity, and energy consumption to infant size. American Journal of Obstetrics & Gynecology, 138, 1185-1189.
- Heins, H. C., Nance, N. W., McCarthy, B. J. & Efrid, C. M. (1990). A randomized trial of nurse-midwifery prenatal care to reduce low birth weight. Obstetrics/Gynecology, 75, (3), 341-345.
- Helton, A. S. Anderson, & Snodgrass, F. G. (1987). Battering during pregnancy: Intervention strategies. Birth, 14, (3), 143-147.
- Hillard, P. J. (1985). Physical abuse in pregnancy. Obstetrics & Gynecology, 16, 185-190.
- Holmes, T. H. & Rahe, R. H. (1967). The social readjustment rating scale. Journal of Psychosomatic Research, 11, 213-218.
- Hollingshead, A. B. (1956). The two-factor of social position. Privately published. New Haven, Conneticut.
- House, J. (1981). Work, stress and social support. Menlo Park, CA: Addison Wesley Publishing.
- Institute of Medicine. (1985). Preventing low birth weight. Washington, D.C.: National Academy Press.
- Inside Metro Phoenix. (1988). Phoenix, Arizona: Arizona Republic/Gazette Publishers.
- Jessup, M. & Green, J.R. (1987). Treatment of the pregnant alcoholic-dependent woman. Journal of Psychoactive Drugs, 19(2), 193-203.
- Joffe, M. (1982). Social inequalities in low birth weight: Timing of effects and selective mobility. Social Science and Medicine, 28, 613-619.

- Johnston, C. (1981). Cigarette smoking and the outcome of human pregnancy: A status report. Clinical Toxicology, 18(2), 189-209.
- Kaltreider, D. F., & Johnson, J. W. C. (1976). Patients at high risk for low birth weight delivery. American Journal of Obstetrics & Gynecology, 124, 251.
- Kavanaugh, K., Meier, P.P., & Engstrom, J.L. (1989). Reliability of weighing procedures for preterm infants. Nursing Research, 38(3), 178-179.
- Kandall, S. R., Albin, S., Lowinson, J., Berle, B., Eidelman, A. I., & Gartner, L. M. (1976). Differential effects of maternal heroin and methadone use on birth weight. Pediatrics, 58, 681-685.
- Kessner, D. M., Singer, J., Kalk, C. E., & Schlesinger, E. (1973). Infant death: An analysis by maternal risk and health care. Washington, DC: Institute of Medicine, National Academy of Sciences.
- Kleinman, J. C. & Kessel, S. S. (1987). Racial differences in low birth weight. New England Journal of Medicine, 317, 12, 749-753.
- Koops, B. L., Morgan, L. J. & Battaglia, F. C. (1982). Neonatal mortality risk in relation to birth weight and gestational age: Update. The Journal of Pediatrics, 101, 6, 969-977.
- Kramer, M.S. (1987). Intrauterine growth gestational\ duration determinants. Pediatrics, 80(4), 502-511.
- Krathwohl, D.R. (1983). Social and behavioral science research. San Francisco: Jossey-Bass, Inc.
- Kruse, D.C, (1989). The development of the Kruse Scale For Measuring Body Image in Pregnancy. Paper presented at the doctoral students workshop of the Eastern Regional Research Conference. Philidelphia, PENN.
- Langman, J. (1981). Medical embryology (4th ed.). Baltimore, Maryland: Williams & Wilkins.
- Lechtig, A. (1982). Studies of nutrition intervention in pregnancy. Birth, 9(2), 115-119.
- Lee, K., Ferguson, R. M., Corpuz, M. & Gartner, L. M. (1988). Maternal age and incidence of low birth weight at term: A population study. American Journal of Obstetrics & Gynecology, 158, (1), 84-89.

- Lieberman, E., Ryan, K. J., Monson, R. R. & Schienbaum, S. (1987). Risk factors accounting for racial differences in the rate of premature births. New England Journal of Medicine, 317, 743-748.
- Luke, B., Hawkins, M.N. & Petrie, R.H. (1981). Influence of smoking, weight gain and pre-gravid weight for height on intrauterine growth. The American Journal of Clinical Nutrition, 34, 1410-1417.
- McCormick, M. C. (1985). The contribution of low birth weight to infant mortality and childhood morbidity. New England Journal of Medicine, 312, 82-90.
- McFarlane, J., Parker, B., Soeken, K. & Bullock, L. (1992). Assessing for abuse during pregnancy. Journal of the American Medical Association, 267(23), 3176-3178.
- McFarlane, J. (1993). Abuse during pregnancy: The horror and the hope. AWHOONN Clinical Issues, 4(3), 350-362.
- Metcuff, J., Costiloe, J. P., Crosby, W., Bente, L., Seshachalam, D., Sandstead, H.H., Bodwell, C.E., Weaver, F. & McLain, P. (1981). Maternal nutrition and fetal outcome. American Journal Clinical Nutrition, 34, 708-721.
- Metcuff, J., Sandstead, H. H., Bidwell, C. E. (1984). Equation helps predict low birth weight. Agricultural Research, 32, 14.
- Metropolitan Life Insurance Company. (1983). The build study. Society of Actuaries and Associated Life Insurance Medical Directors of America.
- Michielutte, R., Ernest, J. M., Moore, M., L., Meis, P., Sharp, P. C., Wells, H. B. & Buescher, P. A. (1992). A comparison of risk assessment models for term and preterm low birth weight. Preventative Medicine, 21, 98-109.
- Miller, R. K., Faber, W., Asai, M., D'Gregorio, R. P., Ng, W. W., Shah, Y. & Neth-Jessee. (1993). The role of the human placenta in embryonic nutrition. In Maternal nutrition and pregnancy outcome: Annals of the New York Academy of Science, 678, 92-105.
- Mills, J. L., Graubard, B. I., Harley, E. E., Rhoads, G., & Berendes, H.W. (1984). Maternal alcohol consumption and birth weight. Journal of the American Medical Association, 252(14), 1875-1879.

- Monthly Morbidity and Mortality Report. (1989). U.S. Public Health Service: Washington, DC.
- Munro, B. H. & Page, E. B. (1993). Statistical methods for health care research. Philadelphia: J.B. Lippincott.
- Murray, J. L. & Bernfield, M. (1988). The differential effect of prenatal care on the incidence of low birth weight among blacks and whites in a prepaid health care plan. New England Journal of Medicine, 319, 1385-91.
- Naeye, R.L. (1981). Nutritional/nonnutritional interactions that affect the outcome of pregnancy. American Journal of Clinical Nutrition, 34, 727-731.
- Newton, R. W., Webster, P. A., Binu, P. S., Maskrey, N. & Phillips, A. B. (1979). Psychological stress in pregnancy and its relation to the onset of premature labor. British Medical Journal, 2, 411-413.
- Norbeck, J. S. & Anderson, N. J. (1989). Psychosocial predictors of pregnancy outcomes in low-income, black, Hispanic and white women. Nursing Research, 38(4), 204-209.
- Norbeck, J. S. & Tilden, V. P. (1983). Life stress, social support and emotional disequilibrium in complications of pregnancy: A prospective, multivariate design. Journal of Health and Science, 24, 30-46.
- Norusis, M. J. (1990). The SPSS guide book to data analysis for release 4. Chicago, IL.:SPSSPC, Inc.
- Nunnally, J. C. (1978). Psychometric theory. 2d edit. New York: McGraw-Hill.
- Oakley, A. (1985). Social support in pregnancy: The 'soft way' to increase birthweight? Social Science and Medicine, 21(11), 239-68.
- Ounsted, M. & Scott, A. (1982). Social class and birthweight: A new look. Early Human Development, 6, 83-89.
- Pedhazur, E. J. & Schmelkin, L. P. (1991). Measurement, design and analysis: An integrated approach. Hillsdale, NY: Lawrence Erlbaum Associates.
- Perkins, R. P. (1981). The neonatal significance of selected perinatal events among infants of low birth weight. I. Overall results. American Journal of Obstetrics & Gynecology, 139, 546-561.

- Philipps, A.F. (1992). The placenta: A neonatologist's perspective. In The Arizona Placenta Project, (pp.11-13). Phoenix, AZ: Arizona Medical Association.
- Picone, T. A., Lindsay, H. A., Schramm, M. M. & Olsen, P. (1982). Pregnancy outcome in North American women II: Effects of diet, cigarette smoking and psychological stress on maternal weight gain. American Journal of Clinical Nutrition, 36, 1205-1213.
- Picone, T. A., Lindsay, H. A., Olsen, P. N. & Ferris, M. E. (1982). Pregnancy outcome in North American women II: Effects of diet, cigarette smoking, stress and weight gain on placentas and on neonatal physical and behavioral characteristics. American Journal of Clinical Nutrition, 36, 1214-1224.
- Piechnik, S. L. & Corbett, M. A. (1985). Reducing low birth weight among socioeconomically high risk adolescent pregnancies. Successful intervention with certified nurse-midwife managed care and a multidisciplinary team. Journal of Nurse-Midwifery, 30, 88-98.
- Poland, M. L., Ager, J. W., Olson, K. L. & Sokol, R. J. (1990). Quality of prenatal care; selected social, behavioral and biomedical factors; and birth weight. Obstetrics Gynecology, 75(4), 607-612.
- Powers, M. G. (1982). Measures of socioeconomic status. Washington, D. C.: American Association for the Advancement of Science.
- Rofe', Y. & Goldberg, J. (1983). Prolonged exposure to a war environment and it's effects on the blood pressure of pregnant women. British Journal of Medical Psychology, 56, 305-311.
- Rush, D., Stein, Z. & Susser, M. (1980). A randomized controlled trial of prenatal supplementation in New York City. Pediatrics, 65, 656-7; 683-97.
- Shiono, P. H., Klebanoff, M. A., Graubard, B. I., Berendes, H. W., & Rhoads, G. G. (1986). Birth weight among women of different ethnic groups. Journal of the American Medical Association, 255, 1, 48-52.
- Scholl, T. O., Miller, L. K., Shearer, J. Cofskey, M. C., Salmon, R. W., Vasilenko, P. & Ances, I. (1988). Influence of young maternal age and parity on term and preterm low birth weight. American Journal of Perinatology, 5(2), 101-104.

- Shapiro, S., McCormick, M. C., Starfield, B. H. Krischer, J. P. & Bross, D. (1980). Relevance of correlates of infant deaths for significant morbidity at 1 year of age. American Journal of Obstetrics and Gynecology, 136, 363-373.
- Sherwin, L. N., Scoloveno, M. A., & Weingarten, C. T. (1991). Nursing care of the childbearing family. Appleton & Lange: Norwalk, Connecticut.
- Showstack, J. A., Budetti, P. P. & Minkler, D. (1984). Factors associated with birthweight: An exploration of the roles of prenatal care and length of gestation. American Journal of Public Health, 74(9), 1003-1008.
- Singleton, E. G., Harrell, J. P. & Kelly, L. M. (1986). Racial differentials in the impact of maternal cigarette smoking during pregnancy on fetal development and mortality: Concerns black psychologists. Journal of Black Psychology, 12(2), 71-83.
- Slap, G. B. & Schwartz, J. S. (1989). Risk factors for low birth weight to adolescent mothers. Journal of Adolescent Health Care, 10(4), 267-274.
- Spence, A. P. & Mason, E. B. (1987). Human anatomy and physiology, (3rd ed.). Menlo Park, California: Benjamin/Cummings Publishing Company.
- Springer, N. S., Bischooping, K., Sampsel, C. M., Mayes, F. L., & Peterson, B. A. (1992). Using early weight gain and other factors to predict pregnancy outcome. Journal of the American Dietetic Association, 79(2), 217-219.
- Stember, M. L. (1986). Model building as a strategy for theory development. In Chinn, P. L. Nursing research and methodology: Issues and implementation (pp.103-119). Rockville, MD: Aspen.
- Struening, E. J., Rabkin, J. G., Cohen, P., Raabe, G., Muhlin, G. L. & Cohen, J. (1973). Family ethnic and economic indicators of low birth weight and infant mortality: A social area analysis. Annals New York Academy of Science, 218, 87-107.
- Stunkard, A.J. & Waxman, M. (1981). Accuracy of self-reports of food intake. Journal of the American Dietetic Association, 79, 547-551.

- Sussman, S. (1963). Narcotic and methamphetamine use during pregnancy: Effect on newborn infants. American Diseases of Children, 106, 325-330.
- Taffel, S. (1986). Association between maternal weight gain and outcome of pregnancy. Journal of Nurse-Midwifery, 31(2), 78-85.
- Taper, L. J., Hayes, M., Rogers, C. S. & Frary, R. B. (1984). Influence of maternal weight, smoking and socioeconomic status on infant triceps skinfold thickness an growth during the first year. Birth, 11(2), 97-101.
- Teberg, A. J., Settlage, R., Hodgman, J. E., King, Y. & Aguilar, T. (1989). Maternal factors associated with delivery of infants with birthweights less than 2500 grams in a low socioeconomic population. Journal of Perinatology, 9(3), 291-295.
- U.S. Public Health Service. (1980). Promoting Health/Preventing Disease: Objectives for the Nation. Washington, D. C.: U. S. Government Printing Office.
- Usher, R., McLean, F., & Scott, K. E. (1966). Judgement of fetal age II.: Clinical significance of gestational age and an objective method for its assessment. (1966). Pediatric Clinics of North America, 13, 835-848.
- Vanden Berg, B. J. (1981). Maternal variables affecting fetal growth. American Journal of Clinical Nutrition, 34, 722-726.
- Verran, J. A. & Ferketich, S. L. (1987). Testing linear model assumptions: Residual analysis. Nursing Research, 36(2), 127-129.
- Verma, U. L., Tejani, N. A. Chatterjie, S., & Weiss, R. R. (1980). Screening for SGA by the Roll-Over Test. Obstetrics & Gynecology, 56, 591-594.
- Wen, S. W., Goldenberg, R. L., Cutter, G. R., Hoffman, H., Cliver, S. P., Davis, R. O., & DuBard, M. B. (1990). Smoking, maternal age, fetal growth and gestational age at delivery. American Journal of Obstetrics & Gynecology, 162, 53-8.
- Wilcox, A. J. (1983). Intrauterine growth retardation: Beyond birthweight criteria. Early Human Development, 8, 189-193.

- Williams, C., Highly, W. Hsu, E., Lewis, J., Tobert, B., Woullard, D. Kirmani, S., & Chung, R. A. (1981). Protein, amino acid and calorie intakes of selected pregnant women. Journal of the American Dietetic Association, 78, 28-35.
- Williams, D. F., Serdule, M. K., Kendrick, J. S. & Binkin, N. J. (1989). Comparing the prevalence of smoking in pregnant and non-pregnant women. Journal of the American Medical Association, 261(1), 70-74.
- Williams, R. L., Binkin, N. J. & Clingman, E. J. (1986). Pregnancy outcomes among Spanish-surname women in California. American Journal of Public Health, 76(4), 387-391.
- Worthington-Roberts, B. (1987). Nutritional support of successful reproduction: An update. Journal of Nutrition Education, 19(1), 1-10.
- Wright, J. T., Barnson, I. G., Lewis, I. G., MacRae, K., Waterson, E. J., Toplis, P. J., Gordon, M. G., Morris, N. F. & Murray-Lyon, I. M. (1983). Alcohol consumption, pregnancy and low birth weight. Lancet, 1, 663-665.
- Young, C., McMahon, J. E., Bowman, V. & Thompson, D. (1989). Maternal reasons for delayed prenatal care. Nursing Research, 38(4), 242-243.
- Zlatnik, F. J. & Burmeister, L. F. (1983). Dietary protein in pregnancy: Effect on anthropometric indices of the wellborn infant. American Journal of Obstetrics & Gynecology, 146, 199-203.
- Zuckerman, B., Frank, D. A., Hingson, R., Amaro, H., Levenson, S. M., Kayne, H., Parker, S., Vinci, R., Aboagye, K., Fried, L. E., Babral, H., Timperi, R., & Bauchner, H. (1989). Effects of maternal marijuana and cocaine use on fetal growth. The New England Journal of Medicine, 320(12), 762-768.

APPENDIX A

University of San Diego Committee for the
Protection of Human Subjects Approval Letter

BARROW NEUROLOGICAL INSTITUTE

June 24, 1991

Diane Kruse, MS, RN
202 West Pine Valley Drive
Phoenix, AZ 85023

Dear Diane:

I have received the copy of the final approval from the University of San Diego Human Subjects Committee for your research proposal: "Wellgrownness of the Newborn and the Factors Contributing to Low Birth Weight."

I presume that you have spoken to Donna Adams regarding the committees recommendations for your revised Data Collection Form. eg Item #5 - change Mexico to other Country, there are 2 items #35.

Why is the St. Joseph's Hospital Form included in the packet?

If you have any questions, please contact me or Melinda Preston, the Committee Vice Chairperson.

We wish you success with your study and look forward reviewing your results.

Sincerely,

Marilyn M. Ricci, RN, MS, CNRN
Chairperson
Nursing Research Council

MMR/tl

St. Joseph's Hospital and Medical Center
350 West Thomas Road
Phoenix, Arizona 85013-4496
(602) 285-3000

APPENDIX B
Consent Form

UNIVERSITY OF SAN DIEGO

CONSENT TO ACT AS A RESEARCH SUBJECT

Mrs. Diane Kruse, who is a doctoral candidate in Nursing from the University of San Diego and a Faculty Associate at Arizona State University's College of Nursing, is doing a research study on birthweight and the well-grownness of the newborn. The purpose of this study is to look at some of the things in pregnancy that make a healthy baby. Since I have been invited to participate in this study, I understand that I will be asked to fill out a questionnaire including a diet history and questions about body image in pregnancy, exercise, stress and other factors relating to nutritional status and the baby that is born. I further understand that Mrs. Kruse would like to look at my medical records, the baby's nursery record and examine my baby in the hospital after he/she is born.

My participation in the data collection will take about 20 minutes in the waiting room in my prenatal clinic, doctor's office or in my home. Participation in the study will not involve any added risks or discomforts to me except for possible minor fatigue. There are no foreseeable risks. The benefits are, that doctors and nurses may understand better what makes a healthy baby. My participation in this study is entirely voluntary. I understand I may refuse to participate or withdraw at any time without jeopardy to my medical care. There is no financial compensation for my participation.

I understand my research records will be kept strictly confidential. My identity will not be disclosed without consent required by law. I further understand, that to preserve my anonymity, only group data will be used in any publication or presentations of the results of this study. The code numbers and matching names will be kept locked by Mrs. Kruse and then destroyed after the raw data has been analyzed.

Mrs. Kruse, or her research assistant, has explained this study to me and answered my questions. If I have other questions or research-related problems, I can reach Mrs. Kruse at Arizona State University's College of Nursing at 965-3244. If I want a copy of the completed study (after 3 years) I can contact Mrs. Kruse at ASU. There are no other agreements, written or verbal, related to this study beyond that expressed on this consent form. I will be given a copy of this consent form.

I, the undersigned, understand the above explanations and, on that basis, I give consent to my voluntary participation in this research.

NOTE: If you are under 18, and not an emancipated minor, parent or legal guardian should also sign this consent form, below.

Signature of Subject

Date

Location

Witness

Date

Researcher

Date

Parent/legal guardian

Date

NOTE: You are voluntarily allowing your child/legal ward to participate in this study. Your signature above means that having read the information provided above, you have decided to permit your child/legal ward to participate. You will be given a copy of the consent form to keep.

I also give permission for Mrs. Kruse or her research assistant to examine my baby and view my baby's nursery chart at _____
hospital

Signature

Date

NOTE: Once the baby's record is matched with this Questionnaire, no names will be used, only code numbers.

file:diss.con

**St. Joseph's Hospital & Medical Center
Well-Grownness of the Newborn and Factors
Contributing to Low Birth Weight**

**INFORMED CONSENT FOR VOLUNTEERS
Participation in a Research Study**

INVITATION TO PARTICIPATE:

Mrs. Diane Kruse, who is a doctoral candidate in Nursing from the University of San Diego is doing a research study on birth weight and the well-grownness of the newborn. I have been invited to participate in her research.

PURPOSE OF THE STUDY

The purpose of this study is to look at the things in pregnancy that make a healthy baby that is not too small and is not born too early. Examples of these things might be how healthy I was before birth; the stress, nutrition, smoking, and exercise I had during pregnancy.

EXPLANATION OF PROCEDURES:

Since I have been invited to participate in this study, I understand that I will be asked to fill out questionnaires about body image in pregnancy, exercise, stress, nutrition and other factors relating to the pregnancy and the baby that is born. I further understand that Mrs. Kruse would like to obtain information from my medical records, the baby's nursery record and examine my baby in the hospital after he/she is born. My participation in the data collection will take about 30-45 minutes in the waiting room in my prenatal clinic or doctor's office. Mrs. Kruse or her research assistant will interview me there.

RISKS AND BENEFITS:

Participation may result in mild, temporary psychological discomfort during the interview. The benefits are that doctors and nurses may understand better what makes a healthy baby.

FINANCIAL COMPENSATION:

There is no financial compensation for my participation.

CONFIDENTIALITY:

I understand my research records will be kept strictly confidential. My identity will not be disclosed without consent required by law. I further understand that, to preserve my anonymity, only group data will be used in any publication or presentations of the results of this study. The code numbers and matching names will be kept locked by Mrs. Kruse and then destroyed after the raw data has been analyzed.

Continues on back

OFFER TO ANSWER QUESTIONS:

Mrs. Kruse, or her research assistant, has explained this study to me and answered my questions. If I have other questions or research-related problems, I can reach Mrs. Kruse at 993-9521. If I want a copy of the completed study (after 3 years), I can contact Mrs. Kruse. There are no other agreements, written or verbal, related to this study beyond that expressed on this consent form.

VOLUNTARY PARTICIPATION:

My participation in this study is entirely voluntary. I understand that I may refuse to participate or withdraw at any time without jeopardy to my medical care.

I, the undersigned, give voluntary consent to participate in the research described above. I understand the explanations. I will be given a copy of this consent form to keep.

NOTE: If you are under 18, or not an emancipated minor, a parent or legal guardian should also sign this consent form, below.

Signature of Subject

Date

Witness

Date

Researcher

Date

5-29-92

Parent/Legal Guardian

Date

NOTE: You are voluntarily making a decision to allow your child/legal ward to participate in this study. Your signature above means that you have read the information provided above, and have decided to permit your child/legal ward to participate. You will be given a copy of this consent form to keep.

I also give permission for Mrs. Kruse or her research assistant to examine my baby and view my baby's nursery chart at:

Hospital

Signature

Date

APPENDIX C

Letter of Permission for Brown's Inventory

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

*School of Nursing
Department of Community Health Care Systems
Mail Stop, SM-24*

October 31, 1990

Dear Diane,

I just returned from sabbatical leave last month and have been trying to catch up on all that seemed to "fall through the cracks" last year while I was away. I see that my secretary was confused about your request and sent you the wrong support scale. Even though your need for this has probably passed, I wanted to correct our error. The information below is what you requested in your original letter. Again, I apologize for the delay in an appropriate response.

I am delighted about your interest in the Support Behaviors Inventory and have enclosed three different versions for your examination. The first version is the original 45 item scale, in which half of the items make direct reference to pregnancy and half are more general. In the second version I have removed all references to pregnancy and improved the expression of the ideas. The second version could be used with any population. In the third version I reduced the number of items from 45 to 11 and was able to maintain an internal consistency reliability of .91. I believe however that the longer scale offers richer data and is preferable unless questionnaire space is a major issue for you. If you decide to use the original version you made wish to improve/clarify some of the items as they are in the second version.

At this time I have received over 50 requests for use of the SBI in research endeavors, most addressing perinatal populations. While I did not undertake another research project specifically for the purposes of instrument development, data from these other studies has provided evidence of content, construct, criterion and predictive validity. The Cronbach alpha reliability coefficients have remained high ranging from .90 to .96. The study findings vary in regard to the association between partner support and other support. Correlations between the two types of support range from none to moderate, with some studies showing no relationship between the two while other reveal a weak to moderate (.1-.4) relationship. This data suggests that the two types of support are distinctive and the presence of one type of support cannot be counted on to serve as a marker for the other type of support. Data has also suggested there are no differences in the partner support scores between married women and single women living with their partner. The items are also designed to accommodate Gay and Lesbian couples, although I do not have any data comparing gay and straight couples.

Please note that the SBI is unique among support scales in that it provides the opportunity to obtain a measure of satisfaction with "partner" (spouse, mate, boyfriend, etc.) support separate from "others" support. All of my work however, has been with family members or individuals who have a "steady partner." If your sample will include some unpartnered or single people several options come to mind: 1) leave scale as is and change the directions (in a VERY obvious way since I've found people don't usually read directions!) and direct respondents to leave the

partner column blank or mark a large X through that column 2) make only one column and change the question/directions to have people consider all the people in their life at one time while answering. I have also thought that if option one was used, it would be very interesting to ask everyone who did have a partner, spouse, lover, boyfriend, etc. to complete the partner column and then include a question about exactly what kind of relationship people were involved in (i.e. living together or not, married or not, gay or straight, steady or casual boyfriend) in order to compare the groups. My clinical experience tells me that support from a boyfriend or partner even if people are not married or living together is important to assess and can make a substantial contribution to the individual's well being. Also in terms of format, some investigators have preferred to repeat the items in the scale first giving the instruction to answer in regard to partner and then give instruction to answer in regard to other people instead of the current two columns next to each other format. If you are interested in using the Shortened Version, the psychometrics of the scale indicate that all of the items are very highly intercorrelated. It would also be appropriate then for you to select 10-15 items that are most relevant to your particular study to form the shortened version.

Scoring for the SBI is simple and involves summing the responses with a higher score indicating greater support satisfaction. I used the satisfaction with partner support subtotal as a variable separate from the satisfaction with others support subtotal in some analyses. I also combined the two subtotals to create an overall support satisfaction score, depending on the research question I was asking. If you choose to implement a more creative strategy with both partnered and unpartnered subjects, then you will have some challenges in creating analysis strategies as well. The possible responses in the answer column of the SBI are somewhat unique and were developed through the process of several pilot tests. I found that initially people's responses were heavily weighted in the satisfied direction, so I developed more gradations of satisfied to increase the variability in the responses.

I am pleased that you are considering using the SBI, feel free to modify it to suit your specific needs. This letter serves as permission for use. However, if you decide to use the SBI, I would sincerely appreciate receiving a summary of the results of your study, particularly any information you glean on reliability and validity. I wish you the very best in your research endeavors.

Sincerely,

Marie Annette Brown Ph.D., RN, ARNP
Associate Professor and Coordinator
Primary Health Care Pathway

APPENDIX D

Assessment Battery

1. Date Profile Sheet
2. 24-Hour DINE Food Record Form
3. Brown Shortened Social Support Behaviors Inventory
4. Life Events Stress Scale
5. Kruse Body Image in Pregnancy Scale
6. Admission Status Record
7. Ballard Gestational Assessment Form

KRUSE WELL-GROWNESS OF THE NEWBORN STUDY
DATA PROFILE SHEET: GENERAL INFORMATION

Remember, no one will know your answers; this questionnaire will be placed in the brown envelope and sealed and then given to Mrs. Kruse.

1. Today's Date:_____ 2. Your Birth Date:_____

3. When is this Baby Due:_____

4. Think about your LAST pregnancy...did the pregnancy end in:

_____this is my first pregnancy
_____a birth.....date_____
_____a miscarriage...date_____
_____an abortion.....date_____

5. Race: Please check one:

White:(1) ☐
Black:.....(2) ☐
Mexican-American.....(3) ☐
Asian.....(4) ☐
Native American.....(5) ☐
Other.....(6) ☐
What_____

In what country were you born?_____

6. Education: How many years of School did you FINISH?

Elementary School:_____ College: _____
High School: _____ Post-Graduate Work:_____

7. What is your combined, yearly Family Income (before you pay taxes)? Check below

Over \$100,000.....(1) ☐
\$75,000-\$99,999.....(2) ☐
\$50,000-\$74,999.....(3) ☐
\$25,000-\$49,999.....(4) ☐
\$20,000-\$24,999.....(5) ☐
\$15,000-\$19,999.....(6) ☐
\$10,000-\$14,999.....(7) ☐
\$ 5,000-\$9,999.....(8) ☐
Below \$5,000.....(9) ☐

8. What is your husband's, partner or father's Occupation (Job Description)?_____

What company does he work for:_____

9. Smoking in pregnancy: Please check one

- _____ I have never smoked
_____ I smoke but quit when I first found out I was pregnant
_____ I smoke but cut down when I found out I was pregnant

ON THE AVERAGE, ABOUT HOW MANY CIGARETTES DO YOU USUALLY SMOKE IN ONE DAY, NOW? (20 cigarettes in one pack) _____

10. What is your Height without shoes? _____

11. Now wrap your thumb and middle finger of your right hand around your left wrist and squeeze lightly. Do your fingers touch?

Check below which frame you are:

- Big boned; or large frame.....(1) ☐
Average; or average frame.....(2) ☐
Small boned; or small frame.....(3) ☐

12. How much did you weigh RIGHT BEFORE you got pregnant? _____

13. How much weight have you gained so far? _____

14. Have you had to cut down on your eating to keep your weight gain at a certain number? _____yes _____no

If yes, what is the number you are trying to hold your weight to? _____

Why are you planning to gain just this much?

15. Have you ever had a drink of beer, wine or liquor?
_____yes _____no

16. If yes, how old were you when you had your first drink?_____

What did you prefer at that age?_____ (beer, wine or liquor)

How old were you when you first got drunk?_____

How many drinks did it take to get high when you were young?_____

What do you prefer NOW?_____ (beer, wine or liquor)

How many drinks does it take to get high NOW?_____

On the average, how many glasses or cans do you drink NOW? _____per week _____per day

How big are the cans or glasses that you drink?_____

Have you ever felt you should CUT DOWN on your drinking? _____yes _____no

Have people ANNOYED you by criticizing your drinking? _____yes _____no

Have you ever felt bad or GUILTY about your drinking? _____yes _____no

Have you ever had a drink first thing in the MORNING to steady your nerves or get rid of a hangover? _____yes _____no

17. Are you in the WIC (Women's Infant & Children's Supplemental Food) Program for food coupons during pregnancy? _____yes _____no

18. What recreational or street drugs do you take? Check below

Marijuana.....(1) ☐
Amphetamines.....(2) ☐
Cocaine.....(3) ☐
"Ice".....(4) ☐
Heroin.....(5) ☐
Crystal Meth.....(6) ☐
Speed.....(7) ☐
Methadone.....(8) ☐
Other.....(9) ☐

What _____
I have never used anything.....(10) ☐
I quit when I found out I was pregnant.....(11) ☐

19. On the average, how much do you use of the above drugs in one: _____day _____week

19. What kinds of regular exercise do you get? Check below

Walking- How far_____ (1)
Swimming- How far_____ (2)
Bicycling- How far_____ (3)
Running- How far_____ (4)
Aerobics- How long_____ (5)

How often do you do this?_____

How LONG do you do it at one time?_____

20. Describe the stressful things in your life now that you are pregnant?_____

21. Do you work outside the home now?_____yes _____no
If no, when did you quit?_____

If yes, how many hours do you work per week?_____
What is your occupation or job description?_____

What company do you work for?_____

22. What things make you tired, now?_____

23. How many preschool children do you have at home to take care of?_____

24. Do you have help with the housework? _____yes _____no

25. Are you in a relationship with a man who:

- a. has threatened to hurt you?
- b. has hit, slapped or kicked you?
- c. has physically hurt you?
- d. hurt you before you were pregnant?
- e. has increased hurting you since you became pregnant?
- f. uses harsh words, or is cruel or sarcastic to you?

YES	NO

THANK YOU.

file:diss.que

DAY 2

FOOD RECORD

Name: _____

Date: _____

M	Item #	Computer		Food Name	Brand	√(Check)			How Cooked	Amount Eaten
		Code	Portion			Fresh	Frozen	Canned		
M	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	11									
	12									
	13									
	14									
	15									
	16									
	17									
	18									
	19									
	20									
	21									
	22									
	23									
	24									
	25									
	26									
	27									
	28									
	29									
	30									

BROWN SHORTENED SOCIAL SUPPORT BEHAVIOR INVENTORY

Think about how much support you get from your husband/partner, your family, friends and co-workers. How satisfied are you with the support they give you? Please look at the items below and rate how satisfied you feel about the behavior described below. **Very satisfied** is a 6 and **very dissatisfied** is a 1.

How well do they do this?	1 very dissatisfied	2 somewhat dissatisfied	3 partly sat./ partly diss.	4 somewhat satisfied	5 satisfied	6 very satisfied
1. Share similar experiences with me.						
2. Help keep up my morale.						
3. Help me out when I am in a pinch.						
4. Show interest in my daily activities and problems.						
5. Go out of their way to do special or thoughtful things for me.						
6. Allow me to talk about things that are personal and private.						
7. Let me know I am appreciated for the things I do for them.						
8. Tolerate my ups and downs and unusual behaviors.						
9. Take me seriously when I have concerns.						
10. Says things that make my situation clearer and easier to understand.						
11. Let me know that he/she will be around if I need assistance.						

LIFE EVENTS/STRESS SCALE

INSTRUCTIONS:

1. Look at the first column, the yes column, and mark an X here if these things have happened to you during this pregnancy.
 2. Now, look at the rating column. Put a rating of how stressful the item you marked X was. The rating is from 1 to 10 with a 10 being the most stressful and 1 being the least stressful. REMEMBER, each item that has an X in the first column must have a number in the rating column.
-

	Yes	Rating 1-10
1. Serious physical illness or injury requiring hospital treatment.		
2. Family member or friend seriously ill or dies.		
3. This pregnancy is unwanted or unplanned.		
4. Prolonged ill health in close relative required treatment by a doctor.		
5. Worry over having a handi-capped or deformed child.		
6. Worry over care of other children while in the hospital for this birth.		
7. Increase in number of arguments with husband/partner.		
8. Marital separation or divorce.		
9. Your husband is unfaithful.		
10. You are made homeless or have to sleep in a hotel.		
11. Your husband/partner is arrested.		
12. Your husband/partner becomes unemployed.		
13. Income decreased substantially (by 25%).		
14. Getting into debt beyond your means of paying back.		
15. You were in contact with someone who had an infectious disease that might affect your baby.		
16. You heard that something you took during the pregnancy might be harmful to the baby.		

KRUSE BODY IMAGE SCALE FOR PREGNANCY © 1988

INSTRUCTIONS: There are several statements below for you to read. First, decide if this experience or feeling has happened to you. Put an **X** in one of the first set of boxes. Then, think about how much this experience or feeling has bothered you and put an X in one of the second set of boxes. Remember, put only one X per set.

		Do you feel this way? Does this happen to you?				Does it bother you?			
		Never	Rarely	Quite a Bit	Always	Not A Bit	A Little Bit	Quite A Bit	Extremely So
1.	I love being pregnant.								
2.	Strangers stop to talk about my pregnancy.								
3.	My family treats me special now.								
4.	I seem to have lost my feel; I can't see them.								
5.	My husband/partner finds me less sexually attractive.								
6.	My belly button sticks out.								
7.	I worry about my husband/partner being unfaithful now.								
8.	Space around me seems crowded.								
9.	Society thinks pregnant women are healthy and radiant.								
10.	I'm glad pregnancy is only temporary.								
11.	I like what I see in the mirror.								
12.	I like all the attention I get now that I'm pregnant.								
13.	My husband/partner is proud of my shape.								
14.	I have decided to stop gaining any more weight.								
15.	I'm proud of my body now.								
16.	My family nag me about my weight.								
17.	I shouldn't gain too much weight so that I can lose it easier afterwards.								
18.	It's OK to be fat if you're pregnant.								
19.	I have a difficult time controlling my weight when I am not pregnant.								
20.	I urinate a lot more than usual.								

NEUROMUSCULAR MATURITY

	0	1	2	3	4	5
Posture						
Square Window (Wrist)						
Arm Recoil						
Popliteal Angle						
Scarf Sign						
Heel to Ear						

PHYSICAL MATURITY

	0	1	2	3	4	5
SKIN	gelatinous red, transparent	smooth pink, visible veins	superficial peeling &/or rash, few veins	cracking pale area, rare veins	parchment, deep cracking, no vessels	leathery, cracked, wrinkled
LANUGO	none	abundant	thinning	bald areas	mostly bald	
PLANTAR CREASES	no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases cover entire sole	
BREAST	barely percept.	flat areola, no bud	stippled areola, 1-2 mm bud	raised areola, 3-4 mm bud	full areola, 5-10 mm bud	
EAR	pinna flat, stays folded	sl. curved pinna, soft with slow recoil	well-curved pinna, soft but ready recoil	formed & firm with instant recoil	thick cartilage, ear stiff	
GENITALS	scrotum empty, no rugae		testes descending, few rugae	testes down, good rugae	testes pendulous, deep rugae	
GENITALS	prominent clitoris & labia minora		majora & minora equally prominent	majora large, minora small	clitoris & minora completely covered	

Gestation by Dates _____ wks

Birth Date _____ Hour _____ am
pm

APGAR _____ 1 min _____ 5 min

MATURITY RATING

Score	Wks
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

SCORING SECTION

	1st Exam=X	2nd Exam=O
Estimating Gest Age by Maturity Rating	_____ Weeks	_____ Weeks
Time of Exam	Date _____ am Hour _____ pm	Date _____ am Hour _____ pm
Age at Exam	_____ Hours	_____ Hours
Signature of Examiner	_____ M.D.	_____ M.D.

Figure 33-32. Ballard tool for gestational age assessment. (Reproduced, with permission, from Ballard JL, et al. A simplified score for assessment of fetal maturation in newly born infants. J Pediatr. 1979;95:769-774.)

PLEASE NOTE

**The diskette is not included in this material.
It is, however, available for consultation at
the author's graduate school library.**

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