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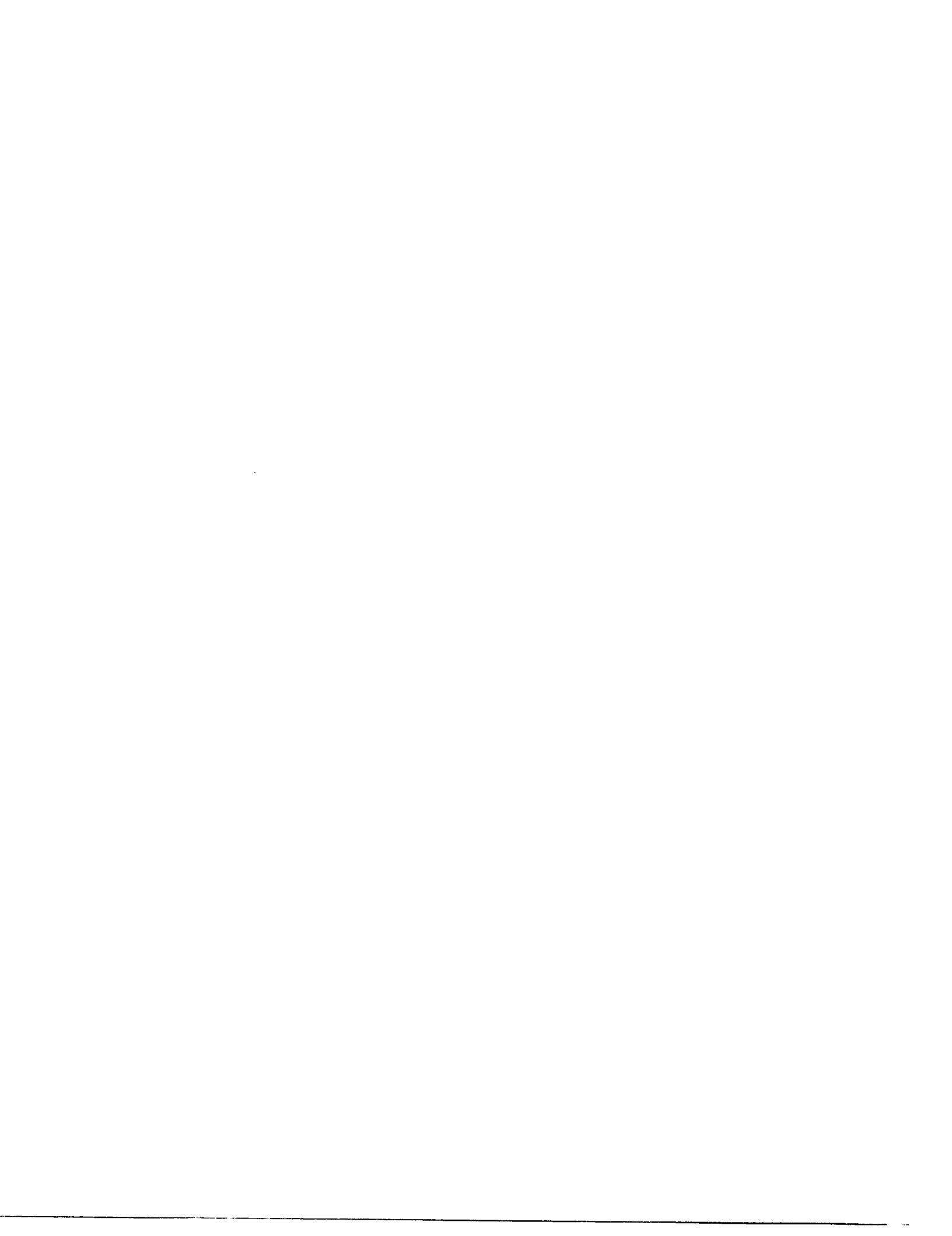
The childbirth environment and maternal stress

Carr, Katherine Ann Camacho, Ph.D.

University of Washington, 1989

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The Childbirth Environment and Maternal Stress

by

Katherine Ann Camacho Carr

A dissertation submitted in partial fulfillment
of the requirements for the degree of

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University of Washington

Abstract

The Childbirth Environment and Maternal Stress

by Katherine Ann Camacho Carr

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A small n (n=10) within subject design study was conducted to concurrently describe patterns of social interaction and maternal stress response during active labor. Multiple methods and repeated measures were utilized to capture the complex nature of this person-environment transaction. Physiologic measures, observational methods and a qualitative interview were used. Participants were married, Caucasian, English-speaking, middle class, healthy, low risk, functional primigravidae between the ages of 22 and 33 years, who labored and gave birth in a large, urban, Level III obstetrical unit. Maternal stress parameters measured at time 1 (T1) defined as 5-6 centimeters of cervical dilation and time 2 (T2), 90 minutes later or complete dilation included: state anxiety (Spielberger State Trait Anxiety Inventory), plasma cortisol, epinephrine and norepinephrine, report of pain (10 centimeter visual analogue pain scale). In addition, maternal heart rate (MHR) and

fetal heart rate (FHR) were measured every minute for approximately 90 minutes from T1 to T2 via a Hewlett Packard 8040A Dual Capacity electronic fetal monitor and a computerized data acquisition system. Social interactions were assessed simultaneously with the Labor Social Environment Observational Code (LSEOC), which assessed who interacted with the laboring woman, what type of interaction occurred and maternal affect and contraction status associated with the interaction. Labor progress, procedures, use of medication and length of labor were also assessed using Friedman Graphic Analysis of Labor. A semi-structured qualitative interview was conducted within 24 hours after delivery to obtain the women's perceptions of the physical and psychosocial childbirth environment during labor.

Analysis of data focused on within subject variance with attention to patterns within and across subjects. Data was presented descriptively and graphically. Time series analytic techniques were planned but not feasible due to low time zero correlations of pertinent variables.

Social interaction data exhibited three childbirth environmental patterns; 1) the sustaining; 2) the protecting: engaged; and 3) the protecting: disengaged environments. Maternal stress parameters covaried with environmental type. Labor outcome was related to environmental type.

This study is an initial examination of the labor social environment and its relationship with measures of maternal stress response. Studies in the past have focused on individual responses and have rarely, if ever, described them in an environmental content. Data from the study will be useful to perinatal nurses, childbirth educators and parents to help further understanding of the person/environment relationship during childbirth. Future nursing intervention and nursing research should focus on the manipulation of the social environment rather than the physical appointments in labor and delivery to improve childbirth outcomes.

Doctoral Dissertation

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In memory of my father
Raymond James Totleben

Chapter 1

Statement of the Problem

The care of childbearing women during labor has been an important area of concern to the nursing profession. Nursing care during childbirth is aimed at the promotion of a safe, satisfying childbirth experience for the woman and her family. Prevention and nursing diagnosis of potential or actual complications of labor is an essential component of this care. Maternal stress has been identified as an important factor associated with the development of maternal/fetal complications of labor such as prolonged, dysfunctional labor (abnormal labor pattern), arrest of labor and fetal distress (Bonica, 1972; Garrett, 1954; & Lederman, Lederman, Work & McCann, 1978, 1979 & 1981).

The predominant response to these complications has centered around treatment modalities including an increased rate of Cesarean delivery, which now accounts for 20-30% of all births in the United States, and the development and utilization of maternal/neonatal intensive care units. These complications are among the most common indications for primary Cesarean delivery in the United States and account for over one-third of these surgical deliveries, which are associated with an increased risk of maternal and infant morbidity and mortality (National Institutes of

Health, 1980). Despite these advances in treatment, the incidence of stress-related complications of childbirth and their sequelae continues to rise. Little effort has been directed at prevention of excessive maternal stress and it has been viewed as a solely biophysical problem without attention to the complex biopsychosocial nature of stress phenomena.

Perinatal nurses play an important role in prenatal, labor and birth care. They can focus on preventive and diagnostic strategies for excessive maternal stress response in addition to treatment strategies. Nursing views the client within a context or environment and nursing therapeutics may be directed at the client or the environment (Nightingale, 1859).

Lazarus and Folkman (1984) described stress as the process of transaction between a person and her environment. The work of Kiritz and Moos (1974) and Kornfeld (1972) supports the notion of environmental effects on individual psychophysiologic response. The environment can effect corticosteroid production (Frankenhaeuser, 1981; Kiritz & Moos, 1974; Mason, 1970) and heart rate (Dimascio et al., 1964). Frankenhaeuser (1981), in studies of stressful person-environment transactions, specifically identified the psychosocial aspects of the environment as critically involved with the activation of the Sympathetic Adrenal Medullary (SAM)

response and the Hypothalamic-Pituitary Adrenal Cortical (PAC) response. She maintained that the physical dimensions of the environment may not be as critical to humans as it is to other animals because of our cognitive powers and sociocultural development.

By examining both individual and environmental variables simultaneously, knowledge can be gained to direct perinatal nursing care. Modification of the birthing environment to meet the needs of the laboring woman and her partner may facilitate adaptation and avoid an excessive stress response and resultant complications. Sparse research describes any aspect of the childbirth environment or relates any dimension of the childbirth environment to maternal stress response.

Stress during labor is the process of transaction between the woman and the childbirth environment. Physical and psychosocial dimensions of the childbirth environment may influence maternal/fetal psychophysiologic response. Little is known about the facets and role of the psychosocial dimension of the childbirth environment and its relationship to excessive maternal stress response.

Purpose

This study focused on a description of the psychosocial dimension of the childbirth environment concurrently with selected measures of maternal stress response. The specific aims of the research were to:

1) describe selected parameters of maternal stress response during labor; 2) describe the social interaction dimension of the childbirth environment; and 3) describe the relationship between patterns of maternal stress response and social interaction. Specifically, the study addresses the following questions:

1) What are the patterns of social interaction between the laboring woman and her partner, the nurse and others during active labor?

2) What are the patterns of maternal stress response, as measured by maternal perceptions of anxiety and pain, cortisol and catecholamine response?

3) What are the patterns of maternal stress response, as measured by maternal and fetal heart rate, during active labor?

4) Is there a relationship between stress response, as measured by maternal and fetal heart rate, and social interaction during active labor? What is the pattern of that relationship?

The results of this study provide a foundation for future experimental work where specific nursing strategies for supportive labor care can be tested. In order to promote maternal/fetal health and reduce the incidence of stress-related childbirth complications, perinatal nurses can begin to change more than the wallpaper when considering therapeutic manipulations of the childbirth environment.

Chapter 2

Review of the Literature

Theory of Maternal Stress Response/Adaptation

Introduction

Childbearing women respond individually to the labor and delivery environment during childbirth. Person and environmental variables affect maternal stress response (through cognitive appraisal) during labor, a stressful event, to impact health/illness outcomes for mother and fetus. Figure 1 presents a conceptual model of stress response/adaptation. This global conceptual model could be used to explain individual differences in stress response with a variety of stressful events, including life-threatening illness, surgery, undergoing an examination or death of a family member. This global conceptual model is congruent with current theoretical work on stress (Lowery, 1987). Fawcett (1984) provides a distinction between such global conceptual models and theoretical models. She identifies theoretical models, which guide research, as those that deal with one or more specific, concrete concepts and propositions.

Figure 2 presents such a specific application or a conceptual model and displays a theoretical Model of Maternal Stress Response/Adaptation. This theoretical

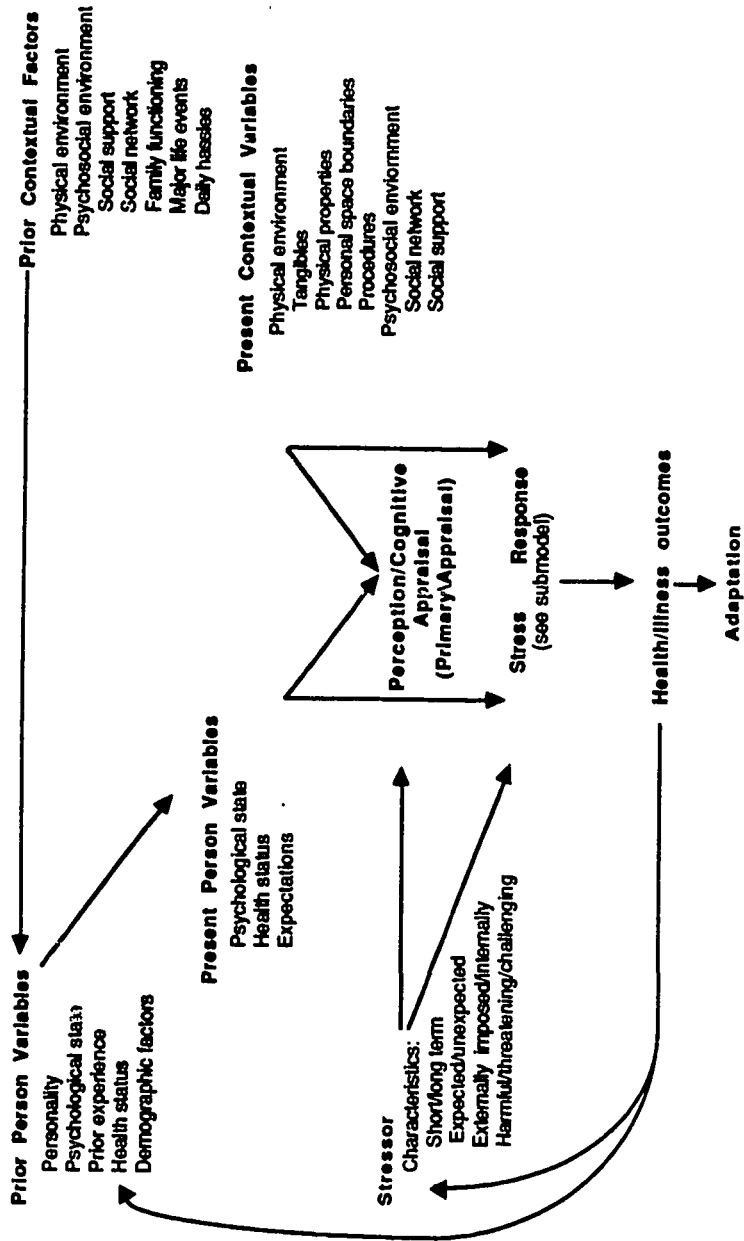


Figure 1. Conceptual Model of Stress Response/Adaptation

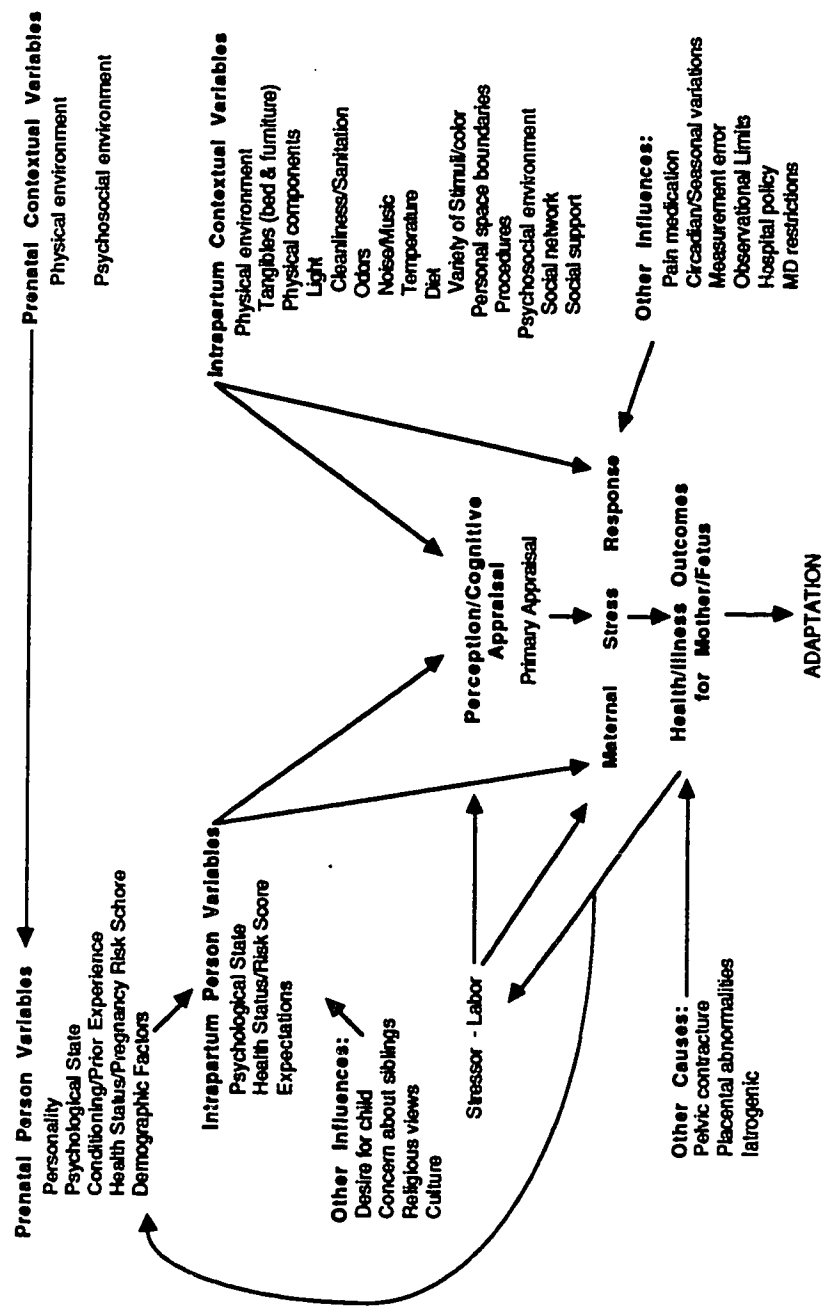


Figure 2. Theoretical Model of Maternal Stress Response/Adaptation

model is specifically proposed for women experiencing childbirth but it remains congruent with the larger more global conceptual model. The theoretical model of maternal stress response/adaptation has guided the development of this research and will influence the development of a program of study. Figure 3 displays a submodel of maternal stress response and portrays the placement of the current study in the theoretical model presented. Variables measured in the study are included in the figure. Further analysis of the theoretical model follows.

A theoretical model of Maternal Stress Response/Adaptation is complex, multidimensional, additive and interactive. Major sets of variables, relationships between sets and within sets (when this is known) are discussed below. In addition, assumptions and issues underlying the model are addressed. Finally, a few words are included on other influences on variables within the model.

General Comments

The individual is in continual interaction with her environment or context for the purpose of successful existence or adaptation. Successful adaptation is defined as survival, meeting one's own physical and psychosocial needs and participation in the continuation of the species. Figures 2 and 3 depict a specific theoretical application of the stress response/adaptation process, while Figure 1

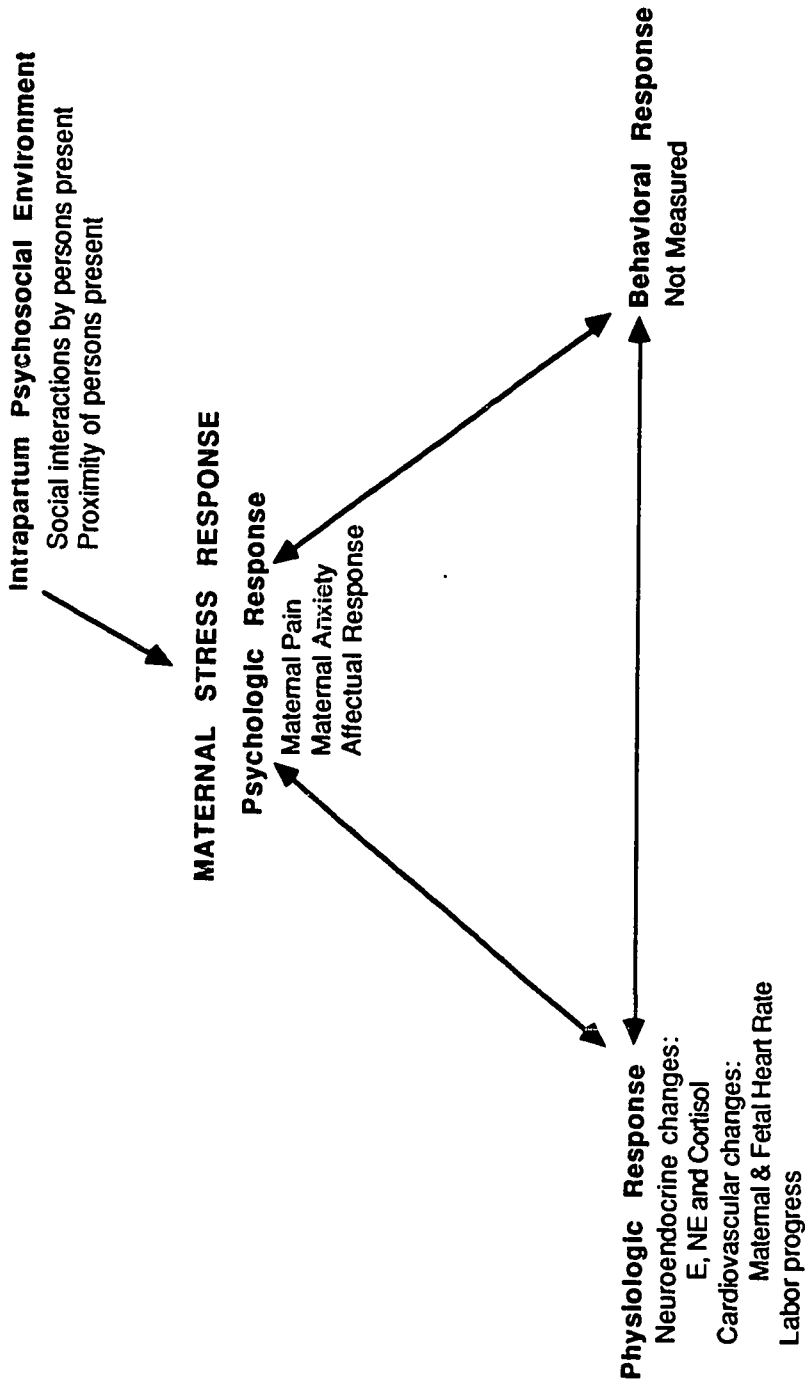


Figure 3. Submodel of Maternal Stress Response

presents a generalized, conceptual view. Variables in both models are organized in the following sets: 1) person variables (prior and present); 2) contextual variables (prior and present); 3) stressors; 4) perception/cognitive appraisal; 5) stress response; and 6) health/illness outcomes.

Person Variables

Prior person variables (Prenatal Person Variables) that are considered to influence maternal stress response include many prenatal person characteristics or states such as personality, psychological state (anxiety, fear, depression, world view, locus of control, type A/B, self-esteem and sense of mastery), conditioning, prior experience, health status and demographic factors. Present person variables (Intrapartum Person Variables) during childbirth include some of the same person characteristics or states but at a different time period, during labor. One cannot assume that all person variables are stable throughout pregnancy and labor. For example, anxiety level and sense of mastery may be very different during pregnancy as compared to labor. Health status could also change drastically. In addition, expectations of the labor and birth experience may influence perception and maternal stress response. On the other hand, personality may be quite stable over long periods of time and may not need to be assessed at both times.

All of these person factors influence perception (Rose, 1980). Perception is a process of awareness by which patterns of stimuli are recognized in a meaningful way by the individual. Perceptive processes serve as a background from which meaning is ascribed to an event and relevant adaptive responses emerge. Therefore, meaning is not an inherent quality of an experience but is the result of interpretation (Schutz, 1962). Thus different individuals may assign different meanings to the same pattern of stimuli based on their past experiences (previous labors, vicarious experiences), conditioning (childbirth education), demographic factors (age, marital status, number of previous children) or psychological state (anxiety, sense of mastery). The meaning ascribed then determines the relevant responses as the person attempts to achieve stability between herself and the environment. These responses form the basis for the patterns of stress response.

Contextual Variables

Prior contextual variables (Prenatal Contextual Variables) that are considered to influence maternal stress response include prenatal environmental properties, such as the physical environment (i.e., presence of pollutants, radiation, cigarette smoke, adequate housing, etc.) and the psychosocial environment, including amount and type of social support, social network characteristics, family

functioning, major life events and daily hassles. Present contextual variables (Intrapartum Contextual Variables) during childbirth are also of two types, physical and psychosocial. The variables encompassed by this physical dimension include tangible components, such as furniture and equipment, over personal space boundaries and procedures. The tangible components and other physical properties may either promote a sense of familiarity or depersonalization. Limitations may be imposed on the woman's personal space in varying degrees by the physical dimensions or other aspects of the physical environment. For example, if connected to an electronic fetal monitor, the woman can only assume certain positions in bed and cannot move freely about. Another element of the physical environment is the procedures designed to assist, maintain or promote maternal/fetal well-being. Devices such as those used to monitor or administer intravenous fluids are usually unfamiliar to the woman and are not used under her control or direction.

The intrapartum psychosocial environment has not been characterized adequately in the literature. However, the concepts of social network and social support can be used to try to delineate it. Social network is limited to a few key individuals during labor, usually the partner, nurse and other care providers, and there is limited information on the appropriate number of social ties needed by the

woman at that time. Therefore, the functional aspects of the social environment become more pertinent. The literature conceptualizes this functional aspect of the social environment as social support or the dynamic process of interpersonal exchange that influences the cognitive, emotional and physiologic welfare of the recipient with the intention of fostering adaptation within a certain environment (Caplan, 1974). Intention should be highlighted as it is often the intention of the social network participants to provide supportive functions; however, these are sometimes viewed as nonsupportive, threatening or negative by the woman herself. As implied, support is a bidirectional process that may depend on the characteristics of the recipient as well as the roles and functions of the supporter. Normal, healthy individuals engage in an equal exchange of affect and instrumental support with their social network (Pattison & Pattison, 1981). The hospitalized, laboring woman may not be capable of such equal exchange and may experience alterations in the nature of the support needed as well as structural changes in the availability and frequency of contact with social network participants as labor progresses.

The presence of significant others and hospital staff providing "caring behaviors" may influence an individual woman's adaptation to stressful stimuli during labor. Swanson-Kauffman (1986) examined caretaking behaviors as

they related to the human experience of miscarriage. Her qualitative analysis of statements from 20 women who experienced miscarriage identified their "caring needs." Nursing care can then be directed at meeting the caring needs of women who experience such perinatal loss. Her dimensions of caring include knowing, being with, doing for, enabling and maintaining belief. These dimensions of caring can be used to define and operationalize the concept of relational social support within the context of labor. Table 1 summarizes Swanson-Kauffman's dimensions of caring and presents indicators of these caring behaviors that could be observed in the childbirth environment. Swanson-Kauffman's caring and relational social support involves assistance, maintenance and validation of the recipient. The bidirectional nature of this caring or support, as mentioned above, still presents a measurement dilemma. If caring behaviors are observed by a researcher, they will need to be validated by the woman herself. The woman's perception of caring may be more important than the actual observations. However, these subjective reports are subject to the influence of the woman's prior expectations. Observing emotional tone/affect of the recipient (through verbal and nonverbal cues) along with the caring behaviors of the supporters will lend a clue to the supportive or nonsupportive nature of the caring behaviors.

Table 1

Indications of Social Support in the Childbirth Environment

Swanson-Kauffman's Dimensions of Caring	Indicators of Relational Social Support
1. Knowing - understanding the woman's personal beliefs; personalized care.	1. Caretaker shows awareness of name, preferences (birth plan) of women; shows individual regard; aware of needs; aware of the meaning of labor and childbirth to the woman.
2. Being with - feeling with the person developing a person to person relationship.	2. Presence of caretaker at side of the laboring woman; eye contact; touching; taking time with the woman.
3. Doing for - comforting maintenance acts, protective/restorative behaviors, helping, succor.	3. Comfort measures; health maintenance acts; helping behaviors; protective behaviors; restorative behaviors; succor (Leininger).
4. Enabling - giving information; being sensitive to timing.	4. Caretaker performs acts that help the woman gain more self-knowledge, self-control, or readiness for self-healing regardless of health status.
5. Maintaining belief - woman seen as functional and capable; foster belief in self to get through an experience.	5. Caretaker provides encouraging words; encourages belief that the woman will get through labor and accomplish her goals.

Relationship of Person Variables and Contextual Variables

The person variables and contextual variables continually influence perception/cognitive appraisal throughout labor. It is this interplay of the person and her environmental context that seems to determine the type and amount of stress response. Thus adaptation is determined in part by environmental factors and by those of the person (Kiritz & Moos, 1974). Lazarus and Hagens (1968) found that physical factors did not affect a stress significantly. The personal relationship between the patient and others was the most crucial factor in their study. Thus, it seems that the social environment exerts a stronger effect (hopefully positive) on individual adaptation than perception of the physical environment. This is probably true in the childbirth environment as well. The physical environment is highly controlled and relatively free of obvious physical threats to survival.

The Stressor: Labor

The stressor, in this case, labor (Stressor in Figure 2), and its characteristics (amount of pain, length of time, predictability and controllability) has also been identified as a determinant of the stress response (Frankenhaeser, 1981; Mason, 1975). The stressor may influence maternal perception through cognitive processing and/or directly influence stress response (through subcortical processes). For example, during labor a woman

may experience a slow passage of time and cognitively assess this situation as stressful. She may also experience direct physiologic alterations.

Perception/Cognitive Appraisal

Person and contextual variables influence the individual's perception and cognitive appraisal. The individual assignment of meaning to an event, as threatening, challenging, novel or harmful, is indicated by psychological, physiological and behavioral responses. This state of arousal or stress response is composed of these three major sets of dimensions (Mason, 1975; Henry & Ely, 1980; Scott, Oberst & Dropkin, 1980; Riley & Furedy, 1985; & Wild & Hanes, 1976).

Cognitive appraisal is described as the individual process of categorizing an encounter and all its facets, with respect to significance to well-being (Lazarus & Folkman, 1984). Cognitive appraisal is an intrapsychic process in the individual that serves an evaluative function, but cannot be measured directly. There are two stages to cognitive appraisal: primary and secondary. During primary appraisal, the person identifies an encounter as irrelevant, benign-positive or stressful. Most women appraise labor as a stressful event. Stress appraisals are further broken down into those that present harm/loss, threat or challenge. Patterns of maternal response may reflect type of stress appraisal. Lazarus and

Folkman (1984) state that stress appraisals are not mutually exclusive and may shift as an encounter unfolds. This may certainly be the case during labor.

Johnson and Rice (1974) studied distress resulting from clinically induced pain in 52 male subjects. Subjects were randomly assigned to four different informational conditions. Data suggest that alterations of cognitive appraisal through the provision of sensory information influences stress response, as measured by distress ratings in this study. Further work of Johnson, Rice, Fuller and Endress (1978) investigated the influence of sensory information and coping strategy instructions on recovery from surgery (n=81). Descriptions of typical sensations and events as well as instructions in coping activities were found to dampen negative moods postoperatively, hasten recovery and decrease length of stay. These data also suggest that alterations in cognitive appraisal with sensory information and coping instructions influences stress response and health/illness outcomes. Environmental manipulation may also alter cognitive appraisal by increasing resources available for coping.

Maternal Stress Response

The maternal stress response (See Figure 3: Submodel of the Theory of Maternal Stress/Adaptation) is composed of three sets of dimensions: the psychological, physiological and behavioral response. Psychological response includes

secondary appraisal. Secondary appraisal occurs in order to assess what can be done to manage the situation. The affective reaction to a stressor occurs as a response to the interplay between primary and secondary appraisals. Various emotions, including anxiety, fear, uncertainty, sense of mastery, are shaped by the cognitive appraisal process (Lazarus & Folkman, 1984). The individual's subjective reports or observations of verbal and nonverbal cues of anxiety, fear, uncertainty and control represent possible indicators of the psychological response dimension.

Stress parameters most frequently used to reflect the physiological response dimension include neuroendocrine and cardiovascular changes. Neuroendocrine changes and alterations in neurochemicals (transmitters and regulators) and hormones have long been associated with the stress response. Cannon's work (1927) outlines the classic description of the activation of the sympathoadrenal medullary (SAM) axis as part of the fight or flight syndrome with norepinephrine (NE) and epinephrine (E) as the major neurochemicals. Selye (1974, 1979) identified the general adaptation syndrome, described as the activation of the pituitary adrenalcortical (PAC) axis, with cortisol as the major hormonal agent. Selye and Cannon both supported a theory of non-specificity in the stress response. However, the research of Mason (1971,

1974) and Henry and Ely (1979) supports a theory of specificity for PAC and/or SAM responses based on differences in the individual's perception of the stressor. PAC response is assessed utilizing measures of cortisol, ACTH and the gonadotropin hormones. SAM response is assessed utilizing E and NE measures. These same neuroendocrines and hormones are involved in maternal stress response and effect labor through further alteration of maternal/fetal physiologic, psychologic and behavioral response.

Cardiovascular change, another aspect of physiologic response, is primarily observed in end-organ and peripheral vascular response. In laboring women, cardiovascular change most notably affects uterine musculature and vasculature, heart rate and blood pressure. These changes are mediated by E, NE and cortisol, which when levels notably increase, stimulate vasoconstriction and decreased myometrial activity. This leads to the production of uterine/placental hypoxia (lack of oxygen) and is clinically observed as lack of progress in labor (arrest of labor, prolonged or dysfunctional labor) and/or fetal distress. Uterine contraction patterns and fetal heart rate patterns are commonly used as clinical indicators of end-organ response. Maternal heart rate and/or blood pressure can also be monitored to obtain information on peripheral vascular response.

Behavioral response includes overtly observable behaviors, such as maternal positioning, proximity to others, movement (or restriction of movement), vocalizations (including verbal communications) and breathing.

Interrelationship of the Stress Response Dimensions

The psychological, physiological and behavioral dimensions of the stress response are interrelated. This interrelationship can take three possible forms: 1) a parallel relationship; 2) an epiphenomenologic relationship, where one dimension is a by-product of the other and depends upon it but does not interact or affect the other; or 3) an interactive relationship (Riley & Furedy, 1985). Most evidence points to an interactive relationship. Two types of interactive relationships can be identified: 1) a dualistic one, with the dimensions divided into separate worlds of the mind and body (Cartesian dualism) that somehow still interact; and 2) a monist one, with the three dimensions viewed as separate systems within the same world. The position taken in the model presented is one of interaction with the three dimensions as distinct systems, affecting and interacting with one another. Burchfield et al. (1985) suggest that psychological response is accompanied by physiologic response, but it is not known whether these systems act in parallel or are interactive. Lazarus and Folkman's cognitive appraisal theory supports the notion of the

psychological dimension as the prior cause for the physiological and behavioral response dimensions. Interactions then occur between all three dimensions.

Health/Illness Outcomes

Evidence is clear that stress response has implications for health/illness and is involved in disease processes such as heart disease, cancer, infection and high blood pressure. Health/illness outcomes influence successful adaptation/maladaptation and may also feedback to become a stressor, reactivating or intensifying the stress response. This feedback can be immediate as in the case of arrested labor, an outcome of stress response that increases pain and length of labor, changes predictability and controllability. Or, the feedback can be more long term and result in alterations of health status, such as infant developmental delay secondary to hypoxia and fetal distress.

Model Linkages

In order to fully explicate the theoretical model of Maternal Stress Response/Adaptation, the assumptions of the model and model linkages, with summaries of related empiric evidence, are presented. The placement of the present study in the theoretical model is presented.

Assumptions

The following assumptions underlie the theoretical model of maternal stress response/adaptation: 1) The

person and the context are open systems that interact with each other; 2) The impact of a stressor is determined by the interaction between person variables and contextual variables; 3) Stressors arise from the context or from within the person; 4) Context is external to the person; 5) Stress is not measurable solely as a stimulus or a response but as a transaction; 6) Stress response can be effected by resources from the context and/or the person; 7) Cognitive appraisal effects stress response and is not directly measurable except through subjective assessment; 8) Characteristics of the stressor effect the stress response; and 9) Labor is a stressful event.

Model Linkages: Person and Contextual Variables and Stress Response

Prior and present person and contextual variables increase/decrease susceptibility to illness outcomes for mother/fetus as mediated by maternal stress response. Several studies indicate that the pathological effects of stress response can be modified by the availability of various sources of social support (Broadhead et al., 1983; Diamond & Jones, 1983; Kahn & Antonucci, 1980). Norbeck and Tilden (1983) studied prenatal life stresses and emotional social support. They found a significant relationship between increased life stress and gestational complications. Complications were also increased when life stresses were increased and tangible social support was

decreased. Cronenwett (1985) examined social network characteristics and perceived social support during the third trimester of pregnancy. Emotional and instrumental social support were important in explaining six week postpartum outcomes. However, this study did not measure stress response per se or labor outcomes. Nuckolls, Cassel and Kaplan (1972) performed a classic study relating maternal psychosocial assets, life crises and the outcome of pregnancy. They found high rates of pregnancy complications when life changes were high and favorable psychosocial assets (as measured by TAPPS) were low. Lederman et al. (1978, 1979) provides strong evidence for the relationship of maternal psychological factors (primarily anxiety) and stress response in labor. These studies correlate high maternal anxiety with high E, NE and cortisol. Maternal expectations and their effects on health/illness, as mediated by the stress response have not been studied.

Model Linkages: Maternal Stress Response and Health/Illness Outcomes

Maternal psychophysiologic response during labor influences maternal/fetal outcome. In labor, plasma E, NE and cortisol have been consistently found to be elevated above normal levels. Abnormally high levels of E have been associated with decreased uterine contractility (the uterus has sympathetic innervation), longer labors and changes in

fetal heart rate. This is probably due to the adrenergic effects on placental blood flow causing decreased placental perfusion and resulting in uterine and fetal hypoxia. High levels of NE and cortisol have also been correlated with increased length of labor, increased maternal anxiety and decreased uterine activity. Only Lederman et al. (1981) studied E, NE and cortisol in relation to maternal psychologic variables. No studies were found that discussed specific patterns of maternal stress response.

Maternal psychological response (cognitive and affective) influence pregnancy outcome. Many investigators have found a relationship between maternal anxiety and pregnancy outcome (Beck et al., 1980; Burnstein et al., 1974; Crandon, 1979, Erickson, 1976; Gorsuch & Key, 1974; Pilkowsky, 1972). Beck et al. (1980) studied maternal state anxiety on admission in labor. The level of maternal anxiety was predictive of length of labor. Erickson found that women who experienced uterine inertia, prolonged first stage labor and other labor complications scored, significantly higher on a scale measuring "fears for self" than did women who did not experience these complications. Whether this measures anxiety, uncertainty or something else can not be determined. Lederman, Lederman, Work, and McCann (1981) studied self-reports of anxiety during labor and correlated increased anxiety with elevated plasma E levels. Both anxiety and high E levels were correlated

with changes in uterine contractility and fetal heart rate. Reviews of Myers and Myers (1979) and Winston, and Shnider (1979) suggest that there is a detrimental effect of maternal excitement and anxiety on fetal heart rate patterns. Elevated E levels, resulting from maternal anxiety, can effect uterine blood flow to the fetus by constriction of uterine vasculature (Eskes, 1973; Marshall, 1977; Rosenfeld 1978; & Zuspan, 1962). Several studies have also reviewed the influence of fear and loss of control during labor. Scott-Palmer and Skevington (1981), Sherwen (1983), Willmuth (1975), Willmuth, Weaver & Borenstein (1978) all report an increased sense of mastery (control) and decreased fear with educational preparation for labor.

Maternal behavioral response influences maternal/fetal outcome. Such behavioral responses as positioning and restriction of movement influence the outcome of labor. Use of the recumbant position for labor is related to prolongation of labor (Caldeyro-Barcia, Noriega-Guerra, Cibils & Alvarez, 1960; Mendez-Bauer, 1975; Caldeyro-Barcia, 1979; and Roberts, 1980) and the development of supine hypotensive syndrome and aortal compression with resulting fetal distress (Caldeyro-Barcia, Bieniarz & Maqueda, 1966; Bieniarz, Caldevro-Barcia & Hashimoto, 1966; Ueland & Hanen, 1969; and Huch, 1970). Recumbant positions do not always facilitate fetal rotation and

descent, and therefore may prolong labor and adversely affect fetal condition or necessitate the use of other interventions with their own inherent risks (i.e., forceps) (Andrews, 1980; Borell & Fernstrom, 1967). Restriction of maternal ambulation is also related to prolonged labor and associated fetal effects (Flynn & Kelly, 1976; Diaz, 1978; Caldeyro-Barcia, 1979).

Model Linkages: Intrapartum Contextual Variables and Maternal Stress Response

The childbirth environment or context influences maternal stress response. The relationship between the childbirth environment and the parturient's stress response has not been thoroughly examined. Many studies have focused on the person variables. Few have viewed the context as a set of variables influencing maternal response. This study focused on a careful description of the childbirth social context while concurrently describing selected parameters of maternal stress response.

Other Influences

Confounding factors are present in the theoretical model in four locations. Other influences, such as the desire for a child, concern about siblings, religious interpretations of childbearing and culture may influence maternal psychological state and/or childbirth expectations. Other influences, such as pain medications and circadian/seasonal cycles may influence neuroendocrine

levels and other physiologic response indicators. In addition, measurement error is likely because of the complex assays required for neuroendocrine substances and the sometimes confusing measurement and interpretation of uterine contraction patterns and fetal heart rate patterns. Other causes, of health/illness outcomes for mother and fetus, not mediated by the stress response are possible. Pelvic contracture, placental abnormalities and/or a constitutionally large fetus can cause some of the same complications of labor as increased stress response (arrest of labor, prolonged or dysfunctional labor and/or fetal distress). Finally, other influences, such as observational limitations, restrictive hospital policy or physician preferences, may alter maternal behavioral response.

Summary

Despite these other influences, the theoretical model of maternal stress response/adaptation and the conceptual model of stress response/adaptation provide guidance for the investigation of individual differences in stress response. The theoretical model attempts to explain how maternal person and contextual variables effect cognitive appraisal and maternal stress response during labor, a stressful event, to impact immediate health/illness outcomes for mother and fetus with long-term implications for successful adaptation. The model does not require a

normative approach. Health/illness outcomes can be adaptive or maladaptive. Maternal stress response can be chronic or acute in nature. The general conceptual model can be applied to either situation and a variety of stressful events. Most importantly, nursing therapeutics can be directed at many different variables in the model to prevent stress response, to promote adaptive response and to identify and treat maladaptive response through a focus on person and/or contextual variables.

Conceptualization of the Childbirth Environment

Nightingale's Conceptualization

The concept of environment, although one of the four major concepts in most nursing theories, has been the least explicated. Nightingale's theory of nursing in Notes on Nursing (1859) can be used as a basis for viewing the nursing client within an environmental context. Although Nightingale did not use the term environment or context, she wrote extensively about the concept. She identified the environment as all external conditions and influences affecting the person. These conditions and influences were viewed as being capable of preventing, suppressing or contributing to disease and death, health and wellness. Nightingale focused on a relationship between nature, the sick person (patient or nursing client) and the immediate environment or sickroom. Nightingale stressed that nursing actions focus on the environment, as well as on the

patient, in order to place the person in an environment conducive to health. Other nursing theorists including Neuman (1982), Rogers (1980) and Rov (1984) have also identified the importance of viewing the nursing client in an environmental context.

Environment or context is external to the person. The environment and the person interact to influence stress response and adaptation (Lazarus & Folkman, 1984). The environment is either a source of stressors, resources or both, dependent upon the characteristics of the individual person and the specific circumstances. For the purpose of this study, the place of labor and birth, the childbirth environment is the context of interest. The goals of the childbirth environment are: 1) to ensure the physical safety and well-being of mother and infant; 2) to enhance parents' sense of self-esteem; 3) to provide a satisfying emotional experience; and 4) to promote family attachment.

Nightingale discussed three dimensions of the environment: physical, psychological and social. These dimensions were viewed as interrelated, not distinct. Her conceptual framework of environment, as adapted by Torres (1980), can be seen in Figure 4.

The Inanimate Dimension

The three dimensions can be reclassified as either animate or inanimate. The inanimate refers to the physical dimension, which is either natural or man-made (Yarrow

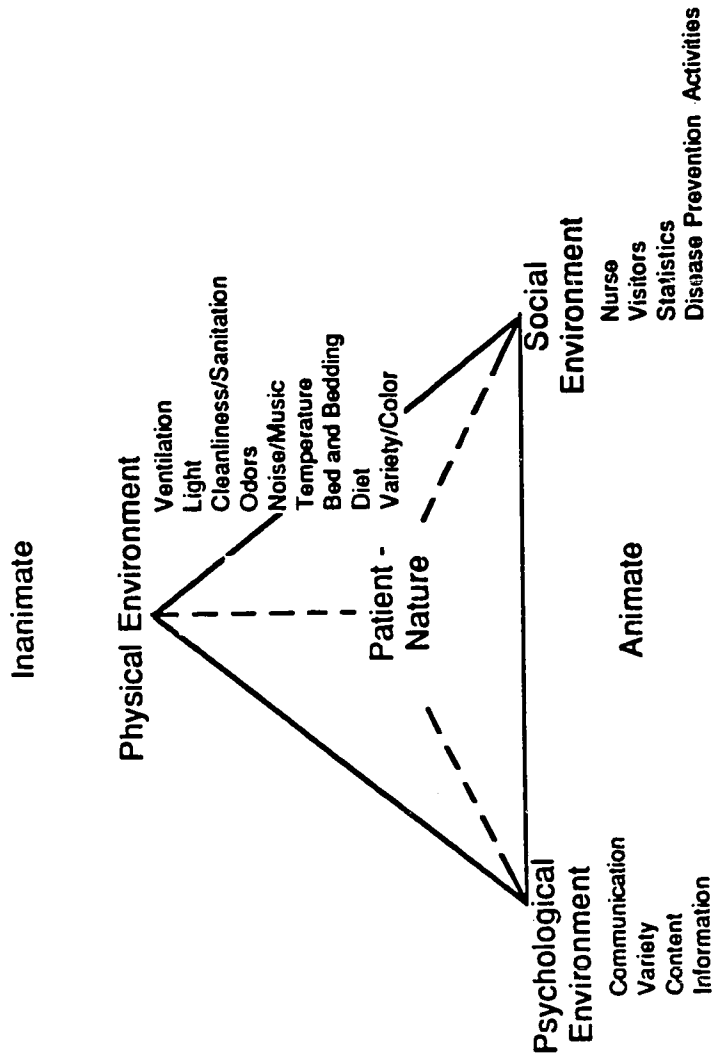


Figure 4. Nightingale's Conceptual Framework of Environment

Rubenstein, Pedersen & Jankowski 1972). Nightingale emphasized the importance of the physical environment probably reflecting the situation at her time in history. She also stressed that when the physical environment was adequate, more attention could and should be paid to the psychological and social dimensions. A stressful physical environment was seen by Nightingale as affecting the patient's emotional state. Nightingale outlined components of the physical environment that should be attended to including ventilation, light, cleanliness, odors (effluvia), noise/music, temperature, bed and bedding, diet, sanitation and variety of stimuli/color.

The physical dimension of the childbirth environment also refers to the biophysical world surrounding the childbearing woman. It can be proximal or distal. The labor and birth physical environment is proximal, while prenatal physical contextual features, such as the presence of environmental toxins, are distal. The childbirth physical dimension is inanimate and it can be natural or man-made, familiar or unfamiliar. Components of the childbirth physical environment include: tangible components (e.g., equipment, bed and bedding), physical properties including ventilation, light, cleanliness/sanitation, odors, noise/music, temperature, diet, variety of stimuli/color and personal space boundaries. These

components can be measured or described to characterize the inanimate physical dimension of the childbirth environment.

However, many of these components of the physical childbirth environment are highly regulated and standardized in hospital labor and delivery units today. Ventilation and cleanliness/sanitation are regulated by extensive infection control policies. Equipment and furniture, as well as other tangible components of the physical environment, are also very standardized. Most women encounter an electronic fetal monitor, a standard labor bed/delivery table or combination labor/delivery bed. Most labor rooms have been redecorated to have home-like features, including prints on walls, sheets and curtains, wallpaper and pleasing colors. Variety of stimuli/color has been somewhat standardized by these changes. Light, presence of odors, noise/music and temperature still vary but within commonly accepted parameters. Diet is determined by physician preference and maternal status in labor. Personal space boundaries may range from limited to unlimited. Most hospitalized women today experience limited personal space boundaries during active labor due to attachment to the electronic fetal monitor. They must stay in bed or stand near the bed in order to be monitored. Telemetric monitoring may change this. Procedures, including vaginal examinations, monitoring of vital signs, administration of intravenous fluids and fetal monitoring

are all commonplace events in the hospital childbirth environment.

In summary, many of the components of the hospital childbirth physical environment are regulated and standardized, allowing for little variation, but providing a safe, non-threatening and in some instances, physically-pleasing surrounding for the childbearing woman and her family.

The Animate Dimension

The animate environment refers to the psychological and social dimensions of the environment. The animate environment includes stimuli transmitted through interaction with living things (Moos, 1973; Yarrow, Rubenstein, Pedersen, & Jankowski (1972). Nightingale's components of the psychological dimension of the environment include communication, information, variety and content. These components arising from the psychological dimension, were viewed as having psychological effects. The social dimension was linked to the psychological, as the nurse and visitors were the usual sources of communication, information, variety and content. Nightingale also addressed components of the social environment in the broad sense. First, she emphasized the need for statistical data to be used to discuss individual patient needs to society at large. Secondly, she directed attention to disease prevention activities, thus relating aspects of the social

environment back to the physical, such as health practices of the community that might influence disease incidence (Nightingale, 1859).

The childbirth environment also has psychological and social dimensions. These dimensions are linked, like Nightingale's, and can be referred to as the psychosocial dimension of the childbirth environment. The childbirth psychosocial dimension is animate and the predominant components are relational activities, not unlike Nightingale's communication and information provided by the nurse and visitors. The relational activities of the childbirth psychosocial dimension can be examined through the use of the concepts of social network structure and social support. The childbirth psychosocial dimension can be distal or proximal. The intrapartum psychosocial dimension is proximal, while prenatal psychosocial features, such as the presence of an adequate support network, are distal. Some of these distal features of the psychosocial environment might also include aspects of Nightingale's broad societal concerns for disease prevention. For example, pregnant women are prenatally exposed to social features (e.g., lack of access to care and poverty) that influence pregnancy outcome. Changes in these distal features of the childbirth psychosocial environment could influence health/illness outcomes for women and their infants and prevent such poor outcomes as

low birth weight or other aspects of maternal/infant morbidity and mortality.

The intrapartum psychosocial environment has not been characterized adequately in the literature. The concepts of social network and social support can be used to delineate this dimension of the childbirth environment. Kahn and Antonucci (1980) describe the convoy or personal network structure through which aid, affect and affirmation are given and received by a person to moderate the effects of life stress and promote well-being. Mitchell (1969) also provides a structural focus for social support and defines it as a set of linkages among a defined set of individuals. Social network is limited to a few key persons during labor and there is limited research on the appropriate number of social ties needed by the laboring woman in our culture. Sosa et al. (1980) studied the effects of randomly assigning an untrained, unfamiliar woman to laboring primigravidae. The experimental group (n=20), who received the continued human presence during labor, showed a lower rate of perinatal problems (such as C-section rate) and shorter lengths of labor. These women were also more awake after delivery and stroked, smiled and talked to their babies more than the control group. The study did not correlate these effects with measures of anxiety or catecholamine response. However, it could be hypothesized that the experimental group was less anxious

and less stressed with a normal catecholamine response, that did not interfere with uterine contractility.

Most women in the United States today are attended by a significant other, usually the husband/partner, as well as nursing staff during labor. Therefore, the functional aspects of the social environment become more important. Kahn and Antonucci (1980) describe interpersonal interactions as the source of social support. Weiss (1974) and House (1981) also define social support as deriving from social relationships. House (1981) defines social support as four broad classes or types of supportive behaviors that flow between people including: 1) emotional support (empathy, caring, love and trust); 2) instrumental support (direct aid or assistance); 3) informational support, which provides the person with information for coping; and 4) appraisal support, information given to the person relevant to self-evaluation. The social support, or interpersonal exchange, which influences the cognitive, emotional and physiological welfare of the recipient (Caplan, 1974) becomes the component of interest in the childbirth psychosocial environment. Caretaking activities are the predominant type of interpersonal exchange during labor. These caretaking behaviors can be further delineated by Swanson-Kauffman's (1986) dimensions of caring including: knowing, being with, doing for, enabling and maintaining belief. These caring dimensions, as applied to the

childbirth environment, were used to construct the Labor Social Environment Observation Code (see Methods section). Caretaking activities involve both physical and psychosocial interchange between the woman and her caretakers, the nurse and her husband/partner. They are not unidirectional but interactive processes. Person factors, of the woman and her caretakers, will influence the interactive process that occurs with caretaking. Caretaking behaviors by labor support persons are usually intended to help the woman cope with the stress of labor. However, at times, they are viewed by the woman as nonsupportive, threatening or negative.

Two methodological issues are raised by this conceptualization of caretaking activities. First, it raises the question of who defines the supportive/nonsupportive nature of caretaking activities, the nurse or the woman, the researcher or the subject. Secondly, it raises the issue of whether or not caretaking needs of laboring women are universal, specific or some of both. This objective/subjective measurement dilemma can be partially resolved through the use of multiple methods. Objective observations using a validated behavioral coding scheme to record caretaking events and maternal effectual response can be compared to subjective interview data regarding the supportive/nonsupportive nature of caretaking activities by the nurse, partner and others. While

universal caretaking needs of laboring women are widely known and used as a basis for clinical practice, specific attention should be given to the person/environment fit for each individual laboring woman.

Person Environment Interaction

Kiritz and Moos (1974) were among the first to describe physiologic effects in the person due to the characteristics of the psychosocial environment. Their research supports the notion that different dimensions of the psychosocial environment can be distinguished and produce distinctive influences on physiologic response, including variation in corticosteroid production. Kornfeld (1972) characterized the hospital environment as physical (bricks and machines) and people, including physical contact. He also maintained that maladaptive cardiovascular, endocrine and other physiologic responses were activated by the hospital environment. Lundberg and Frankenhaeser (1980) go one step further in describing differential corticosteroid responses to varied psychological stressors in the environment. Their research showed differential response patterns of the Pituitary Adrenal Cortical System (PAC) and the Sympathetic Adrenal Medullary System (SAM) to different psychological environmental conditions. The SAM system was activated when the person was challenged and in control of the environment, while the PAC system was activated with a

conservation-withdrawal response. Frankenhaeser (1981), Mason (1970), and Lazarus and Folkman (1984) all agree that stress is a process of transactions between a person and her environment. Arousal of the SAM and PAC systems is determined by the individual's cognitive appraisal of the meaning of the stressor and the context in which the stimuli are embedded rather than the physical properties of the stimuli.

Few studies exist that examine person environment interaction with a childbirth focus. Hodnett and Abel (1986) examined person environment interaction as a determinant of the length of time in labor. This prospective study, of 80 women who chose home birth and 80 who chose hospital birth, assessed person characteristics including anxiety (STAI), childbirth expectations, expectations of control or mastery (LAS) and arousal seeking tendency (AST). The hospital childbirth environment was characterized as a high load environment with novel, complex and high levels of stimuli. The home childbirth environment was characterized as a low load environment with familiar, simple and low levels of stimuli. Although no data were presented, the researchers stated that there were differences in the psychosocial aspects of these two environments as well. They felt that the home childbirth environment contained a higher amount of positive psychological support than the hospital

environment. Their findings included: 1) higher anxiety levels in the hospital group; 2) higher levels of expectations of control and mastery in the home group; and 3) an interaction of arousal seeking tendency, length of labor and place of birth. AST predicted length of labor for both groups but home birth women with high AST had shorter labors, while hospital birth women with low AST had shorter labors. Although conclusions cannot be drawn from this study regarding the effects of home versus hospital settings for childbirth, it can be concluded that environmental stimuli, both physical and psychosocial, influence maternal psychophysiological response during labor.

Griffing (1983) examined blood pressure, pulse rate, cortisol, epinephrine and norepinephrine levels of women in two different physical environments, a traditional (hospital-like) labor and delivery room and a naturalistic (home-like) one. The pulse rates and blood pressures of the women in the naturalistic labor and birth environment were significantly lower than those in the traditional environment. Laboratory error rendered the cortisol and catecholamine measures useless. However, the findings of this study are suggestive of differences in psychophysiological response between the two groups due to differences in the physical environment.

Psychophysiological Response and Maternal/Infant Outcome

Maternal Anxiety

Maternal anxiety, an intrapsychic response, has been studied by many investigators and found to have a relationship to maternal/fetal outcome, specifically complications of labor and delivery. Anxiety may be defined as an emotional state characterized by feelings of nervousness, tension, worry, apprehension and heightened autonomic nervous system activity. Anxiety is a general intrapersonal response. While stress response can be intrapersonal, it is usually the result of a specific person-environment transaction stimulated by a specific event. Anxiety is the product of primary appraisal, while stress response involves coping and secondary appraisal (Lazarus & Folkman, 1984). Spielberger, Gorsuch and Luschene (1970) differentiated between state anxiety, a transitory emotional condition, and trait anxiety, a stable individual characteristic. Some research reports do not reflect this difference.

Research that measures anxiety during pregnancy should consider maternal age, education, history, marital status, parity and the timing of measurement (trimester of pregnancy) in the design (Lederman, 1984). Differences in obstetrical outcome and anxiety levels may be due to these factors alone and result in spurious findings. Despite the fact that most research designs have not included these

factors, self-reported anxiety is, to date, the most discriminating psychosocial measure for predicting maternal/fetal outcome (MacDonald, 1968; Chalmers, 1982; Istvan, 1986). A review of the research relating maternal anxiety to maternal/infant outcome follows.

Zuckerman et al. (1963) reported that anxiety, as reported by a checklist during pregnancy, was directly related to the amount of analgesic medication given during labor. One must assume that as anxiety increased, analgesia use increased with resultant effects on maternal-fetal outcome. These effects were not measured directly. Burnstein, Kinch and Stern (1974) measured anxiety during pregnancy but found no significant difference in prenatal anxiety between those women who had labor complications and those who did not. Anxiety was measured at an unspecified time during pregnancy and the sample was of mixed parity, which may account for the insignificant findings. Gorsuch and Key (1974) administered the STAI Trait Scale in the first or second trimesters to a mixed parity sample. The state scale was administered at monthly intervals following the initial trait scale assessment. The Schedule of Recent Events (SRE), a measure of life changes, was also administered during the first, second and third trimesters and after delivery. They reported that elevated trait anxiety during the first trimester was associated with pregnancy and labor abnormalities and high life changes

during the second and third trimesters were associated with pregnancy and labor abnormalities. They did not consider the moderating influence of social support and did not measure differences in social support in the sample. Crandon (1979) administered the Institutes for Personality and Abilities Testing Anxiety Self-Analysis Form (IPAT) to a group of pregnant women with unspecified parity during the third trimester to assess anxiety. The incidence of obstetric complications of all types was higher in the high anxiety group in contrast to the normal anxiety group. However, some of the obstetrical complications listed, such as manual removal of the placenta, hardly seemed related to psychological state. Use of the IPAT in studies of anxiety as related to obstetrical complications has also been criticized. The instrument is reportedly insensitive to acute changes in anxiety level that occur during pregnancy (Spielberger & Jacobs, 1979). The most commonly used instrument measuring anxiety during pregnancy is the Spielberger State Trait Anxiety Inventory (STAI). Several more recent studies have used the STAI.

Beck, Siegel, Davidson, Kormeier, Bretenstein, and Hall (1980) studied anxiety using the STAI in the third trimester and on admission in labor. The level of maternal state anxiety at labor admission, but not prenatal trait anxiety, was predictive of length of labor. Increased anxiety levels correlated with longer labors.

Lederman, Lederman, Work and McCann (1978)

investigated the relationships between maternal anxiety, progress in labor and selected biochemical correlates of stress. They measured maternal anxiety in married primigravid women (n=32) using the STAI state and trait scales prenatally and the state scale only at each of three time periods during labor, 1 to 2, 3 to 5, and 10 centimeters of dilation. Plasma for cortisol, epinephrine, and norepinephrine was also collected at these same intervals. Duration of labor from three centimeters to complete dilation and from complete dilation to delivery was calculated. Data show that higher epinephrine levels were associated with slower progress in labor and high anxiety levels. Epinephrine, a sympathetic adrenal medullary stress hormone that is highly responsive to anxiety, was identified as an intervening variable relating anxiety and slow or no labor progress.

Barnett and Parker (1986) conducted a study of highly anxious, moderately anxious and minimally anxious primiparous women (n=147) as determined by STAI during the postpartum period. Highly anxious mothers were more likely to have experienced labor and delivery complications and were more likely to have dysmature infants or infants who had feeding difficulty. While these findings are congruent with those of other studies, the retrospective assessment

of anxiety after delivery confuses possible correlates of anxiety with consequences or determinants of anxiety.

Norbeck and Tilden (1983) are among the few investigators of anxiety and obstetrical complications who controlled for preexisting maternal obstetric complications and demographics that might otherwise lead to spurious results. They recruited a sample of women screened for medical/obstetrical complications and administered a battery of instruments including a life change survey, the STAI, two social support measures, depression and self-esteem scales. In a series of multiple regression analyses controlling for medical/obstetrical and demographic factors, life change prior to pregnancy was related to pregnancy complications only, whereas a composite "emotional disequilibrium" score composed of the scores from the STAI, depression and self-esteem scales was related to neonatal complications only. In addition, an interaction effect was identified between life change and tangible social support. Subjects with the highest life change and lowest tangible support had the highest pregnancy and neonatal complications. Subjects with low life changes and low tangible support had higher rates of labor and delivery complications.

Despite the limitations of the reviewed research, it is obvious that a link exists between maternal emotional distress and poor reproductive outcome. Research supports

Rubin's (1975) contention that all fears and conflicts of pregnancy come together in the critical experience of labor and delivery. However, in order to clarify the specific role of anxiety, further study of this link may benefit from methodological guidance. Lederman (1984) and Istvan (1986) offer the following suggestions: 1) the use of prospective designs measuring anxiety during pregnancy; 2) multivariate design with serial data collection to identify correlates of anxiety; 3) the use of screening criteria to control for variables such as age, parity, preexisting medical/obstetrical complications, and race that may influence anxiety; 4) use of a theoretical framework for guidance in study design to enable theoretical consideration of possible patterns of relationships between anxiety and other variables; and 5) use of random sampling methods when possible.

While it is clear from the above studies that maternal anxiety is linked to complications of pregnancy, labor and delivery, further discussion of the underlying mechanisms is in order and will be presented in the next section.

Maternal Stress Hormones

Research with primates has outlined at least one mechanism that may account for poor obstetrical/neonatal outcomes as a consequence of maternal anxiety and activation of the sympathetic adrenal medullary system. This mechanism has been described the most clearly by Myers (1977) and Myers and Myers (1979) in several studies of

Rhesus monkeys. They showed that maternal stress, as induced by interaction with a handler during labor, resulted in elevations of epinephrine and norepinephrine, which reduced uterine blood flow. Reduction of uterine blood flow led to 1) decreased placental blood flow and fetal hypoxia; and 2) decreased uterine contractility with increased length of labor. Due to differences in placentation and the endocrinology of parturition between Rhesus monkeys and humans, further research with humans was reviewed.

Plasma epinephrine, norepinephrine and cortisol, three key neuroendocrine substances associated with the stress response, have all been found to be consistently elevated in normal human labor (Joupilla, Puolakka, Kaupilla, & Vuori, 1984; Lederman, Lederman, Work & McCann, 1978), 1979; Schnider, Aboud, Artal, Henriksen, Stefani, & Levinson, 1983). Abnormally high levels of epinephrine have been associated with decreased uterine contractility, longer labors and changes in fetal heart rate by these same investigators. Elevated epinephrine levels, resulting from increased maternal anxiety, affected blood flow to the uterus and fetus by constriction of the uterine and placental vasculature (Eskes, 1973; Marshall, 1977; Rosenfeld, 1978; & Zuspan, 1962). Abnormally high levels of norepinephrine and cortisol have also been correlated

with increased maternal anxiety, decreased uterine contractions and increased length of labor.

The two studies of Lederman et al. (1978, 1979), while not without methodological problems, provide the most convincing evidence for a relationship between maternal stress hormone elevation and outcome. These studies (n=32) were prospective, multivariate and controlled for age, parity and preexisting medical/obstetrical status. Increased maternal anxiety correlated with increased levels of epinephrine and increased fetal heart rate abnormalities. Increased norepinephrine and cortisol also correlated with fetal heart rate abnormalities and decreased uterine activity. It was hypothesized that increased levels of epinephrine acted on uterine beta receptors to cause vasoconstriction, decreased uterine contractility, increased length of labor and fetal heart abnormalities.

While these two studies provide a strong basis for the relationship of maternal anxiety, stress hormonal response and associated outcomes, several methodological problems exist that are almost unavoidable given the clinical setting of the studies. Nineteen of the 32 subjects received some form of medication, including narcotics, sedatives, tranquilizers, and infused oxytocin. Many of these may have affected duration of labor independently of maternal anxiety or epinephrine level. Group means for

anxiety and hormonal values were presented with no discussion of these groups separately. Within subject analysis may help to examine these complex interrelationships when other confounding variables are present. The Lederman et al. studies also suffered from laboratory error. The radioimmunoassay used to measure the catecholamines showed a large coefficient of variation ($\pm 32\%$). Its sensitivity to the range of catecholamines encountered in the subjects must be questioned. High Performance Liquid Chromatography (HPLC) is a more sensitive measure of catecholamines in all ranges. In addition, the Lederman et al. (1978, 1979) studies did not mention any environmental factors, such as physical surroundings or the presence of supportive others. Variations in these childbirth contextual variables may have influenced maternal anxiety and hormonal response. Avoidance of these three methodological concerns were considered in the present study design. A within subject approach was used to enable careful examination of responses when confounding variables, such as maternal medication use, were present. Improved laboratory assays were used. Finally, contextual variables were either described or controlled so that patterns of maternal anxiety, stress response hormones and outcome could be viewed as a person-environment transaction. The next section details the specific methods used.

Chapter 3

Methods

Design

This study sought to describe selected parameters of maternal stress response and the concurrent social interactions during childbirth. An intensive single-case, small-n, or within subjects' design was used due to the exploratory nature of this research and the complexity of the phenomena under study (Barlow & Hersen, 1984; Kazdin, 1982; Robinson & Foster, 1979). Multiple research methods were utilized to capture the complex nature of these phenomena and to establish convergent validity (Campbell & Fiske, 1959). The study also contained elements of a time series design as subjects were asked to submit to repeated measures of pulse, fetal heart rate, and social interaction during labor (Gottman, 1981). Manipulation of the social environment was not done; however, natural variations in social exchange permitted examination of its relationship to stress response.

Internal Validity and Generalizeability

The single-case design offers the following advantages: 1) detection of small variations in the variables under study; 2) control of certain extraneous

variables; and 3) intensive study of individual responses in relation to the environment (detection of patterns) (Mitchell, 1988). Frequent, repeated measures permit detection of patterns or alterations in level and slope (Kazdin, 1982). Repeated measures taken from an individual subject also decreased the influence of extraneous variables threatening internal validity, as each subject served as her own control (Robinson & Foster, 1979). Selection criteria also reduced the effect of extraneous variables. Characteristics of the subjects, such as age, parity, marital status, obstetrical/medical status, and prenatal preparation were controlled through the use of selection criteria. Instrumentation threats to internal validity were present and will be discussed at length in the instruments section.

Autocorrelation and cross correlation (between variables) are frequently viewed as threats to statistical validity (Cook & Campbell, 1979). However, in single-case design they are the aspects of interest. Single-case design seeks to discover these sources of variability so that future studies might control these to increase reliability and generalizeability (Barlow & Hersen, 1984). The patterns of relationships within and between social interactions and maternal/fetal stress parameters are best studied with frequent repeated measures. Aggregation of these data, though conducive to between subjects

comparisons, would obscure the patterns of interest. Alternative designs can be used if statistical validity is an issue. Generalizeability is based on the replications over subjects (Robinson & Foster, 1979).

The Setting

After obtaining the appropriate human subjects' approval, pregnant subjects were recruited from the waiting areas of several private group obstetrical practices. Prenatal data collection was conducted in the third trimester of pregnancy (mean 37.7 weeks gestation, range 36-39 weeks gestation). Data were collected in the subject's home or the physician's office.

The remainder of the study data were collected during childbirth (mean 40 weeks gestation, range 38-41.5 weeks gestation). The childbirth setting was a large metropolitan tertiary level obstetrical unit. This unit contained eight labor rooms, two of which were combination labor/delivery rooms. All rooms were private except one labor room which was semi-private. A surgical suite and standard delivery rooms were located nearby. A family lounge was also available. Labor rooms and combination rooms were furnished with standard hospital beds or labor/delivery beds, decorated with soft colors, print curtains, and pictures on the wall. Each room contained several chairs/stools, a bedside table, a large waste container, a large laundry container and an electronic

fetal monitor. IV poles and suction/oxygen outlets were located in a wall panel above each bed. Other equipment was usually located within built-in cupboards. Additional equipment was present in the combination rooms including a covered instrument table, baby warmer, and basins. All direct patient care in the obstetrical unit was provided by registered nurses. Nurse to patient ratio varied from 1:1 to 1:3 dependent upon the census of the unit and the patient's status in labor.

The Sample

Sample selection criteria included the following:

- 1) first childbirth; 2) married or in a partnered relationship; 3) English-speaking Caucasian female;
- 4) 18-40 years of age; 5) no known major obstetrical/medical complications; 6) low risk labor as defined by University of Washington Regional Perinatal Intrapartum Risk Criteria; and 7) childbirth preparation (classes) with partner planning to attend labor and birth. Socioeconomic level was identified. The study was limited to primigravidae as there are known differences in anxiety and autonomic response due to parity (Lederman, 1987). Participants were limited to those who were in a partnered relationship as differences in social support can influence pregnancy outcome (Norbeck & Tilden, 1983). An age criterion facilitated the low risk status of the sample with adolescent and elderly gravidae excluded from the

sample. Anxiety and life stress, factors influencing pregnancy outcome, may also be different for these women. Ethnic differences were also possible so the study was limited to Caucasians. The study was also limited to women with a low risk status at the onset of labor as obstetrical/medical complications may influence anxiety, stress response and/or social interchange in many ways. It was required that partners be present during the labor as they are critical components of the social environment during labor. The mere presence of supportive others has been known to influence maternal/fetal outcome (Susa et al., 1980).

A convenience sample was selected from the prenatal population of women in two private obstetrical practices who were willing to cooperate with the study. Potential subjects were identified and screened by the office nurse of each physician's practice. Initial contact and explanation of the study was provided by the researcher either on the telephone or in the doctor's office while women were waiting for a prenatal visit. Twenty women were contacted: 15 agreed to participate. Two delivered before completing any data collection while three completed only prenatal data collection. The remaining 10 participated in the entire study. Women who agreed to participate were to be admitted to the study hospital for childbirth, were in the third trimester and met the selection criteria as

determined by review of the Background Information Sheet (Appendix A).

Sample Size

Effect size of environmental variables and maternal stress response was difficult to estimate for this study as so little research has been done in this area. This study provides some descriptive information on effect size so that future experimental studies can be planned appropriately as far as statistical power is concerned. A large number of participants is not necessary or desired in single-case design as the examination of variance is within each subject. Each subject represents a sample with multiple data points or intrasubject replications (Kazdin, 1982). Single case methodology also allows one to analyze data as the study proceeds. Therefore, subjects were recruited until no new patterns of social interaction were encountered. Ten subjects participated in the study with data collection occurring prenatally, during labor and postpartum.

Instruments

The following section details the rationale for including various constructs, their measures and validity/reliability information. Table 2 summarizes the constructs and their measures.

Table 2

Guide to Constructs and Their Measures

Construct	Measure
1. <u>Maternal Stress Response</u>	
a. Psychologic Response: cognitive appraisal and affective responses.	Anxiety - STAI (State only in labor) Prenatal baseline T1 & T2 in labor ^a Pain - VAS Pain Line T1 & T2 in labor
b. Physiologic Response: neuroendocrine activation (PAC & SAM);	Plasma C, E & NE Prenatal baseline T1 & T2 in labor
End-organ response (uterine activity as measured by length of labor);	EFM to obtain fetal heart heart rate every 60 seconds from T1 to T2 Friedman Graphic Analysis of Labor - completed throughout labor
Peripheral changes: and	Maternal heart rate - every 60 seconds from T1 - T2
Central changes	Not measured

(Table 2 Continued)

Construct	Measures
c. Behavioral response: overt behaviors such as breathing, vocalizations, verbal communications, movements, position and proximity to others.	Not measured except proximity to others coded by observers during labor social interactions every 60 seconds from T1 to T2 ^a
2. <u>Childbirth Environment:</u>	
a. Physical dimension: tangibles, physical properties, procedures & personal space	Labor Physical Environment Checklist; Friedman Graphic Analysis of Labor
b. Psychosocial dimension: social interactions	Labor Social Environment Observational Code every 60 seconds form T1 - T2
Woman's perception of social environment	Semi-structured interview within 24 hrs. post delivery using an Interview Guide

^aT1 or Time 1 refers to the beginning of intensive observations at 5-6 cms. T1 or Time 2 refers to the end of these observations 90 minutes later or 10 cms., whichever occurs first.

Maternal Stress Response

Psychologic Response Measures

The stress response has three major components: psychologic, physiologic and behavioral response (Mason, 1975; Scott, Oberst & Dropkin, 1983; Riley & Furedy, 1985; Wild & Hanes, 1976). Psychologic response includes the affective and cognitive results of cognitive appraisal, including the perception of stress as harm/loss threat or challenge (Lazarus & Folkman, 1986). As cognitive appraisal is a complex intrapsychic event, its measurement proposes great difficulty. However, many researchers have identified subjective reports of maternal anxiety and pain as the most salient indicators of psychologic response during labor.

Maternal anxiety. Anxiety, an intrapsychic response, has been studied by many investigators and found to have a relationship to maternal/fetal labor outcome. Beck et al. (1980), Burnstein et al. (1984) and Pilkowsky (1971) suggest that maternal anxiety affects maternal/fetal outcome through increased stress response. Beck et al. (1980) studied maternal state anxiety on admission in labor. The level of maternal state anxiety was predictive of length of labor. Increased anxiety levels correlated with longer labors in the Lederman et al. (1979, 1981) studies as well. Both McDonald (1980) and Chalmers (1983)

conclude that maternal anxiety is the most predictive variable related to maternal/fetal outcome.

The Spielberger State-Trait Anxiety Inventory (STAI) was administered prenatally during the third trimester (range 36-39 weeks gestation. mean 37.7 weeks gestation). This 40 item self-report instrument provides separate measures of state and trait anxiety and was used to:

- 1) describe the representativeness of the sample when compared to the anxiety measures of pregnant women obtained in other similar studies; and 2) provide a baseline measure of state anxiety before labor. The STAI has evidence of reliability and validity and has been used extensively with obstetrical samples. The STAI trait scale correlates highly with other measures of trait anxiety including .75 (Pearson r) with the Cattells IPAT Anxiety Scale and .80 with the Taylor Manifest Anxiety Scale (STAI Manual). Test-retest reliability at one week intervals is somewhat lower with the state scale with moderate correlations of .44 and .55 (Spielberger, Gorsuch & Luschene, 1970) (Appendix B). The STAI state scale was also administered twice during labor at Time 1 in early active labor; and at Time 2 in late active labor.

Pain. The pain of labor alone could contribute to maternal stress response. Therefore, a visual analog scale (VAS) pain line of 10 centimeters in length was used twice during labor, at Time 1 and Time 2, to assess this

variable. Women were asked to draw a line on the scale to indicate what level their pain was at at this point in labor. Although this measure was unidimensional and obtained information relating only to intensity, it has been proven to be reliable with laboring women (Chapman, Casey, Dubner, Foley, Gracely, & Reading, 1985; Gerhard, 1987; McGuire, 1984; Revill, Robinson, Rosen & Hogg, 1976). In addition, it was easy to use during labor where a longer more involved scale might prove burdensome (Appendix B).

Physiologic Response Measures

Physiologic response includes the activation of Pituitary Adrenal Cortical (PAC) and/or Sympathetic Adrenal Medullary (SAM) Systems, resulting in the secretion of a complex array of neuroendocrines; end-organ response (primarily observed in uterine musculature and vasculature during labor); peripheral changes in heart rate, blood pressure and electrodermal activity; and central changes in EEG.

Cortisol and catecholamines. Plasma epinephrine (E), norepinephrine (NE) and cortisol (C), three key neuroendocrine substances associated with SAM and PAC activation respectively, have consistently been found to be elevated during normal and complicated human labors (Burns, 1976; Joupilla, Puolakka, Kauppila & Vouri, 1984; Lederman, Lederman, Work & McCann, 1979, 1978; Schnider, Abboud,

Artal, Henriksen, Stefani & Levinson, 1983; Wladimiroff, Lo, Meier, Lamberts & Schalekamp, 1983). Abnormally high levels of E and NE have been associated with decreased uterine contractility, longer labors and changes in fetal heart rate. This is probably due to the adrenergic effects on the uterine musculature and vasculature causing uterine hypoxia, decreased placental perfusion and eventually fetal hypoxia (Garrett, 1954; Levinson & Schnider, 1979; Moawad, 1973; Pinto, Lerner, Pntelli & Rabow, 1968). High levels of cortisol have also been associated with increased length of labor, increased maternal anxiety, decreased uterine activity and fetal heart rate changes by these same investigators.

Cortisol was assayed from plasma obtained through an indwelling heparin lock or intravenous line prenatally, as a baseline, and twice during labor. The Coat-a-Count Kit (Diagnostics, Inc.), a simple radioimmunoassay, which requires minimal sample preparation, was used. This procedure has a high degree of specificity (validity) for cortisol, with very low cross-reactivity with other substances (Coat-a-Count Manual, 1987). Sensitivity for cortisol was linear to the picogram/ml. range, which proved adequate with labor values. The kit was also equipped with calibration standards in order to run an internal standard curve. Precision was high with as little as 0.2 micrograms/dl. of cortisol detected. Samples were frozen

to be run after all were obtained. This assay required only 25 microliters (.025 ml.) of plasma to determine cortisol levels. Two cc of whole blood were obtained, the plasma separated and frozen. Adequate plasma was obtained so that duplicates were run on all samples. Baseline measures were obtained during the third trimester in the morning (0800-0900) following a standardized procedure to minimize the effects of circadian variation, maternal position and venipuncture itself (Appendix D. Labor samples were, of necessity, obtained at varying times in a 24 hour cycle.

High performance liquid chromatography (HPLC) with electrochemical detection (LCEC) has proved to be a sensitive, cost effective method for the measurement of the catecholamines (Hjemsdahl et al., 1979). This method has been correlated with the more expensive, time consuming and difficult radioactive methods with excellent specificity and sensitivity. Sensitivity to E and NE is linear to the picogram/ml. range, which proves adequate for labor values. The Plasma Catecholamine HPLC Analysis Kit (ESA, Inc.) was utilized to assay epinephrine and norepinephrine. Reliability and validity of the assay was established by using calibration standards to run an internal standard curve for each run of catecholamines. Duplicates of all samples were run.

Specific attention was paid to the validity and reliability of both of these biochemical measures by:

- 1) adopting a specific kit or assay for each (Coat-a-Count for Cortisol and Plasma Catecholamine HPLC Assay for catecholamines);
- 2) standardization of collection procedures;
- and 3) collection of adequate plasma to allow for duplicate runs on all samples (a coefficient of variation was calculated for paired samples to check the reproducibility of the assay);
- 4) freezing of samples as they were obtained so that they can be run in a batch;
- 5) running known standards for cortisol and the catecholamines with construction of a standard curve to check linearity, range and sensitivity of the assay; and
- 6) conduction of a pilot test to determine the best method for collection and storage procedures that might be problematic.

Cortisol, E and NE were measured once as a prenatal baseline and twice during labor, before and after the 90 minute observation period of maternal social interactions (Time 1 and Time 2).

Fetal heart rate. Maternal end-organ response during stress in labor is observed in the uterine musculature and vasculature. Uterine contraction and fetal heart rate patterns, as assessed by standard fetal monitoring equipment, are commonly used indicators of uterine and/or fetal hypoxia. These measures provide an assessment of labor progress and fetal status. A Hewlett-Packard 8040A,

Dual Capacity Electronic Fetal Monitor (EFM), was utilized to obtain repeated measures of fetal heart rate every 60 seconds throughout active labor (6-10 cms. or 6 cms. plus 90 minutes of active labor). Placement of the ultrasonic transducer or external fetal monitor was, per hospital routine, on the maternal abdomen over the area of best fetal heart sound transmission. Continuous EFM was standard practice in the study setting and was not instituted because of the needs of the study. Although the information obtained by internal fetal monitoring is of greater validity, external monitoring, which was less invasive, was adequate for the purposes of this study. If internal monitoring with direct fetal scalp electrode attachment was instituted, due to physician preference or necessity, fetal heart rate data were also obtained from it. The proper functioning and calibration of equipment was checked prior to each subject's use of EFM.

Maternal heart rate. Peripheral changes in maternal physiologic response during stress in labor were assessed by repeated measures of heart rate. The Hewlett-Packard 8040A Dual Capacity Electronic Fetal Monitor has the capacity to obtain maternal electrocardiographic (ECG) signals and external ultrasonic fetal signals simultaneously. Subjects were asked to wear a three lead ECG monitor attached to the 8040A. Maternal heart rate was obtained every 60 seconds during active labor (from Time 1

to Time 2). As this measure may be affected by technique, a standard protocol was followed in attaching the maternal ECG leads.

Labor outcome. Labor progress was also assessed using the Friedman Graphic Analysis of Labor, which was already a standard part of the hospital labor and delivery record (Appendix E). Labor progress, as defined by cervical dilation and fetal descent over time, medications, and procedures were all recorded on this time plot of labor.

Computerized Data Acquisition System

A cable was designed by Robert Jaeger, University of Washington Department of Physiology and Biophysics, to obtain the analogue output of the electronic signals of maternal heart rate and fetal heart rate from the Hewlett-Packard 8040A Dual Capacity Fetal Monitor. The electronic signals for maternal and fetal heart rate were calibrated using a volt meter and random heart rate generator. These signals were then digitalized (Remote Measurement Systems ADC-1) and entered into a portable, battery-operated computer (Radio Shack TRS-80 Model 102). Calibration files were stored in the computer's memory to convert the electronic signals to digital data. Data were both stored internally and printed out every 60 seconds by a portable, battery-operated printer (Radio Shack TRP 100). The computerized data acquisition system is depicted in

Figure 5. Data were automatically collected every 60 seconds. Sampling and recording of the two heart rate variables took approximately 5 seconds. Therefore, the actual time recorded in each interval is 55 seconds. This "data loss" of 5 seconds had little effect on the variables measured and coincided with the interval for observational data, where 5 seconds were spent in observing and 55 seconds spent recording and awaiting the next interval. In addition, this measurement error was consistent across all subjects. Following the completion of data collection for each subject, heart rate data were downloaded to a portable disk drive and transferred to a mainframe computer.

Behavioral Response Measures

Behavioral response includes those behavioral events that are overtly observable such as breathing, vocalization/verbal communications, movement, position and proximity to others. Behavioral responses were not measured in this study.

The Childbirth Environment

Aspects of the childbirth environment, such as the physical and psychosocial surroundings in the labor and birth suite, may influence maternal stress response. The childbirth environment can be seen as a source of Figure 5 stressors, resources or both, dependent upon the individual woman's characteristics and those of the labor and delivery environment (Standley & Nicholson, 1980). Many researchers

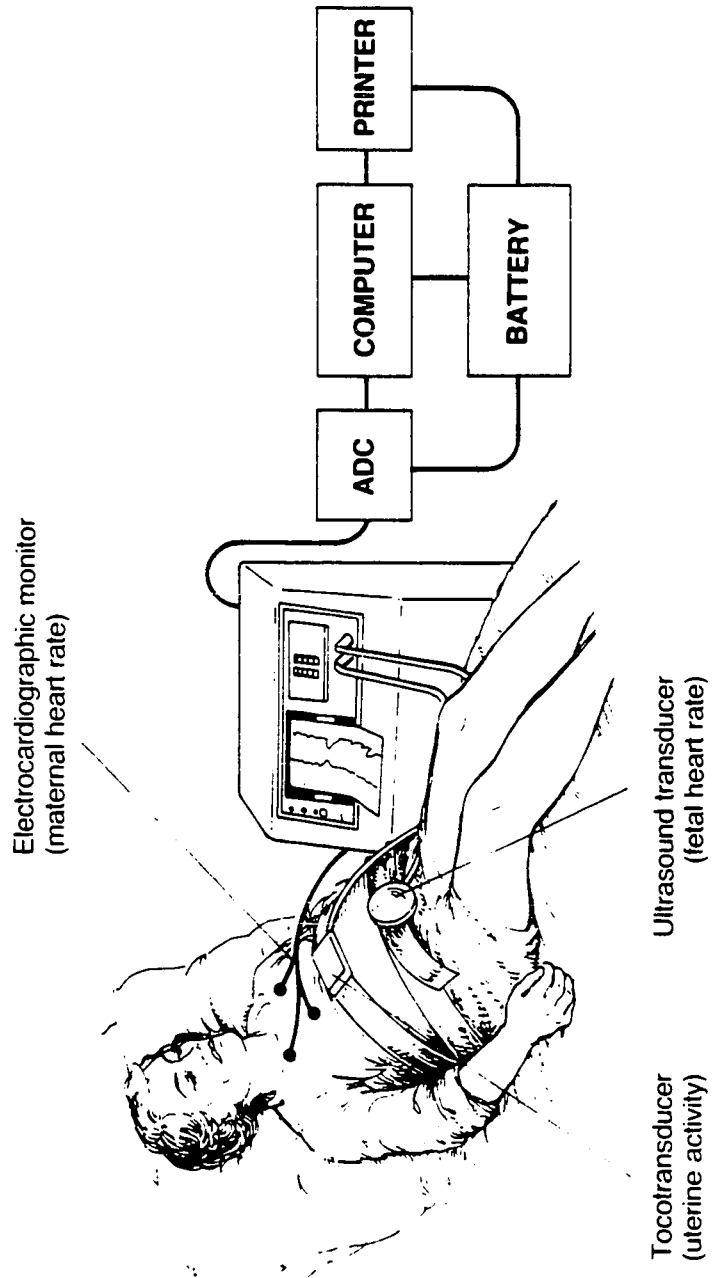


Figure 5. Computerized Data Acquisition System

have focused on the person variables that influence perceptions of stress, while few have focused on the environmental variables that determine person-environment fit and stress response. For the purposes of this study, the environment of interest is the labor area of a typical level 3 hospital obstetrical unit.

Nightingale's theory of nursing (1859) was used as the theoretical basis for viewing the client within an environmental context. Her theory suggests that nursing care focus on environmental manipulation to improve health. Little nursing research has focused on the person in context. One difficulty rests with the characterization and operationalization of the environment for the purposes of research.

Physical Dimension Measure

Using Nightingale's framework, the physical dimension can be characterized. Physical aspects of the environment include tangibles, physical properties (such as light, sound, ventilation, temperature, cleanliness, diet, odors, and level of stimuli), personal space boundaries and procedures. Many of these aspects of the physical childbirth environment are regulated (through infection control standards, ventilation/temperature requirements and dietary limitations) or are fairly standardized across childbirth environments, e.g., consider furniture, lighting, sound and level of stimuli in these novel,

complex high load environments. Personal space limitations (especially when EFM is used) and routine procedures are also standardized aspects of the childbirth environment. The physical dimension of the childbirth environment was simply described using the Physical Environment Checklist (Appendix F).

Psychosocial Dimension Measure

Kiritz and Moos (1974), Mason (1971), Lazarus and Folkman (1986) and Frankenhaeuser (1980) all support the notion that psychosocial factors in the environment may be more important in determining the cognitive appraisal of stress than physical factors, especially those that have little variance. For this reason, the psychosocial environment was the context of interest in this study.

Kiritz and Moos (1974) suggest a relational dimension to be used in the assessment of environments and their influence on psychophysiological response. This relational dimension can be operationalized as social interaction. House (1981) and Kahn and Antonucci (1980) also provide theoretical support for social interaction as the vehicle for social support. House conceptualized social support as four broad classes or types of supportive behavior that flow between people - emotional support, instrumental support, informational support, and appraisal support. Based on House's conceptualization of relational social support, an observational code was developed by Landesman

(1986) to study social interaction and support in families. This code was used in the Family Behavior Study to observe family members interacting around the dinner table. This behavioral code was used as the foundation for the development of the Labor Social Environment Observation Code (LSEOC), an observational tool to assess social interaction and support around the labor bed (Appendix G).

A mutually exclusive and exhaustive behavioral coding system was developed to obtain the following information: 1) the type and frequency of social interactions (verbal and nonverbal) during labor; 2) who is interacting with the woman; 3) the woman's affect associated with the social interaction; and 4) the proximity of the interactors to the woman. Social interactions were observed and coded starting at approximately 5-6 cms. of dilation for 90 minutes or 10 cms., whichever occurred first. The laboring woman was the focal subject and interactions by the nurse, partner, physician and/or others were observed and coded using a modified frequency 60 second interval. All persons with the woman in the labor room were recorded. Paper and pencil and a stop watch were used.

Validity of LSEOC. Content validity for the LSEOC was provided by the Family Behavior Study Observation Code (Landesman, 1986). In addition, the code was reviewed by a childbirth educator/labor monitrice, several labor nurses and an observational researcher. Changes in the code were

made as suggested by these experts to assure clear, concise coding categories and to refine observational methodology. Criterion validity for the LSEOC is provided by House's conceptualization of social support and Swanson-Kauffman's conceptualization of caring (Table 3).

Pilot study. A pilot study was conducted in July, 1987: 1) to test the feasibility and usefulness of the Labor Social Environment Observation Code (LSEOC); and 2) to identify an appropriate frequency for behavioral observations. The coding scheme was used with various time frequencies (10 seconds, 30 seconds and real time) while observing 4 different videotaped labors.

It was determined that real time coding or a long interval modified frequency (greater than 30 seconds), with the woman as focal subject captured both long and short duration social exchanges. Ten second intervals were too short as some behaviors lasted several intervals. Thirty second intervals were also too short for some behaviors. Sixty seconds would also coincide with a reasonable frequency for obtaining maternal/fetal heart rate. A coding manual with coding rules and explicit examples was developed as some behaviors observed had potential for being coded into more than one category and some interactions were combined (e.g., procedural and informational interactions). As the codes are numbered to reflect increased intensity and personalization of

Table 3

Criterion Validity for LSEOC

House's Social Support Categories (1981)	Swanson-Kauffman's Caring Categories (1986)	LSEOC Social Interaction Codes
1. Emotional support	1. Knowing 2. Being with	5. Personal Interactions 6. Active Listening 7. Positive Interactions 8. Intimate Interactions
2. Instrumental support	3. Doing for	3. Procedural Intensity 7. Positive Interactions
3. Informational Support	4. Enabling	4. Informational Interactions
4. Appraisal Support	5. Maintaining Belief	7. Positive Interactions

Note: LSEOC Codes not represented in the table include 0, 1, 2, and 9.
 0 = No interaction
 1 = Negative Interaction
 2 = Controlling/Correcting Interaction
 9 = Other (specify)

interaction (except for number 9, the "other" category), a hierarchical coding rule was established to code the category with the highest number when two categories occurred together. It was also determined that the laboring woman would be the focal subject and interactions by the nurse, partner, physician and/or others would be observed and coded using a modified frequency 60 second interval. (Interactions initiated by the woman and directed to others are not coded.) All persons within the physical environment of the labor room were coded.

Following this pilot study with videotaped labors, a second pilot study was undertaken in a tertiary level, hospital labor, and delivery unit. The purposes of this second pilot study were to: 1) continue to establish content validity of the LSEOC; 2) test the observational coding frequency of 60 seconds previously determined by videotaped observations; 3) check the feasibility of coding multiple simultaneous interactions; 4) refine code categories and coding guidelines as needed; and 5) test the usefulness of the observational data collection sheet.

Four subjects and their partners who met the screening criteria were recruited for participation in the pilot study. All received standard nursing care, fetal monitoring and IV lines per hospital routine. The observer sat in the corner of their labor rooms using the LSEOC with

a stopwatch. One pilot subject was observed for 33 minutes while the other three were observed for 90 minutes each.

Conclusions drawn from this pilot study included:

1) A 60 second interval was adequate to capture social interactions both during and between contractions and allowed plenty of time for recording; 2) All codes were used and no social interactions occurred that could not be coded; 3) Up to four simultaneous interactions could be recorded comfortably; 4) The first 5 seconds of each 60 second interval was devoted to observation, while the remainder of the time was used for coding and preparing for the next coding interval. A shorter interval would have made it difficult to record all social interactions occurring simultaneously. Coding guidelines were clarified including differentiations between various social interaction types and spatial distance descriptors. The data collection sheet was also refined to facilitate easier recording. Standardization of the time window for observation would improve interobserver reliability. A decision was also made to include field notes for each subject. The field notes contain observer notes of any difficulties encountered and the observer's subjective impression of the social support provided to the laboring woman.

Reliability of LSEOC. Prior to the start of the study, a research assistant was trained as a second

observer using the LSEOC with videotapes and several pilot subjects. During the study the second observer collected data for approximately 20 minutes on 8 of the 10 subjects. Table 4 presents the interrater reliability across variables. The kappa statistic (Fleiss, 1981) was used as it employs a correction for chance-expected agreement.

Table 4

Interrater Reliability Across Observations (n=10)

Category	Kappa	
Contraction	.81	*
Maternal Affect	.89	*
Who was present	1.0	*
Proximity of persons present	.86	*
Social interaction type by persons present	.91	*

*Significant at .05 level.

Kappa approaches one if there is complete agreement. For most purposes, a kappa value greater than .75 may be taken to represent excellent agreement beyond chance. Kappas ranged from .81 to 1.

In summary, actions to assure the validity and reliability of the observational data included:

- 1) establishment content validity of the LSEOC with other researchers, a childbirth educator/labor monitrice and

labor and delivery nurses; 2) establishment of criterion validity of the LSEOC by matching its categories with those of other researchers; 3) development of a code manual containing guidelines for observers; 4) conduction of a training program for observers using videotapes of laboring women and actual live observations prior to data collection; and 5) interobserver reliability checks throughout data collection to continue to monitor reliability.

Maternal perceptions. Use of observational methods and a coding system obtains an objective assessment of the nature of social interactions during labor; however, the individual's perceptions of the supportive, nonsupportive or neutral nature of the interactions may be more critical in determining stress response (House, 1980; Mason, 1975; Lazarus & Folkman, 1986). Therefore, subjective assessment of the interactions was also necessary and was used to determine convergent validity (Mitchell, 1986). A qualitative semi-structured interview was conducted within 24 hours following childbirth to obtain each woman's perspective of supportive and nonsupportive verbal and nonverbal social interactions with her partner, nurse and others during labor. Interviews were audiotaped and major themes were extracted from the data. Appendix H contains the Interview Guide used. Actions to assure validity and reliability of the interview data included:

1) establishment of content validity of the Interview Guide with review by a childbirth educator/labor monitrice and perinatal nurses; and 2) development of categories from the analysis by two researchers independently on a percentage of the sample in order to compute intercoder reliability.

Procedures

Subject Selection

The study was approved by the Human Subjects Review Committee of the University of Washington, the Institutional Review Committee of the Hospital and the physicians (Appendix I). Women were approached in the offices of consenting physicians while waiting for prenatal visits. The study was explained and they were invited to participate. Those who agreed to participate were asked to complete the background information sheet which included information related to the selection criteria. Women who met the selection criteria were admitted to the study. An appointment was made with each woman to set up a time for prenatal data collection between 36 and 40 weeks of pregnancy. Early morning appointments (8-9 a.m.) were preferable to allow for an early morning cortisol sample, when diurnal levels are highest.

Prenatal Data Collection

During this appointment women admitted to the study were asked to complete the STAI. With participants resting in a semi-setting position, approximately 4 ml. of blood

was drawn from each woman to obtain baseline plasma cortisol, epinephrine and norepinephrine. Standard procedures for venipuncture were followed. Study participants were asked to notify the investigator by telephone or pager once their labor had begun.

Intrapartum Data Collection

Upon admission to the hospital labor and delivery suite, an intravenous line was placed according to hospital protocol. The STAI (state scale only) and the VAS Pain Line were administered at the following intervals:

- 1) Time 1 (T1) - early active labor or 5-6 cms.; and
- 2) Time 2 (T2) - 90 minutes later or 10 cms., whichever occurred first. Blood samples for C, E and NE were drawn after completing the above at T1 and T2. Four ml. was drawn at each time for a total of 8 ml. obtained for this phase of the study. For comparison, it should be noted that on admission in labor approximately 10 ml. of blood is drawn for routine laboratory work. To maintain needle patency, the IVs were flushed with heparin after each blood sample. Hospital protocol regarding IV care was followed. Fetal heart rate was obtained via the Hewlett-Packard 8040A EFM and the computerized acquisition system every 60 seconds from T1 to T2. Placement of the ultrasonic transducer to assess fetal heart rate was according to established hospital protocol. Maternal heart rate was observed via the Hewlett-Packard 8040A EFM and the

computerized acquisition system every 60 seconds from T1 to T2. The Labor Social Environment Observational Code was used from T1 to T2 (5 second observation period and 55 second record period). Paper and pencil and a stopwatch were used to record. Disturbance to the woman and her family was minimized. There was minimal to no interaction with the family or staff during data collection.

Postpartum Data Collection

An interview was conducted within 24 hours, at the woman's convenience, to determine her subjective report of supportive or nonsupportive social interactions during the recent labor. Maternal and infant charts were also reviewed to determine the presence of maternal/infant complications such as arrest of labor, prolonged, dysfunctional labor and/or fetal distress.

Chapter 4

Analysis and Results

Analysis of the data focused on descriptive statistics and graphic analysis to describe major variables for each woman. Analyses were performed using the Statistical Package for the Social Sciences X, Version 3. Graphics were produced within the Statistical Package for the Social Sciences, Graphics software.

A description of the sample is presented first, followed by descriptions of the physical and psychosocial dimensions of the childbirth environment. Patterns of social interaction are presented and maternal stress response variables are described and related to these patterns.

Sample Description

A total of 13 subjects were admitted to the study. Prenatal data only were collected on three women because of rapid labor and delivery (n=1) and Cesarean delivery (n=2). Prenatal, intrapartum and postpartum data were collected on 10 women between October and December, 1988. Table 5 displays selected characteristics of these 10 women. Their ages ranged from 22-33 years with a mean age of 29.3 years.

Table 5

Subject Characteristics (n=10)

Subject Planned	Age	Gravidity/Parity/Abortions	Years of Education	Weeks Gestation At Delivery	Anesthesia
1	32	1/0/0	13	38	None
2	30	1/0/0	17	40	None
3	30	2/0/1 spontaneous	16	40	None
4	22	1/0/0	14	39	None
5	26	3/0/1 spontaneous 1 elective	16	40	None
6	32	2/0/1 spontaneous	15	40	None
7	33	1/0/0	13	41	Possible epidural
8	28	2/0/1 elective	14	41.5	Possible epidural
9	31	1/0/0	20	41	Possible epidural
10	29	2/0/1 elective	12	38	None
Range:	22-33		12-20	38-41.5	
Mean:	29.3		15	40	

Their years of education ranged from 12-20 years with a mean of 15 years. All were Caucasian, married, middle to upper middle class, as determined by family income, occupation and partner's occupation. Nine were employed professionals and one woman was a full-time homemaker. All were experiencing their first term pregnancy and childbirth. All participated in childbirth education and all husbands attended the labors as the primary support person. Seven women planned no analgesia/anesthesia, while three planned possible epidural. All delivered at term from 38-41.5 weeks gestation with a mean of 40 weeks gestation.

Setting Description

The physical dimension of the childbirth environment was characterized for each woman by using the Labor Physical Environment Checklist at Time 1 (approximately 5-6 centimeters of cervical dilation) in labor. Eight of the 10 determinations of physical properties in the labor room were determined by the consensus of two observers. Table 6 summarizes the findings for all subjects.

Four subjects (subjects 1,2,3 and 8) labored in combination labor and delivery rooms, while six subjects (subject 4,5,6,7,9 and 10) labored in standard labor rooms. The subjects in standard labor rooms were either moved to the delivery room or a combination room for delivery.

Table 6

Labor Physical Environment (n=10)

Tangibles	Subject Number
Room Type: Combination Room ^a Labor Room	1,2,3,8 4,5,6,7,9,10
Bed Type: Labor/Birthing Bed Standard Labor Bed	1,2,3,8 4,5,6,7,9,10
Physical Properties	
Light	
Bright	9
Moderate	1,2,6,8
Dim	3,4,5,7,10
Sound	
Loud	8
Moderate	3,5,6,7,9
Quiet	1,2,4
Temperature	
Hot	6,9
Moderate	2,4,5,7,8,10
Cold	1,3
Other Information	
Crowded	1,2,3,4,7,8,9, & 10
TV on	5,7,8

^aCombination rooms had extra equipment present including an instrument table, baby warmer and basins for delivery.

^bSubject 4 was in a double labor room with another woman in labor.

Bed type was determined by the type of labor room. Those subjects who labored in combination rooms used a labor/birthing bed, manufactured by the Adel Corporation, while those in the labor rooms utilized a standard hospital bed.

Physical properties, including the light level, sound level and temperature, also varied across subjects. Only one subject's room (subject 9) was rated as having bright light, while four subjects' rooms (subjects 1,2,5, and 8) were rated as having moderate light levels. Five subjects' rooms (subjects 3,4,5,7, and 10) were rated as having dim lighting. Only one subject (subject 8) was exposed to a loud level of sound, while five (subjects 3,4,6,7, and 9) were exposed to moderate sound levels. Three subjects (subjects 1,2 and 4) were exposed to a quiet sound level during labor. Two subjects (subjects 6 and 9) were exposed to a hot temperature, while six (subjects 2,4,5,7,8 and 10) were exposed to moderate temperatures. Subjects 1 and 3 were exposed to cold temperatures during labor. Most subjects (subjects 1,2,3,4,7,8,9 and 10) labored in crowded rooms that were small in size and/or filled with equipment and people. The television was on for the majority of the observation period for subjects 5, 7 and 8.

Women were also asked their impressions of the physical environment in labor and delivery during the postpartum interviews. Women had few comments to offer

about the labor rooms or the combination rooms. Examples of their comments follow.

"The room was fine but just not important" (Subject 1).

"I liked the combination room, so I didn't have to move at the last minute, but I didn't notice the light, temperature or sound in the room" (Subject 2).

"I liked the quiet and the low lights because it helped me to relax" (Subject 4).

"I have no real impression of the physical surroundings during my labor. It doesn't really matter if its homelike or familiar - you don't notice" (Subject 5).

"I was unaware of the equipment and didn't remember much about the lighting or temperature either" (Subject 9).

"The room was too small, but I was glad that there were no other laboring women in there with me. The bed, the lights and the temperature were all fine, but I felt like I was on a leash with a short cord (referring to the fetal monitor attachment)" (Subject 10).

Subject 8, unlike the others, disliked the physical surroundings and commented:

"I wanted a regular labor room and delivery room. I was concerned about delivering in that room (the combination room). It's not as sanitary as the delivery room. People can come in in their street clothes" (Subject 8).

Several subjects commented on the labor beds. Subjects 1 and 3 said the beds were "okay". Subject 2 said she "didn't notice". The other subjects had no comments. Several other comments were made about the physical surroundings. Subject 3 wanted more pillows and towels available. Subject 5 liked the shower being located close by but felt like there was a lack of pictures and objects in the environment that could be used as focal points during breathing and relaxation. Subject 6 felt more comfortable because a Neonatal Intensive Care Unit (NICU) was located within the hospital. She commented that she was "32 and you never know what can happen. The baby might need the NICU."

These specific statements and the lack of comment in many cases provide support for the notion that the physical properties of the childbirth environment, while not irrelevant, are probably not the most crucial aspects of the childbirth context that mediate stress response. The childbirth physical environment was seen as safe, satisfactory and even pleasant by most of the women in the study even though they experienced a variety of physical environmental conditions. Many women could not remember much about the environmental conditions or stated that they were not important. This was not true for the psychosocial dimension. The next section presents data describing the

psychosocial dimension of the childbirth environment and will answer the study question:

What are the patterns of social interaction between the laboring woman and her partner, the nurse and others during active labor?

The Childbirth Environment

The Psychosocial Dimension

Persons Present During Observation

The nurse and the woman's partner played key roles in the childbirth psychosocial environment. The doctor, other support persons and other health care personnel rarely appeared and/or interacted with the women during the study. Table 7 presents the amount of time that each subject was observed during active labor and the percentage of time that other persons were present during the observation period. Subjects were observed using the Labor Social Environment Observational Code (LSEOC) from 59-90 minutes with a mean of 83 minutes. Nurses were present 60-93% of the time (mean 78%). Partners were present from 59-100% of the time (mean 92%). Other nonprofessional support persons were present only for subjects 4 and 8, 10% and 54% of the time, respectively. In both instances the additional support person was the woman's mother. Even though the mother of subject 8 was present for 54% of the time, she did not interact with her laboring daughter. She sat more than 5 feet away and read a book or watched television. Doctors were present 0-20% of the time (mean 6%).

Table 7

Percent of Observation Time Persons Present (n=10)

Subject	Total Minutes Observed	RN Present	Partner Present	Other Persons Present	Support Present	Doctor Present	Other Health Care Providers Present
1	90	77	100	0	0	6	19
2	90	92	99	0	0	10	0
3	90	78	99	0	0	3	4
4	59	59	97	10	10	20	9
5	90	66	90	0	0	7	19
6	82	76	99	0	0	0	12
7	90	93	91	0	0	7	0
8	90	78	59	54	4	4	0
9	67	93	94	0	0	2	5
10	81	85	93	0	0	3	0
Range	59-90	59-93	59-100	0-54	0-20	0-19	0-19
Mean	83	78	92	6	7		

Other health care providers, including nurses, medical students or the anesthesiologist were present from 0-19% of the time (mean 6.8%). Partners spent the most time with the women. Obstetrical nurses also spent a lot of time with the women. Obstetricians spent little time with the laboring women. Other support persons were present for only two of the women in the study and other health care providers were infrequently present.

Social Interaction Types by Persons Present

Since each person present contributed to the pattern of total social interactions, Table 8 presents the percentage of the nine interaction types for each subject by all persons present. Variation in interaction type across subjects was present for all types of interaction except negative and correcting/controlling interactions, which occurred very infrequently or never in the study. The percentages of procedural interactions, active listening interactions, positive and other interactions varied the most among subjects. Subjects 2, 6 and 9 received more positive social interaction than any other kind (74%, 42%, and 43% respectively). Subjects 1, 3, 4, and 10 received more active listening interactions than any other kind (47%, 36%, 37% and 38% respectively). Subject 5 received more procedural interaction (35%) than any other type. Subjects 7 and 8 experienced more other interactions (29% and 38%) than any other type. Seven of the 10

Table 8
Percent of Social Interaction Types for Each Subject (n=10)

Subject	Social Interaction Types									
	0	1	2	3	4	5	6	7	8	9
1	6.6			27.6 ^b	1.5		47.4 ^a	11.7		5.1
2				11.0 ^b	7.7	0.6	5.5	73.5 ^a	0.6	1.1
3	0.6			23.5	3.0	1.8	35.5 ^a	27.1 ^b		8.4
4	2.6			27.0 ^b	5.2	2.6	37.4 ^a	20.0		5.2
5	1.1			34.8 ^a	4.5	1.1	27.5 ^b	12.9		18.0
6	3.9	0.6		14.9	6.5	0.6	29.9 ^b	42.2 ^a		1.3
7				26.7 ^b	8.1	8.1	25.0	2.9		29.1 ^a
8				28.4 ^b	8.5	5.7	15.9	4.0		37.5 ^a
9				24.0 ^b	10.1	1.6	20.9	42.6 ^a	0.8	
10				24.0 ^b	9.6		37.7 ^a	24.0 ^b		4.8
Range	0-6.6	0-0.6	0	11-34.8	1.5-10.1	0-8.1	5.5-47.4	2.9-73.5	0-0.8	0-37.5
Mean	1.48	.06	0	24.2	6.8	2.2	28.3	26.1	0.1	11.1

Note. 0 = No interaction.

1 = Negative.

2 = Controlling/Correcting.

3 = Procedural.

4 = Informational.

5 = Personal.

6 = Active Listening.

7 = Positive.

8 = Intimate.

9 = Other (TV watching for partner)

^a = Most frequent type for Subject.

^b = Second most frequent type for Subject.

subjects (subjects 1,2,4,7,8,9, and 10) experienced procedural interactions as the second most frequent type of interaction. Subject 3 experienced positive interactions as the second most frequent type of interaction. Subjects 5 and 6 experienced active listening as the second most frequent type of interaction.

Proximity of Persons Present

In addition to social interaction type by the persons present in the labor room, the LSEOC also allowed for tabulation of the proximity zone, or closeness of each person, to the laboring woman. Proximity zone 1 indicated that a person interacting with the woman was within 2 feet. Proximity zone 2 indicated that a person interacting was nearby within 2-5 feet, while proximity zone 3 indicated that the person was greater than 5 feet away from the woman but still in the labor room. Table 9 presents the total percentage of time spent in each proximity zone across persons for each subject, as well as the percentage of time spent in each proximity zone by the nurse and partner.

Variation in the closeness of persons to the laboring woman was present across subjects. Three patterns of closeness were identified and are summarized in Table 10. The data of subjects 2, 6 and 9 exhibited the first pattern, the together pattern. Subjects in the together pattern experienced more than 85% of their total social interactions within the closest proximity zone, proximity

Table 9

Percent of Time in Each Proximity Zone (n=10)

Subject	By All Persons			By RN			By Partner				
	1	2	3 ^a	0	1	2	3	0	1	2	3
1	49	47	4	23	60	13	3	0	22	79	0
2	91	7	2	8	86	4	2	1	97	1	1
3	64	34	2	22	19	57	2	1	91	6	2
4	70	30	0	41	34	25	0	3	92	5	0
5	40	53	7	35	30	33	2	10	31	48	11
6	86	13	1	23	57	18	1	1	99	0	0
7	75	24	1	7	90	2	1	9	48	43	0
8	26	44	30	22	32	40	6	41	17	42	0
9	95	2	2	7	90	3	0	6	94	0	0
10	91	9	0	15	73	12	0	7	92	1	0

^aProximity Zones

- 0 = Person missing.
- 1 = < 2 feet from the woman.
- 2 = 2-5 feet from the woman.
- 3 = > 5 feet from the woman.

zone 1, less than 2 feet away. Less than 15% of their social interactions occurred in the other proximity zones. A close proximity of less than 2 feet allows for intense interaction and focus on the woman. The data of subjects 1, 3, 4, and 5 exhibited the second pattern of closeness, the nearby pattern. Subjects in the nearby

Table 10

Patterns of Closeness During Social Interaction

Pattern:	Together	Nearby	Farther Away
Criteria for Inclusion:	> 85% social interactions in zone 1	< 85% social interactions in zone 1 > 40% social interactions in zone 1; > 20% in zone 2.	< 40% social interactions > 40% in zone 2.
Subjects Included:	2,6,9, & 10	1,3,4, & 7	5,8

pattern experienced less than 85% but at least 40% of their social interactions in proximity zone 1. In addition, they experienced at least 20% of their interactions nearby within proximity zone 2. These women experienced less closeness than women in the together pattern. The data of subjects 5 and 8 exhibited the third pattern of closeness, the farther away pattern. These women experienced less

than 40% of their social interactions in proximity zone 1 and more than 40% occurred farther away in proximity zone 2. These women experienced even less closeness than women in the other two patterns of closeness. In order to examine these patterns further, a more careful visual inspection of the social interaction data was undertaken.

Due to the relatively infrequent presence of the doctor, other support persons and other health care providers, subsequent analyses focused on the social interactions of the dominant interacters in the childbirth environment, the nurse and the woman's partner.

Patterns of Social Interaction By Nurse and Partner

Percentages of social interaction types by the nurse and partner were visually examined for each subject on pie graphs (Appendix J). Three patterns were found in the data, not determined a priori. Table 11 presents the criteria for inclusion, defining characteristics, and focus of each pattern.

The social interaction data by the nurse and partner of subjects 2, 6, and 9 exhibited the first pattern, called the sustaining environment. To sustain means to nurture, maintain, support or uphold, to keep going. Lesser and Keane (1956), in their classic discussion of the role of the nurse in labor, use the word sustain to describe the objective of nursing actions during childbirth. The sustaining environmental pattern was identified when the

Table 11
Patterns of Social Interaction By Nurse and Partner

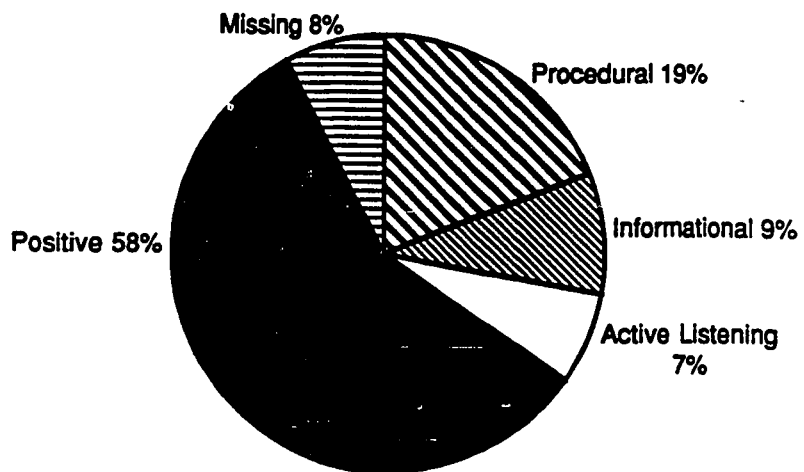
	Pattern: Sustaining Environment	Protecting: Engaged Environment	Protecting: Disengaged Environment
Criteria for Inclusion:	Nurse and partner together provide positive interactions as the most prevalent type. Nurse provides 40% or less procedural interactions and provides at least 15% positive interaction.	Nurse provides 40% or greater procedural interactions as her most prevalent type; partner provides active listening as the most prevalent type. Positive interaction is present to a varying degree.	Nurse provides 40% or greater procedural interactions as her most prevalent type; partner disengaged either missing or performing other interactions as most prevalent type.
Characteristics:	Intensive positive emotional and physical comfort measures to sustain the laboring woman. Woman-centered holistic.	Intensive protector behaviors by nurse and partner. Some positive emotional and physical comfort measures. Focus on technology to prevent bad outcomes; secondary focus on the woman.	Intensive protector behaviors by nurse only. Partner withdrawn or disengaged. Limited positive interactions. Technology focused.
Subjects Included:	2,6,9	1,3,4,5, 6 10	7 & 8

most prevalent category of social interaction by nurse and the partner was positive interaction. The nurse also provided 40% or less procedural interactions, and at least 15% positive interactions. Figure 6 displays the percentages of social interaction types by the nurse and partner of subject 2, a representative of the sustaining environment.

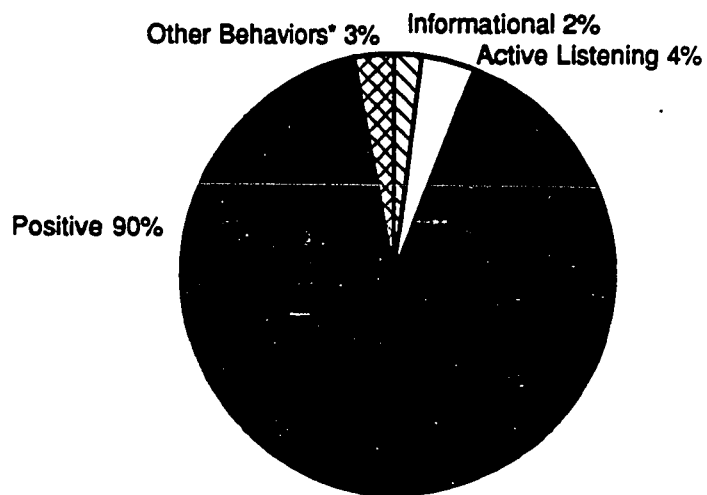
The sustaining environment was characterized by intensive positive psychological and physical support behaviors on the part of the nurse and the partner and protective behaviors on the part of the nurse. The positive psychological and physical support measures included such things as encouraging verbalizations and comfort measures. The nurse also provided procedural interactions such as vaginal examinations, assessment of vital signs and fetal monitoring. These interactions appear to be woman-focused and based on a holistic view of the woman as her psychological and physical needs were considered.

The patterns of closeness discussed above also provide evidence for the intensive nature and women-centered focus of the sustaining environment. All three in the sustaining environment experienced more than 85% of their social interactions in proximity zone 1, less than 2 feet away. The holistic person focus of the sustaining environment may arise from a belief that childbirth is a normal

Percent Social Interaction Type by Nurse: Subject 2



Percent Social Interaction Type by Partner: Subject 2



Total Observation Time = 90 Minutes

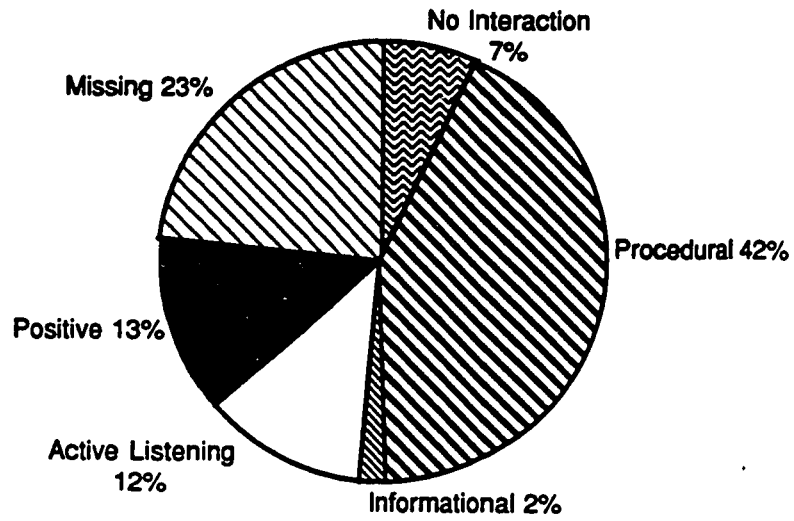
*Categories less than 2% collapsed into Other Behaviors

Figure 6. Percent Social Interaction Types By Nurse and Partner: The Sustaining Environment - Subject 2.

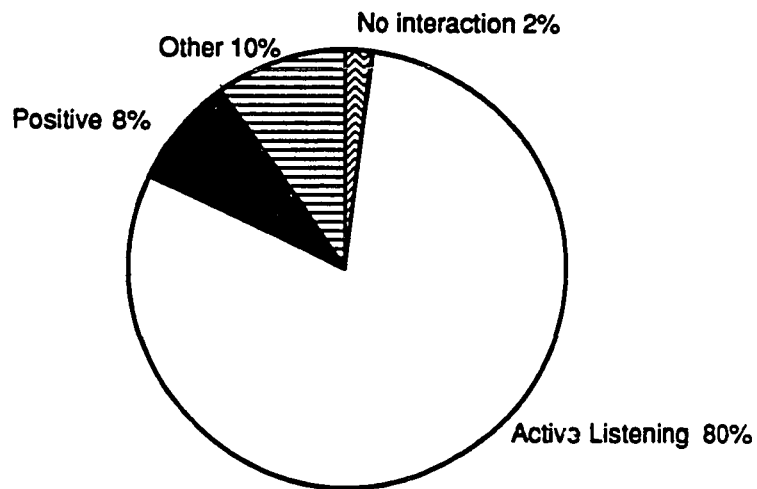
psychophysiologic process, a peak life experience and woman/family-centered. Such an underlying belief does not eliminate the need for procedural interactions but places them as an adjunct to the provision of nurturance, the support of normal psychophysiologic processes and focus on the woman. Physical closeness of the support persons accompanies the intense psychological and physical support measures that facilitate normal childbirth.

The second pattern of social interaction, called the protecting environment: engaged, was exhibited by the data of subject 1, 3, 4, 5, and 10. To be categorized in this environmental pattern, subjects experienced procedural interaction by the nurse and active listening by the partner as the most prevalent types of social interaction. These subjects experienced greater than 40% of their social interactions by the nurse as procedural, with a balance of other interaction types by the nurse, including some positive interactions. Partners in the protecting: engaged environment provided active listening at least 38% of the time with varying amounts of positive interaction. When actively listening, partners are attentive to their wives, looking at them and/or touching them, but not providing verbalizations or specific comfort measures. Figure 7 displays the social interaction data of subject 1 as a representative of the protecting: engaged childbirth environment.

Percent Social Interaction by Nurse: Subject 1



Percent Social Interaction Type by Partner: Subject 1



Total Observation Time = 90 Minutes

Figure 7. Percent Social Interaction Types By Nurse and Partner: The Protecting: Engaged Environment - Subject 1.

The protecting: engaged environment is characterized by the intensive protector activities of the nurse and the attentiveness of the partner. Protection involves guarding, defending, safeguarding, watching, conserving and insulating against danger. The nurse provided protection for the mother/fetus through procedural interactions such as fetal monitoring and assessment of vital signs. These procedures were performed more frequently for these women than for those in the sustaining environment. Partners were also on guard as they watched and perhaps touched their wives, but less frequently provided the more active positive interactions. However, it is important to note that positive interactions from the nurse and partner occasionally occurred in the protecting: engaged childbirth environment.

The protecting: engaged environment has a dual focus, the prevention of bad outcomes and the woman. The proximity data suggest that the prevention of bad outcomes is the primary focus with the woman's supportive needs as secondary. The nurse and partner are more physically removed from some of the women in the protecting: engaged environment. Subjects 1, 3 and 4 experienced at least 20% of their social interactions in proximity zone 2.

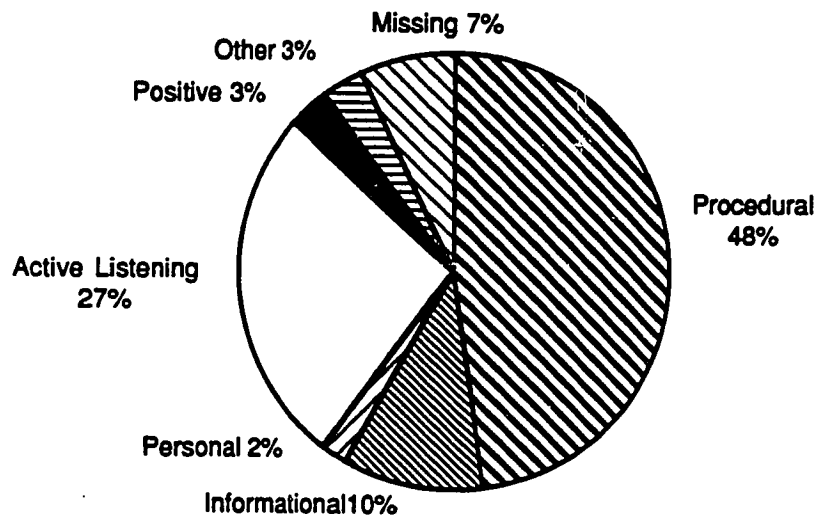
The focus of this environmental type on protection and monitoring may arise from a belief that childbirth is a disease fraught with danger for the mother and fetus.

Technology can be used to detect and prevent bad outcomes and therefore becomes the central focus of interaction. The roles of the nurse and partner shift from primarily sustainant and secondarily protectant to primarily protectant and secondarily sustainant. Closeness is helpful in meeting the woman's sustainance needs but not a prerequisite for some of the protective functions of today's childbirth environment, such as reading fetal monitor output.

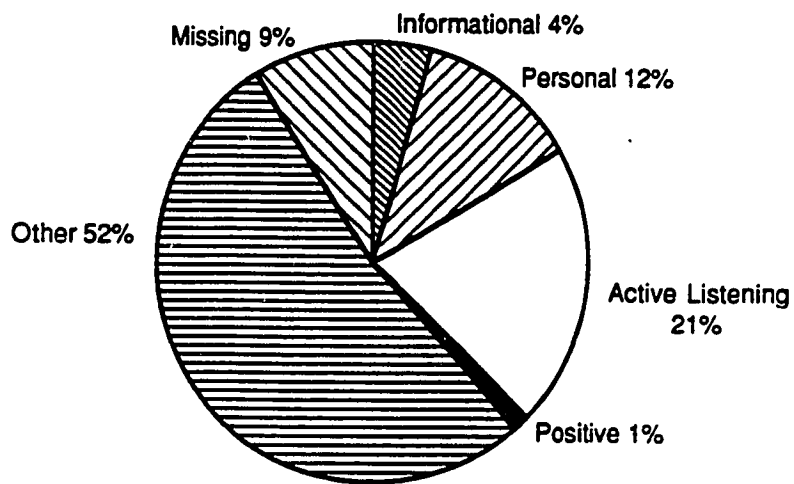
The third pattern of social interaction is really a variation of the second and is called the protecting: disengaged childbirth environment. Subjects were included in the third pattern when the nurse provided greater than 40% procedural interactions, the same inclusion criteria for the second pattern. However, in the protecting: disengaged environment, the partner's behavior is different from that in the protecting: engaged childbirth environment. Instead of actively listening to their laboring wives, these partners are either watching television or are missing from the labor room. The social interaction data of subjects 7 and 8 display the protecting: disengaged pattern. Figure 8 displays the social interaction data of subject 7, as representative of the protecting: disengaged environment.

The protecting: disengaged environment is characterized by the very intense protector activities of

Percent Social Interaction Type by Nurse: Subject 7



Percent Social Interaction Type by Partner: Subject 7



Total Observation Time = 90 Minutes

Figure 8. Percent Social Interaction Types By Nurse and Partner: In Protecting: Disengaged Environment - Subject 7.

the nurse and the withdrawal of the partner from interaction. Procedural interactions for subjects 7 and 8 were the most prevalent social interactions by the nurse (48% and 52%, respectively). These percentages of procedural interactions were also the highest observed across all subjects. Partners of these subjects were disengaged and did not attend to their laboring wives for a large proportion of the time observed. The partner of subject 7 watched television 52% of the time and the partner of subject 8 was absent from the room for 41% of the time. These men were excused from the usual partner role of providing positive interactions or active listening. In fact, unlike the other environmental types few positive interactions were provided by either the nurse or partner.

The focus in the protecting: disengaged environment was technology. The two women in this environment had epidural anesthesia and nursing procedural activities increased as a result. Additional blood pressure monitoring, attention to fetal monitor tracings, vaginal examinations and adjustments of intravenous fluids are necessary when anesthesia is used and are reflected in the data. In addition, the anesthetized woman, with good pain relief, may elicit less support from her partner. Physical comfort measures for the relief of or coping with pain are not as necessary.

Beliefs underlying this environmental type may be similar to type two, the protecting: engaged environment, but perhaps represent a different level on a continuum. With a technological focus, the same underlying belief may be present--that childbirth is a disease and women/fetuses must be protected from the things that can go wrong. However, the personal needs of the woman, other than to be monitored, are treated as secondary. Less than 40% of the interactions of subject 8 occurred in proximity zone 1, while the majority took place in proximity zone 2. Partners were absent physically and/or emotionally. Nurses provided assembly-line care. Positive encouragement and comfort measures were secondary. Medication had made them unnecessary. The woman was treated as a generic labor patient where technology made things happen and prevented bad outcomes.

Three environmental types have been identified by examining the composite patterns of social interaction by the nurse and partner during active labor. Next, social interaction by the nurse and partner will be examined over time in order to answer the question of whether or not social interaction changed over time.

Psychosocial Environment Over Time

Graphic analysis was used to examine the relationship between social interaction types by the nurse, the partner and time. Line graphs of the nine social interaction types

by nurse and partner were examined for each subject in order to describe the patterns of social interaction by the nurse and partner over time (Appendix K). Criteria for evaluation were identified that would allow examination of the social interaction data for changes over time, when time series analytic techniques were not possible due to low zero order correlations of heart rate variables and social interaction types. Criteria for evaluation included: 1) changeability or number of changes from one type of social interaction to another during the total observation period; and 2) the identification of the longest duration of a single social interaction type in the first and second halves of the observation time.

Changeability

Changeability of social interaction by the nurse ranged from 24-51 with a mean of 41 changes in social interaction during the observation period (Table 12). Changeability of social interaction by the partner ranged from 14-46 with a mean of 30 changes in social interaction over time. Nurses showed more frequent changes from one type to another type of social interaction over time than partners for eight of the 10 subjects. High changeability in social interaction is expected from nurses during labor as they must provide a wide range of social interactions types including procedural, informational, positive and active listening type interactions. Partners

Table 12

Changeability of Social Interaction Across
Time (n=10)

Subject	Time Observed	RN	Partner
1	90	40	23
2	90	45	14
3	90	44	36
4	59	24	24
5	90	38	25
6	82	42	46
7	90	42	32
8	90	37	26
9	67	57	43
10	81	50	32
Range	59-81	24-51	14-46
Mean		41	30

Note. Changeability is defined as the number of changes from one type of social interaction to another during the observation period.

are expected to provide attention and positive emotional and physical support but not procedures or information. Yet, when viewed across subjects, partners differed greatly in changeability, while nurses changeability remained more consistent. The question was asked how partner changeability in social interaction related to the identified environmental types. Table 13 displays the changeability scores for social interaction by partners ranked from high to low and environmental type. Two subjects (subjects 6 and 9) in the sustaining environment experienced the highest changeability scores (46 and 43 respectively). These partners frequently changed from one type of social interaction to another and provided primarily positive interactions. The third subject (2) in the sustaining environment experienced the lowest partner changeability. Her partner consistently provided positive interactions with little variability. These data suggest that the sustaining environment can be achieved by varying social interaction type frequently between positive and all other types of social interaction or by consistently providing positive interaction. The sustaining environment has a partner who is responsive to the laboring woman or who provides unconditional positive interaction. Subjects that were in the other two environmental types had medium range values for changeability. Partners in these environmental types may be less responsive and/or provide

positive interaction only conditionally. The changeability data provides further support for the differentiation of the environmental types.

Table 13

Partner Changeability of Social Interaction
and Environmental Type (n=10)

Ranked Changeability Score	Subject	Environmental Type
46	6	Sustaining
43	9	Sustaining
36	3	Protecting: Engaged
32	10	Protecting: Engaged
32	7	Protecting: Disengaged
26	8	Protecting: Disengaged
25	5	Protecting: Engaged
24	4	Protecting: Engaged
23	1	Protecting: Engaged
14	2	Sustaining

Longest Duration of Social Interaction Type

In addition to changeability, social interaction patterns over time were examined for the longest duration of a social interaction type by the nurse and partner in the first and second halves of the observation time. Graphs were divided in half in order to compare the longest

Table 14
Longest Duration Social Interactions By Nurse and Partner (n=10)

Subject	Sustaining Environment		Partner
	RN	First Half/Second Half	
2	Positive/Positive		Positive/Positive
6	Missing/Missing		Positive/Positive
9	Positive/Procedural		Positive/Positive
Protecting: Engaged Environment			
1	Procedural/Missing		Active Listening/Active Listening
3	Active Listening/Missing		Positive/Active Listening
4	Procedural/Missing		Positive/Active Listening
5	Missing/Missing		Active Listening/Other (TV)
10	Procedural/Informational and Procedural		Missing/Active Listening
Protecting: Disengaged Environment			
7	Procedural/Active Listening		Missing/Missing
8	Procedural/Procedural		Missing/Other (TV)

duration social interaction in the first half of the time observed with that in the second half. The consistency of the longest duration interaction type over time observed could then be examined. A ruler was used to measure the durations of social interaction types to determine which had the longest durations. Table 14 presents the social interaction types by the nurse and partner with the longest durations for subjects in the sustaining, protecting: engaged and protecting: disengaged environments. While nurses vary their longest duration of social interaction across subjects, they remain consistent across time for two of the three subjects in the sustaining environment. Partners in the sustaining environment consistently show positive interactions as the longest duration interaction both across subjects and across time. This data supports the differentiation of the sustaining environment. Not only are positive interactions more frequent in this environment, but they are also of the longest duration and consistently provided by the partner across time.

The nurses in the protecting: engaged environment are characteristically providing procedural interactions or missing. While consistent across subjects, they were not consistent across time. Nurse for subjects 1, 3, 4, and 5 were gone from the labor room for the longest duration in the second half of the time observed. Partners exhibited active listening, positive interaction, television (TV)

watching (other) or were missing from the room. Partners longest duration interaction types were fairly consistent across subjects. However, they were not consistent across time except for subject 1. Partners of subjects 3 and 4 changed the longest duration interaction from one that actively provided psychological and physical comfort measures (positive) to just being there (active listening). Subject 5's partner changed from focusing on his wife (active listening) to focusing on the television for longer durations. Although subject 10's partner was missing for the longest duration in the first half of the observation, he frequently provided active listening in the first half as well as the second half of the time observed. The examination of duration data appears to support the differentiation of the second environmental type, the protecting: engaged environment.

Nurses in the protecting: disengaged environment were consistently performing protector behaviors, including procedural interactions and active listening, both across subjects and across time. Partners were consistently disengaged, either missing or watching television, both across subjects and across time.

Graphic analysis of the changeability and longest duration of interaction type across time yielded information that helped to further delineate the three environmental types. Differences in changeability across

time were observed for subjects in the sustaining environment when compared to the protecting environmental types. The examination of the longest duration of social interaction type across time and across subjects also resulted in the observation of characteristic differences between the environmental types.

The preceding section has focused on the examination of the childbirth environment, its physical and psychosocial dimensions. The physical environment varied somewhat across the 10 subjects but did not appear to be an important variable to the women in the study. Examination of the psychosocial dimension revealed three environmental types--the sustaining environment, the protecting: engaged environment and the protecting: disengaged environment. Further examination of the psychosocial dimension was undertaken to identify patterns of social interaction over time.

The next section presents the analysis of maternal stress response variables and will answer the question why these differences in environmental type may be important. Specifically, the following study questions will be answered:

(2) What are the patterns of maternal stress response, as measured by maternal affect, maternal perceptions of pain and anxiety, cortisol and catecholamine response?

(3) What are the patterns of maternal stress response, as measured by maternal and fetal heart rate, during active labor?

(4) Is there a relationship between stress response and social interaction during active labor? What is the pattern of that relationship?

Maternal Stress Response

Maternal stress response variables will be examined next. These variables include maternal affect, anxiety, pain perception, cortisol levels, fetal and maternal heart rate and labor outcome. Data were examined for patterns within and across subjects.

Psychologic Response Variables

Maternal Affect

Maternal affect may play a role in determining patterns of social interaction during labor. Expressions of negative affect, such as pain, anxiety or discomfort, may elicit specific interaction types, such as positive. The percentage of time spent in each maternal affectual state during the observation period as obtained by the LSEOC was summarized for all subjects in Table 15. Overall, laboring women infrequently exhibited positive affect with half of the women exhibiting none at all (range 0-2%, mean 0.8%). The women exhibited varying amounts of neutral and negative affect (range 61-99%, mean 80%; range 0-30%, mean 19% respectively). Two women, subjects 7 and 8, exhibited no negative affect.

As negative affect may indicate increased stress for the laboring woman, the percent of negative affect was ranked from highest amount to the lowest amount and

Table 15

Maternal Affect During Observation Period (n=10)

Subject	Positive	Affective State Neutral	Negative
1	0	74	26
2	2	61	37
3	1	78	21
4	0	95	5
5	0	85	16
6	1	70	30
7	2	98	0
8	1	99	0
9	0	70	30
10	0	73	27
Mean	0.8	80	19
Range	0-2	61-99	0-30

Note. Numbers in table represent percentages of total observation period spent in each affective state, rounded to the nearest whole number.

examined in relation to the subject's environmental type (Table 16). Subjects 2, 9 and 6 spent the highest proportion of the observation period in a negative affective state. All experienced a sustaining environment characterized by intensive positive interaction. Subjects 10, 1,3,5 and 4 ranked in the next five positions. They all experienced the protecting/engaged environment

Table 16

Percent Negative Maternal Affect and
Environmental Type (n=10)

Rank of Percent Negative Affect	Subject	Environmental Type
37	2	Sustaining
30	9	Sustaining
30	6	Sustaining
27	10	Protecting: Engaged
26	1	Protecting: Engaged
21	3	Protecting: Engaged
16	5	Protecting: Engaged
5	4	Protecting: Engaged
0	7	Protecting: Disengaged
0	8	Protecting: Disengaged

characterized by protective nurse behaviors, attentive partners and some positive psychological and physical

support measures. Subjects 7 and 8 displayed no negative affect. Both experienced the protecting: disengaged environmental type characterized by intense nurse protector behaviors and partner withdrawal from interaction. Women who exhibited the most negative affect received the most positive interactions and closest proximities. Women who did not exhibit any negative affect received few positive interactions and experienced persons in the social environment at a greater distance. Women who displayed the middle ranges of negative affect received some positive interaction and attentiveness but not as much as those in the sustaining environment. The match of environmental types and the ranks of maternal affect can be viewed as a measure of person-environment fit. The social environment seemed to fit well for each of these women in that it responded to their increased/decreased stress, as assessed through negative affect, through alterations in social interaction type and proximity of persons present.

Maternal affect may be influenced by contraction status. Were some of the women observed simply contracting more often and therefore displaying a higher percentage of negative affect in response to painful contractions? Table 17 displays the ranking by subjects of the percent of time that contractions were present and relates these to their environmental type. Subjects in the sustaining environment with the highest percent negative affect also

experienced the most contraction time during the observation period. However, results are varied for the other two environmental types.

Table 17

Total Contraction Time and Environmental Type (n=10)

Rank of Percent Time Contraction Present	Subject	Environmental Type
37	2	Sustaining
36	9	Sustaining
33	10	Protecting: Engaged
33	6	Sustaining
31	4	Protecting: Engaged
29	8	Protecting: Disengaged
28	5	Protecting: Engaged
27	7	Protecting: Disengaged
26	1	Protecting: Engaged
21	3	Protecting: Engaged
Range	21-37	
Mean	30	

A crosstabulation of contraction status and maternal affect was examined for each subject to determine the relationship between the two variables and answer the question whether negative maternal affect was always

associated with contractions (Table 18). For five subjects (subjects 2,5,6,9, and 10) negative affect was usually associated with contractions. Subjects 1, 3, and 4 displayed negative affect both with and without contractions. Therefore, for subjects 2, 6 and 9 in the sustaining environment, contractions appear to be the source of negative affect. On the other hand, subjects 1, 3, and 4 in the protecting: engaged environment displayed negative affect more frequently without contractions. These data suggest that the expression of negative affect for these subjects has another source other than contractions.

Maternal affect may also be influenced by medication use. Table 19 presents the subjects ranked by negative maternal affect, their medication use and their environmental type. Subjects with the highest negative affect had no pain medication and were in the sustaining environment. Subjects with medium range negative affect received narcotic analgesia (except subject 1, who received no medication) and were in the protecting: engaged environment. Subjects with no negative affect received epidural anesthesia and were in the protecting: disengaged environment. Medication decreased or eliminated negative maternal affect associated with contraction pain and appeared to play a part in the determination of

Table 18
Contraction Status and Maternal Affect (n=8)

Subject	Contraction Status		
	Negative/Neutral/Positive Affect	Present	Absent
1	10 13 0	0	13 54 0
2	25 8 0	0	8 47 2
3	9 10 0	0	10 60 1
4	2 16 0	0	1 40 0
5	10 15 0	0	4 61 0
6	24 2 0	0	0 55 0
9	20 4 0	0	0 43 0
10	19 8 0	0	3 51 0
Range	0-25 2-26 0	0	0-13 40-65 0-2
Mean	12 13 0	0	3.9 47 .5

Note. Subjects 7 and 8 are excluded as they exhibited no negative affect.

Table 19

Rank of Negative Maternal Affect, Medication, Use, and Environmental Type (n=10)

Rank of Percent Negative Maternal Affect	Subject	Medication Use	Environmental Type
37	2	None	Sustaining
30	6	None	Sustaining
30	9	None	Sustaining
27	10	Narcotic Analgesia	Protecting: Engaged
26	1	None	Protecting: Engaged
21	3	Narcotic Analgesia	Protecting: Engaged
16	5	Narcotic Analgesia/Epidural	Protecting: Engaged
5	4	Narcotic Analgesia	Protecting: Engaged
0	7	Epidermal	Protecting: Disengaged
0	8	Epidermal	Protecting: Disengaged

person-environment fit for each environmental type.

Unmedicated women in the sustaining environment with high levels of negative effect may elicit more positive social interaction from their partners and nurses. Women with narcotic analgesia in the protecting: engaged environment with moderate levels of negative affect may elicit less positive interaction from their partners and nurses, but are still in need of attentive, protective support persons. Narcotic analgesia does not effectively eliminate all labor discomfort. Occasional positive interactions such as supportive statements and physical comfort measures may be needed. Due to the effects of medication on the mother and fetus, the nurse must increase assessments of maternal vital signs and labor progress, as well as fetal assessment activities. Women with epidural anesthesia in the protecting: disengaged environment have no negative affect and may elicit few, if any, positive interactions from their partners and nurses. As epidural anesthesia eliminated negative affect and greatly reduced maternal discomfort, women often fell asleep. Partners turned their attentions elsewhere, while nurses increased their protective interactions due to the possible side effects of the anesthesia itself. Patterns of maternal affect and medication use show a strong association with the three environmental types as determined by social interaction patterns.

Maternal Anxiety

Spielberger State Trait Anxiety Inventory (STAI) was administered prenatally. The range of prenatal state anxiety scores was from 24-60 with a mean of 36. The range of prenatal trait anxiety scores was 28-62 with a mean of 36. Scores above 35 indicate levels of anxiety above the mean for working adult women in the age range of this sample (Spielberger, 1983). Mean values of state/trait anxiety for this sample as a whole indicate that anxiety level was above the mean. Mean trait anxiety for women in the sustaining environment was 33. Mean trait anxiety for women in the other two environmental types was 41. Maternal trait anxiety appears to differ between the sustaining and protecting environmental types.

Four patterns of prenatal anxiety were identified including normal state/normal trait anxiety, high state/normal trait, normal state/high trait and high state/high trait (Table 20). Five subjects (subjects 2,4,5,6, and 7) exhibited a normal state/normal trait pattern. Two subjects (subjects 1 and 3) exhibited the high state/normal trait anxiety pattern. Two subjects (subjects 8 and 9) exhibited the normal state/high trait anxiety pattern. One subject (subject 10) exhibited the high state/high trait anxiety pattern. These data suggest that women in the sustaining environment who had appeared to be more stressed with high negative affect have lower

Table 20
Patterns of Prenatal Anxiety and Environmental Type in Labor (n=10)

Subject	Gestational Week Data Collected	STAI State/Trait Score	Prenatal State/Trait Score	Pattern of Anxiety	Environmental Type
1	37.5		48/32	High State/High Trait	Protecting: Engaged
2	38		27/33	Normal State/Normal Trait	Sustaining
3	37		60/32	Normal State/Normal Trait	Protecting: Engaged
4	38		33/34	Normal State/Normal Trait	Protecting: Engaged
5	38		24/31	Normal State/Normal Trait	Protecting: Engaged
6	37		32/28	Normal State/Normal Trait	Sustaining
7	38		30/33	Normal State/Normal Trait	Protecting: Disengaged
8	38		30/35	Normal State/High Trait	Protecting: Disengaged
9	39		27/37	Normal State/High Trait	Sustaining
10	36		46/62	High State/High Trait	Protecting: Engaged
Range			24-60/28-62		
Mean			36/36		

Note. A raw score of 35 was used as a cutpoint to determine high values for state and trait anxiety (Spielberger, 1983).

prenatal trait anxiety. On the other hand, women in the protecting environments with lower negative affect may be just as stressed due to their higher mean trait anxiety.

State anxiety was also measured with the STAI during labor at approximately 5-6 centimeters of cervical dilation (T1) and 90 minutes later or complete dilation of the cervix (T2). The tool proved to be awkward when used during labor as it took several intervals between contractions to complete and wording seemed inappropriate when being administered to women in the throws of labor or completely comfortable with an epidural. Nevertheless, all of the women completed the state anxiety measures.

Table 21 presents the state anxiety scores, patterns of state anxiety during labor and the environmental type of each subject. Mean values of state anxiety at T1 and T2 (49 and 48 respectively) indicate that the sample as a whole was highly anxious during labor with increased anxiety from the prenatal baseline to T1 but little change in anxiety from T1 to T2. When analysis focused within subjects, a different picture emerged. Five subjects (subjects 1,2,3,6 and 10) increased their state anxiety from T1 to T2 in labor, while five subjects (subjects 4,5,7,8 and 9) decreased their state anxiety from T1 to T2 in labor. Two of the three subjects (subjects 2 and 6) in the sustaining environment experienced an increase in state anxiety despite the intensive positive environment.

Table 21
Patterns of State Anxiety During Labor and Environmental Type (n=10)

Subject	State Anxiety - T1	State Anxiety - T2	Pattern	Environmental Type
1	49	50	Increased	Protecting: Engaged
2	42	46	Increased	Sustaining
3	52	63	Increased	Protecting: Engaged
4	53	46	Decreased	Protecting: Engaged
5	46	38	Decreased	Protecting: Engaged
6	57	56	Increased	Sustaining
7	36	34	Decreased	Protecting: Disengaged
8	61	44	Decreased	Protecting: Disengaged
9	58	46	Decreased	Sustaining
10	44	58	Increased	Protecting: Engaged
Range	36-61	34-63		
Mean	49	48		

Note. T1 = 5-6 cms. dilation.

T2 = 90 minutes later or complete dilation.

Both subjects in the protecting: disengaged environment (subjects 7 and 8) experienced a decrease in state anxiety possibly due to relief of pain with their epidurals. However, subjects 3, 4, 5 and 10 in the protecting: engaged environment also received medication in the form of narcotic analgesia. Yet subjects 3 and 10 increased their state anxiety, while subjects 4 and 5 decreased their state anxiety. Changes in state anxiety during labor appear to be related to maternal medication use, environmental type and other factors not studied.

Maternal Pain Perception

A 10 centimeter visual analogue scale (VAS) pain line was used to measure pain at T1 and T2, as this is reportedly one of the most noted and stressful aspects of labor. Table 22 summarizes the patterns of women's perceptions of pain, cervical dilation, medication use and environmental type. All subjects experienced a significant increase in cervical dilation from T1 to T2 except subject 1 who had an active phase arrest of labor and made only slight progress in cervical dilation. Perceived pain increased for subjects 1, 2, 3, 4, 6 and 10 as cervical dilation increased, while it decreased for subjects 5, 7, 8, and 9. Subjects 5, 7 and 8 had epidural anesthesia. Subject 9 may have reported lower perceived pain as she had just finished the transition phase of labor and was

Table 22

Patterns of Pain Perception, Cervical Dilation, Medication Use and Environmental Type
(n=10)

Subject	Perception of Pain ^a - T1/ Cervical Dilation	Perception of Pain - T2/ Cervical Dilation	Pattern Type	Medication Used	Environmental Type
1	7.6/5 cms.	9/5-6 cms.	Increased pain with dilation	None	Protecting: Engaged
2	6.2/5 cms.	8.3/8 cms.	Increased pain with dilation	None	Sustaining
3	7.6/4-5 cms.	10/6-7 cms.	Increased pain with dilation	Narcotic Analgesia	Protecting: Engaged
4	6.8/6 cms.	8.3/10 cms.	Increased pain with dilation	Narcotic Analgesia	Protecting: Engaged
5	6.2/4-5 cms.	3.1/7-8 cms.	Decreased pain with dilation	Narcotic Analgesia; Epidural	Protecting: Engaged
6	6.9/5-6 cms.	8.2/10 cms.	Increased pain with dilation	None	Sustaining
7	1.5/5 cms.	1.4/7-8 cms.	Increased pain with dilation	Epidural	Protecting: Disengaged
8	8/5-6 cms.	3/8 cms.	Decreased pain with dilation	Epidural	Protecting: Disengaged
9	8/5 cms.	6.3/10 cms.	Increased pain with dilation	None	Sustaining
10	5.8/4-5 cms.	10/9-10 cms.	Increased pain with dilation	Narcotic Analgesia	Protecting: Disengaged

^adetermined by 10 centimeter VAS.

completely dilated at T2. Many women report a sense of pain relief after the completion of transition.

Perceptions of pain, the expression of negative affect and environmental type were related. Subjects 7 and 8, in the protecting: disengaged environment, perceived decreased pain as labor progressed and displayed no negative affect. Women who perceive less labor pain and do not display cues, such as negative affect, to indicate what they need get standard care focusing on protection of mother and fetus, or the protecting: disengaged environment. Women who perceive increasing labor pain and display cues, such as expressions of negative affect, to indicate what they need will get more attention. This attention may take the form of active listening, some positive interaction or a suggestion to use medication as in the protecting: engaged environment. Or, this attention may take the form of intensive psychological and physical support measures in response to the woman's expressions of negative affect and pain to sustain her through the labor as in the sustaining environment. Expressions of negative maternal affect, medication use, maternal trait anxiety and maternal pain perceptions are all variables to be considered in an assessment of person-environment fit in the childbirth environment.

Physiologic Response Variables

Cortisol and the Catecholamines

Plasma for cortisol (C), epinephrine (E), and norepinephrine (NE) was obtained from nine subjects, prenatally as a baseline and at T1 and T2 in labor. The T1 plasma sample from subject 3 was not obtained due to difficulty with the IV line. All prenatal samples were drawn between 8-9:00 a.m. except for two; subject 2 was drawn at 9:30 a.m. and subject 8 at 10:30 a.m. All were drawn without difficulty (except subject 8), usually in the woman's home, after administration of the STAI. Subject 8 was sent to the physician's laboratory for a repeated attempt. Table 23 presents the rank of prenatal plasma C and the environmental types of all subjects. Range of prenatal plasma cortisol was from 31-56 micrograms/deciliter with a mean value of 42. These values show high levels of cortisol and may be reflective of high trait anxiety scores presented earlier, the normally increased levels of cortisol during pregnancy and/or collection methods. There is no obvious relationship of prenatal baseline cortisol and environmental type for childbirth.

Table 23

Rank of Prenatal Plasma Cortisol and
Environmental Type (n=10)

Rank of Prenatal Plasma Cortisol (g/dl.)	Subject	Environmental Type
56	1	2 = Protecting: Engaged
52	3	2 = Protecting: Engaged
49	4	2 = Protecting: Engaged
46	2	1 = Sustaining
46	6	1 = Sustaining
36	7	3 = Protecting: Disengaged
34	10	2 = Protecting: Engaged
33	5	2 = Protecting: Engaged
32	9	1 = Sustaining
31	8	3 = Protecting: Disengaged
Range 31-56		
Mean 42		

Table 24 displays patterns of prenatal anxiety, patterns of baseline cortisol and environmental type for all subjects. There is no obvious relationship between patterns of prenatal anxiety, patterns of baseline cortisol and environmental type. Table 25 presents the patterns of

Table 24
Patterns of Prenatal Anxiety, Baseline Cortisol and Environmental Type

(n = 10)

Pattern of Prenatal Anxiety	Subjects	Baseline Cortisol (µg/dl.)	Pattern ^a of Cortisol Response	Environmental Type
Normal State/Normal Trait	2	46	High	Sustaining Environment
	4	49	High	Protecting/Engaged Environment
	5	33	Low	Protecting/Engaged Environment
	6	46	High	Sustaining Environment
	7	36	Low	
	1	56	High	Protecting/Engaged Environment
	3	52	High	Protecting/Engaged Environment
Normal State/High Trait	8	31	Low	Protecting/Disengaged Environment
	9	33	Low	Sustaining Environment
High State/High Trait	10	34	Low	Protecting/Engaged Environment

^aPattern of cortisol determined by using the mean cortisol of 43 µg/dl. as a cutpoint. Values above the mean are called high, while values below the mean are called low.

Table 25

Patterns of Cortisol Response During Labor and Environmental Type (n=10)

Subject	Cortisol - T1 (μ g/dl.)	Cortisol - T2 (μ g/dl.)	Pattern	Environmental Type
1	82	41	Decreased	Protecting: Engaged
2	46	76	Increased	Sustaining
3	Not Obtained	88	-	Protecting: Engaged
4	88	90	Increased	Protecting: Engaged
5	49	54	Increased	Protecting: Engaged
6	58	62	Increased	Sustaining
7	39	34	Decreased	Protecting: Disengaged
8	61	44	Decreased	Protecting: Disengaged
9	75	84	Increased	Sustaining
10	49	34	Decreased	Protecting: Engaged
Range	39-88	34-90		
Mean	61	61		

cortisol response during labor and environmental type. Time 1 cortisol levels ranged from 39-88 micrograms/deciliter with a mean value of 61. Time 2 cortisol levels ranged from 34-90 micrograms/deciliter with a mean value of 61. Time 1 plasma cortisol values are at or above baseline values for all subjects. Five subjects (2,4,5,6 and 9) had cortisol levels that increased from T1 to T2. Four subjects (1,7,8 and 10) had cortisol levels that decreased from T1 to T2. The T1 sample was not obtained on subject 3 so a pattern of cortisol response was not determined. All subjects in the sustaining environment (2,6 and 9) experienced increased cortisol levels from T1 to T2. All subjects in the protecting: disengaged environment experienced decreased cortisol levels from T1 to T2, almost to the prenatal baseline level, possibly due to suppression of cortisol production by the epidural anesthesia. Subjects in the protecting: engaged environment (1,3,4,5, and 10) show both increases and decreases in cortisol levels from T1 to T2. Subjects 1 and 10 decrease cortisol levels from T1 to T2 while subjects 4 and 5 increase cortisol levels from T1 to T2. Catecholamine levels are pending assay due to laboratory difficulty.

Factors responsible for the variation in hormonal response include individual differences in response, maternal analgesia/anesthesia, diurnal variation (for cortisol) and/or laboratory error. Diurnal variation is a

possible reason for variation of cortisol values as labor samples in the study, of necessity, were collected at varying hours of the day and night. However, all women have higher than normal plasma cortisol (up to 25 microgm/dl.) levels providing evidence of a response pattern on top of normal diurnal values (Diagnostic Products, 1986). Maternal analgesia/anesthesia definitely provides some basis for the variations seen. Almost all subjects (except subject 1) with patterns of decreasing cortisol from T1 to T2 received medication. Almost all subjects (except subject 4) with patterns of increasing cortisol levels from T1 to T2 did not receive medication. Laboratory error was minimized and was discussed in chapter 3.

Individual differences in response may be due to each woman's cognitive and biophysical experience of labor. Extreme levels of cortisol, either too high or too low, may impede the normal physiologic processes of labor. High cortisol levels have been correlated with increased length of labor, increased maternal anxiety and decreased uterine activity (Lederman et al., 1978, 1979). In this study cortisol had a significant positive correlation with anxiety level and negative correlations with Montevideo Units, a measure of uterine contractility. Cortisol also had a positive, but insignificant correlation with length of labor. Before examining the relationship of cortisol,

anxiety and labor outcomes for this sample, fetal and maternal heart rate, the final stress response variables will be presented.

Fetal and Maternal Heart Rate

In addition to the data obtained at T1 and T2, fetal heart rate (FHR) and maternal heart rate (MHR) were obtained every 60 seconds from T1 to T2. FHR was obtained from all subjects, while MHR was obtained from all subjects but 1 and 3 due to clinical indications/nurse preference for the use of the fetal scalp electrode. The fetal scalp electrode utilized the electrocardiographic channel on the fetal monitor, which made it impossible to obtain maternal EKG signals with the research equipment. Table 26 summarizes the descriptive statistics for fetal and maternal heart rate. FHR and MHR were obtained for 90 minutes in subjects 1, 2, 3, 5, 7, and 8; 59 minutes in subject 4; 82 minutes in subject 6; 67 minutes in subject 9; and 81 minutes in subject 10. Mean fetal heart rates ranged from 127 to 156 beats per minute (BPM). Fetal heart rates were within the normal range from 100-160 BPM at all times for subjects 3, 4, 5, 6, and 8. The fetal heart rates of subjects 1, 2, 7, 9 and 10 showed several values below 100. Several explanations for these low values are possible including transient fetal bradycardia and temporary loss of contact by the fetal ultrasonic transducer due to maternal movement. No infant in the

Table 26
Descriptive Statistics for Fetal/Maternal Heart Rate (n=10)

Subject	Fetal Heart Rate				Maternal Heart Rate					
	Minutes Obtained	Mean	S.D.	Range	Median	Minutes Obtained	Mean	S.D.	Range	Median
1	90	129	16.9	74-151	135	Not Obtained				
2	90	139	12.4	87-162	141	90	81	10.6	59-111	81
3	90	135	7.9	110-159	136	Not Obtained				
4	59	133	11.8	101-160	133	59	120	11.5	96-160	121
5	90	136	6.4	116-158	135	90	100	11.7	81-130	98
6	82	133	7.9	118-149	134	82	103	6.9	82-120	104
7	90	156	12.5	78-169	157	90	98	6.3	85-116	100
8	90	134	8.1	100-155	134	90	91	12.1	75-122	89
9	67	127	14.6	54-155	129	67	86	15.3	66-142	82
10	81	134	10.4	89-151	135	81	89	13.2	62-113	90

study experienced prolonged or clinically significant bradycardia. The fetus of subject 1 exhibited variable decelerations during data collection.

Mean fetal heart rates ranged from 127-156 BPM, all within normal limits, and showed little variability across subjects. Mean fetal heart rate did not exhibit a differential response pattern related to the three environmental types (Table 27). No obvious pattern can be determined between mean FHR and environmental type.

Table 27

Rank of Mean Fetal Heart Rate and
Environmental Type (n=10)

Ranked Mean FHR	Subject	Environmental Type
156	7	3 = Protecting: Disengaged
140	2	1 = Sustaining
136	5	2 = Protecting: Engaged
136	3	2 = Protecting: Engaged
134	10	2 = Protecting: Engaged
134	8	3 = Protecting: Disengaged
134	6	1 = Sustaining
133	4	2 = Protecting: Engaged
130	1	2 = Protecting: Engaged
127	9	1 = Sustaining

Mean maternal heart rates across subjects ranged from 81 to 120 BPM. All women experienced fluctuations in heart rate above 100 beats per minute reflecting psychophysiological response above a baseline state (Table 28). Two of the three subjects in the sustaining environment exhibited the lowest mean MHR values. However, no meaningful pattern between mean MHR and environmental type was observed.

Table 28

Rank of Mean Maternal Heart Rate and
Environmental Type (n=8)

Ranked Mean MHR	Subject	Environmental Type
120	4	2 = Protecting: Engaged
103	6	1 = Sustaining
100	7	3 = Protecting: Disengaged
100	5	2 = Protecting: Engaged
91	8	3 = Protecting: Disengaged
89	10	2 = Protecting: Engaged
86	9	1 = Sustaining
81	2	1 = Sustaining

Note. MHR not obtained on subjects 1 and 3.

Further within subject examination of FHR and MHR were undertaken using simple line graphs of these variables

over time. Criteria for evaluation of FHR and MHR were based on standard clinical assessment techniques for heart rate patterns (Neeson & May, 1986). Criteria for evaluation included: 1) baseline heart rate in the first 10 minutes of observation; 2) baseline changes from the first 10 minutes when compared to the last 10 minutes of observation; 3) other notable events and/or baseline changes at any time; and 4) changeability or the number of changes greater than 10 BPM across time. Information on baseline characteristics and baseline change provide information about the overall pattern of heart rate while changeability provides information about moment-to-moment fluctuation of heart rate. FHR baselines are described as normal (120-160 BPM), low (< 120 BPM) or high (> 160 BPM). MHR baselines are described as normal (80-100 BPM), low (< 80 BPM) or high (> 100 BPM). FHR and MHR baseline changes are described as a slight increase/decrease (a 5 BPM change), an increase/decrease (a 10 BPM change) or a marked increase/decrease (> 10 BPM change). Other events are described using standard FHR assessment. Graphs of FHR and MHR for all subjects are contained in Appendix L.

Table 29 summarizes the FHR baseline characteristics. All fetuses had normal baseline FHR except for 7, who had a high baseline. Several patterns of FHR baseline change occurred in the data. Six fetuses (1,2,3,4,7 and 10) showed a decreased baseline FHR as labor progressed.

Table 29

FHR Baseline Characteristics (n=10)

Subject	FHR Baseline ^a	FHR Baseline Changes Over Time ^b	Other
1	Normal	Slight decrease	Regular severe variable decelerators
2	Normal	Marked decrease	Deceleration below 100 at min. 30
3	Normal	Slight decrease	Monitor lost contact for 2 minutes (min. 21-23)
4	Normal	Slight decrease	Period of low FHR baseline (min. 18-30)
5	Normal	Slight increase	
6	Normal	Slight increase	
7	High	Slight decrease	Deceleration below 100 (min. 50)
8	Normal	Marked increase	
9	Normal	No change	Decelerations below 100 (minutes 21, 30, 34, 36, 38)
10	Normal	Decrease	Deceleration below 100 (minute 14)

^aFHR baseline determined in first 10 months:

Normal FHR baseline 120-160 BPM;

Low FHR baseline < 120 BPM;

High FHR baseline > 160 BPM.

^bFHR baseline changes over time assessed by comparing FHR baseline in first half with second half.

Slight increase/decrease = 5 BPM change

Increase/decrease = 10 BPM change

Marked increase/decrease = > 10 BPM change.

Fetuses 1, 3, 4 and 7 showed a slight decrease, while fetus 10 showed a decrease and fetus 2 showed a marked decrease. Three fetuses (5,6 and 8) showed an increased baseline FHR as labor progressed. Fetuses 5 and 6 showed a slight increase, while fetus 8 showed a marked increase. Only fetus 9 showed no change in FHR baseline over time. Fetus 1 showed severe decelerations periodically throughout the observation period. Fetus 2 showed one deceleration below 100 BPM at minute 30. The ultrasonic transducer lost contact with fetus 3 for 2 minutes (minutes 21-23). Fetus 4 experienced a period of low FHR baseline (minutes 18-30). Fetus 7 experienced a deceleration below 100 BPM at minute 50. Fetus 9 had multiple decelerations below 100 BPM at minutes 21, 30, 34, 36 and 38. Fetus 10 had one deceleration below 100 at minute 14.

The decreases in FHR baseline may be the normal fetal response to labor. As fetal descent and head compression increase, FHR baseline drops (Pritchard, MacDonald & Gant, 1986). FHR baseline may rise during labor due to a number of maternal conditions that stress the fetus. Maternal hypotension is the most likely cause for a rising FHR baseline in fetuses 5 and 8 as both of these subjects received epidural anesthesia and maternal hypotension is a common side effect. Periodic decelerations were observed in fetuses 1, 2, 7, 9 and 10. None were clinically significant except for the severe variable decelerations of

fetus 1. At delivery this infant had several loops of cord tightly wrapped around its neck, the probable source of these decelerations. It is unknown why the fetus of subject 4 experienced a low baseline FHR for 22 minutes (minutes 18-30). Narcotic analgesia was not given until minute 31.

FHR baseline characteristics and changes did not appear to relate to a specific environmental type. FHR changeability or number of changes in FHR greater than 10 BPM across time were also examined. FHR variability, the minute-to-minute fluctuation of FHR, is assessed clinically and used to evaluate fetal health., Variability is decreased or absent when the fetus is compromised. High changeability in FHR reflects good variability. Table 30 displays the changeability scores of all FHRs. Changeability ranged from 16-53, with a mean of 28. More variation between fetuses is displayed in the changeability scores than in the assessment of FHR characteristics. Changeability scores were ranked from high to low and matched with environmental type (Table 31). No pattern emerged.

FHR baseline characteristics and changeability do not exhibit a relationship with environmental type. Several reasons for this are possible. Clinically significant fetal distress was not present in the study data to allow full examination of the relationship. More importantly,

FHR may be influenced only indirectly by environmental type through the influences of the environment on the mother and her heart rate.

Table 30

Fetal Heart Rate Changeability (n=10)

Subject	Number of Changes > 10 BPM
1	38
2	18
3	35
4	25
5	16
6	53
7	23
8	23
9	22
10	24
Range	16-53
Mean	28

^aChangeability is defined as the number of changes in FHR greater than 10 BPM.

Table 31
Rank of Changeability in Fetal Heart Rate and Environmental Type (n=10)

Rank of Changeability Score FHR	Subject	Environmental Type
53	6	Sustaining Environment
38	1	Protecting/Engaged Environment
35	3	Protecting/Engaged Environment
25	4	Protecting/Engaged Environment
24	10	Protecting/Engaged Environment
23	7	Protecting/Disengaged Environment
23	8	Protecting/Disengaged Environment
22	9	Sustaining Environment
18	2	Sustaining Environment
16	5	Protecting/Engaged Environment

Table 32 displays the MHR baseline characteristics for eight subjects. MHR was not obtained on subjects 1 and 3. Four subjects (subjects 4,6,7 and 8) exhibited high

Table 32

Maternal Heart Rate Baseline Characteristics (n=8)

Subject	MHR Baseline ^a	MHR Baseline Changes ^b Over Time	Other
2	Normal	No Change	
4	High	Increase	
5	Normal	Slight increase	Markedly increased baseline (mrh 29-44)
6	High	No change	
7	High	No change	
8	High	Marked decrease	
9	Normal	Slight decrease	
10	Normal	Slight decrease	

^aMHR baseline determined in first 10 minutes
 Normal MHR baseline 80-100 BPM
 Low MHR baseline < 80 BPM
 High MHR baseline > 100 BPM

^bMHR baseline changes over time assessed by comparing MHR baseline in first half with second half.
 Slight increase/decrease = 5 BPM change
 Increase/decrease = 10 BPM change
 Marked increase/decrease = > 10 BPM change.

baseline MHR. Four subjects (subjects 2,5,9, and 10) exhibited normal baseline MHR. MHR baseline is expected to

increase as labor progresses (Pritchard, MacDonald & Gant, 1986). Two subjects (subjects 4 and 5) showed an increase over time, while three (subjects 2, 6, and 7) showed no baseline changes. Subjects 8, 9 and 10 showed a decrease in MHR baseline. In addition, subject 5 showed a markedly increased baseline from minutes 29-44. Her epidural was placed and injected at minute 31 and may be the basis for the baseline increase. Decreases in MHR baseline for subjects 8 and 10 may be related to maternal medication. Lack of change in baseline for subjects 6 and 7 may be related to starting out with high baselines. Only subjects 2 and 9, both in the sustaining environment, exhibited normal initial MHR baselines that did not change or decreased slightly. Perhaps the supportive positive environment mediated stress response for these women.

Changeability of MHR was also examined (Table 33). Changeability of MHR ranged from 24-51, with a mean of 28. Changeability of MHR was thought of as an indicator of person-environment fit. If MHR changeability is too high the person may be overcompensating for stressors without enough environmental support. If too low the person may not be coping with stressors or has found an alternate route to cope with them. Table 34 presents the rank of changeability in MHR from high to low and environmental type. No pattern of relationship between MHR changeability and environmental type was seen.

Table 33

Maternal Heart Rate Changeability (n=8)

Subject	Number of Changes > 10 BPM
2	51
4	29
5	36
6	24
7	27
8	35
9	32
10	50
Range	24-51
Mean	28

^aChangeability is defined as the number of changes in MHR greater than 10 BPM.

Table 34
Rank of Changeability in Maternal Heart Rate and Environmental Type (n=8)

Rank of Changeability Score MHR	Subject	Environmental Type
51	2	Sustaining Environment
50	10	Protecting/Engaged Environment
36	5	Protecting/Engaged Environment
35	8	Protecting/Disengaged Environment
32	9	Sustaining Environment
29	4	Protecting/Engaged Environment
27	7	Protecting/Disengaged Environment
24	6	Sustaining Environment

Integrated Response Variable: Labor Outcome

Friedman Graphic Analysis of Labor was completed for each subject, examined for first stage labor complications and related to environmental type (Table 35). Criteria for the identification of labor complications were obtained from Labor: Clinical Evaluation and Management, Second Edition (Friedman, 1978). None of the three subjects in the sustaining environment had a first stage labor complication, while four of the five subjects in the protecting: engaged environment experienced prolonged or arrested labors requiring augmentation. Both subjects in the protecting: disengaged environment also experienced prolonged labor with augmentation or induction.

A strong association exists between the stress-related complications of labor and environmental type. Prolonged and arrested labor are prevalent in the protecting environments and are absent in the sustaining environment.

Summary of Findings

A small n (n=10) within subjects design study was conducted to describe the concurrent patterns of maternal social interaction and maternal stress response. Specifically, the study described patterns of social interaction between the laboring woman, her partner, nurse and others during active labor. Concurrent patterns of maternal stress response were described by obtaining

Table 35

Labor Outcome and Environmental Type (n=10)

Environmental Type	
Sustaining	Protecting: Engaged Protecting: Disengaged
2,6,9	1,3,4,5 and 10 7 and 8
Labor Outcome: First Stage Labor Complications ^a	
2 None	1. Prolonged latest phase; arrest of active labor; variable decelerations of FHR; Pitocin Augmentation
6 None	3. Slow progress of labor - Pitocin Augmentation. 4. None. 5. Slow progress of labor - Pitocin Augmentation. 10. Prolonged latent phase.
	7. Slow progress of labor Pitocin Augmentation. 8. Induction with Pitocin.

^aDetermined by Friedman Graphics Analysis of Labor.

repeated measures of maternal and fetal heart rate, maternal affect, perceptions of anxiety and pain, cortisol and catecholamine response during active labor. The inter-relationship of patterns of social interaction and patterns of stress response was examined. Multiple methods and repeated measures were utilized to capture the complex nature of this person-environment transaction.

Observational methods, physiologic measures and a qualitative interview were used. Analysis of the data focused on within subject variance and detection of patterns within and across subjects. Data were presented descriptively and graphically.

Data were obtained from 10 middle class, married women, aged 22-33 years, experiencing their first childbirth. These women labored with their husbands in a large urban hospital obstetrical unit. The women experienced variation in the room for labor and birth, the birthing bed and the physical properties of the labor room. In general, women were unimpressed and/or unconcerned about the physical characteristics of the childbirth environment. Women said that who was with them was more important than the physical environment in helping them cope with the stress of labor. Partners and nurses were the persons most frequently present with the laboring women in the study. Physicians, other support persons and additional health care personnel were rarely present.

Three patterns of social interaction by the nurse and partner were found, each providing a different social context for labor. Three subjects experienced the sustaining environment, characterized by intensive positive emotional and physical support for the laboring woman. Positive interactions were the most frequent interaction type by nurse and partner, establishing a wholistic woman-centered focus. Five subjects experienced the protecting: engaged environment, characterized by intensive protector behaviors by the nurse and partner. Nurses most frequently provided procedural interactions, while partners provided active listening interactions most frequently. Some positive interaction was also present. This environmental type included a dual focus on technology and the woman. Two subjects experienced the protecting: disengaged environment, also characterized by intensive protector behaviors by the nurse but with withdrawal of the partner from interaction. Nurses primarily provided procedural interactions, while partners watched television or were absent for the majority of the observation time. Little positive interaction occurred, establishing a technology-focused environment.

Patterns of proximity supported the foci of the three environmental types with subjects in the sustaining, women-centered environment experiencing > 85% of their interactions within 2 feet. Subjects in the other two

environments experienced 20% or more of their interactions in the 2-5 foot range. One subject in the protecting: disengaged environment experienced the majority of her interactions farther away in the 2-5 foot range.

Patterns of social interaction by the partner and nurse were also examined over time for changeability and longest duration of social interaction type. Nurses showed more within subject changeability, or number of changes from one type of social interaction to another, than did partners. Partners differed greatly in changeability across subjects. A rank of partner changeability from high to low displayed an interesting pattern with sustaining partners showing the highest and lowest changeability scores. It appears that partners in the sustaining environment are responsive (more changeable) to the laboring woman's cues or providing unconditional positive interaction (minimal changeability). Partners in the other environments may be less responsive and have fewer cues to provide positive interaction. They may also provide positive interaction only conditionally in response to cues.

Social interactions across time were also examined for the longest duration social interaction in the first and second halves of time observed. Nurses varied in the longest duration social interaction across subjects but not across time in the sustaining environment. Partners in the

sustaining environment consistently showed positive interactions across subjects and across time. These data support the differentiation of the sustaining environment. Not only are positive social interactions more prevalent in this environment, but they are of the longest duration interactions and are consistently provided by the partner.

The nurses in the protecting: engaged environment characteristically provided procedural interactions or were missing for the longest duration. While consistent across subjects, they were not consistent across time. Partners in the protecting: engaged environment provided active listening, positive interactions, television watching or were missing for the longest durations. Longest duration interactions by partners in the protecting: engaged environment are fairly consistent across subjects. However, they are not consistent across time. Two partners changed from positive interactions to just being there (active listening), while one switched from attending his wife (active listening) to attending the television (other). The data support the differentiation of the protecting: engaged environment.

Nurses in the protecting: disengaged environment consistently provided procedural interactions and active listening both across subjects and across time. Partners were consistently disengaged, either missing or watching television, both across subjects and across time.

Graphic analysis of the changeability and duration of social interactions across time yielded information to further delineate the three environmental types. Analyses then proceeded to answer the remaining study questions and provide information on why differences in environmental type may be important.

When maternal stress response variables were examined, a strong relationship between negative maternal affect and environmental type was found. The highest levels of negative affect were present in women in the sustaining environment, while negative affect was absent in the women in the protecting: disengaged environment. Contractions, medication use, negative affect and environmental type were related. Women with effective epidural anesthesia in the protecting: disengaged environment showed no negative affect, while women with narcotic analgesia in the protecting: engaged environment showed more. Unmedicated women, in the sustaining environment, showed the greatest amount of negative affect. Person-environment fit, as measured by negative maternal affect, was good for all women in the study as women who expressed increased/decreased stress, as measured by increased/decreased negative affect, received more/less attention, positive interaction and pain relief.

Prenatal state/trait anxiety levels were also examined. Prenatal state anxiety scores ranged from 24-60

with a mean of 36. Prenatal trait anxiety scores ranged from 28-62 with a mean of 36. Scores above 35 indicate higher than average anxiety levels (Spielberger, 1983). Patterns of high/normal prenatal state trait anxiety were examined but did not appear to be related to environmental type. However, mean trait anxiety for the women in the sustaining environment was 33, while mean trait anxiety for women in the other two environments was 41. Women with high prenatal trait anxiety may prefer or elicit the protecting environmental types.

This sample of women were highly anxious during labor with increased state anxiety from the baseline but little change from T1 to T2. Within subject patterns of anxiety were also examined with half of the women increasing state anxiety from T1 to T2 and half decreasing from T1 to T2. No obvious relationship between patterns of maternal state anxiety and environmental type emerged. Changes in maternal state anxiety may be due to maternal medication use, environmental type and other unknown factors.

Patterns of pain perception and cervical dilation were also examined. All subjects except one experienced a significant increase in cervical dilation from T1 to T2. Perceived pain increased for six subjects and decreased for four subjects from T1 to T2. Medication use was associated with three of the four subjects whose perceived pain decreased.

Perception of pain, negative affect, medication use and environmental type appear to be related. Women who perceived less pain, expressed no negative affect and used effective pain relief (epidural) displayed few cues to indicate what they needed. As a result, they received standard care from the nurse, focusing on the assessment of mother and fetus, while their partner withdrew, as in the protecting: disengaged environment. On the other hand, women who perceived more pain, expressed more negative affect and used no medication or one that was less effective (narcotic analgesia) provided more cues and received more attention. The attention took several forms and results in the sustaining or protecting: engaged environments.

Maternal plasma cortisol levels were also examined. Values ranged from 31-56 micrograms/deciliter with a mean value of 42. There was no relationship between prenatal baseline cortisol, patterns of prenatal anxiety and environmental type. Prenatal baseline cortisols were high reflecting normal pregnancy increases, stressful collection methods and/or a highly stressed sample.

Patterns of cortisol response during labor were also examined. Five subjects experienced an increase in plasma cortisol from T1 to T2, while four experienced a decrease. All subjects in the sustaining environment experienced an increase in cortisol from T1 to T2, while all subjects in

the protecting: disengaged environment experienced a decrease almost to the prenatal baseline. Subjects in the protecting: engaged environment showed both increases and decreases. Cortisol response is influenced by a variety of factors, however, the data suggest physiologic response differences in the three social environments. Catecholamine response was assessed but these values are pending analysis.

Fetal and maternal heart rate was also examined. Mean FHR showed no relationship to environmental type. Two of the three subjects in the sustaining environment showed the lowest mean MHRs but no relationship to environmental type was found. Within subject patterns of FHR did not appear to be related to environmental type. Within subject patterns of MHR showed little relationship to environmental type.

Finally, an integrated response, first stage labor outcome was examined for each subject and related to environmental type. A strong pattern was found between the stress-related complications of labor and environmental type. Prolonged and arrested labor was prevalent in the protecting environments and absent in the sustaining environment. However, these results must be interpreted with caution given the limitations of the study.

In summary, this study began to examine the childbirth social environment concurrently with measures of maternal

stress response because excessive maternal stress has been linked with labor complications and fetal distress. Studies in the past have focused on individual responses and have rarely, if ever, described them in an environmental context. Data from the study will be useful to perinatal nurses, childbirth educators and parents to help further our understanding of the person-environment relationship during childbirth. The descriptive information obtained will help us to refocus our clinical practice and research on the influences of the social environment rather than the physical appointments in the childbirth environment.

Chapter 5

Discussion and Conclusions

In this final section results of the study are briefly summarized and related to the study's theoretical framework. Literature is presented to support the major findings of the study. The implications of the study for women and nursing science, limitations and recommendations for future study are also presented.

Patterns of Social Interaction and Maternal Stress Response

Three typologies of the childbirth social environment were found by examining the patterns of nurse and partner social interaction during labor - the sustaining the protecting: engaged and the protecting: disengaged environments. These patterns of the childbirth social environment support and extend May's research on styles of paternal involvement in pregnancy (1982, 1985). She identified three styles of paternal involvement in pregnancy. The first style described men who were "full partners" with their wives during pregnancy and childbirth. These men were emotionally involved, participated in prenatal classes and attended childbirth. They shared the experience of pregnancy with their wives. The second style described men who were "task-oriented" and took some

responsibility for aspects of the pregnancy, such as remodeling the baby's room, making purchases for the baby and reminding their wives to follow their prenatal diet. These men viewed themselves as managers of the experience and would "coach" their wives through childbirth. The third style described men who were "observers", who watched from the sidelines and were uncomfortable with an active role in the pregnancy. May's maternal styles of relating to pregnancy are conceptually similar to the three childbirth environment typologies identified in the present study. Partners in the sustaining environment were "full partners" providing emotional and physical support for their wives during labor. Partners in the protecting: engaged environment were "task-oriented" providing attention and meeting the needs of their wives when they arose. Partners in the protecting: disengaged environment alternated between being "observers" and withdrawing. They did not actively involve themselves in "coaching" their wives through labor.

The work of May and the present study point out an important implication for nursing practice. Nurses caring for women and their partners during labor need to recognize the style differences of partners and alter nursing care based on partner style and the woman's preferences. The nurse may need to facilitate the work of the "full partners" and the "task-oriented" partners by making

suggestions and encouraging them to take the lead in providing positive physical and emotional support for their wives. On the other hand, the nurse may need to provide intensive support for the wives of "observers" who watch from the sidelines or withdraw and do not actively support their wives during labor.

The three childbirth psychosocial environments, the sustaining, protecting: engaged, and protecting: disengaged, were associated with patterns of person proximity, mean levels of maternal prenatal trait anxiety, expression of maternal negative affect, medication use, and cortisol response. The overall pattern of interaction of these person and environmental variables determines the impact of a stressor such as labor. Therefore, the study results should be viewed as patterns of person-environment fit. Person-environment fit is an interactive product of relevant properties of the individual and the context, that predicts health and well-being (French, Rogers & Cobb, 1981). The most important implication of the patterns of childbirth person-environment fit is the relationship to maternal/fetal outcome. While limited to a small number of subjects, the three person-environment patterns were clearly associated with labor outcome. The sustaining person-environment pattern was associated with no complications of labor, while the protecting: engaged and protecting: disengaged person-environment patterns were

associated with prolonged, dysfunctional labors, use of medication and oxytocin, with their own inherent risks. In addition, women in the sustaining environment were pleased with their experience of labor and expressed a sense of accomplishment. Women in the protecting: disengaged environment expressed dissatisfaction with their experience of labor, including the coaching style of their partners and/or the actions of the nurse. Feelings varied between these two extremes in the protecting: engaged environment.

However, the findings of this study are different from those of Lederman et al. (1978, 1979), who correlated increased stress response, including higher anxiety levels, cortisol and catecholamines with increased length of labor, decreased uterine contractility and fetal distress. In the present study, women in the protecting environments, who experienced more active labor complications, exhibited less evidence of stress response. The two women in the protecting: disengaged environment with epidural anesthesia experienced a depressed stress response. They had no expression of negative affect, less perceived pain, decreased cortisol levels and lowered state anxiety as labor proceeded. On the other hand, women in the sustaining environment, who experienced no active labor complications, exhibited more evidence of stress response. These three women had the highest percent negative affect,

more perceived pain, increased cortisol levels and increased state anxiety as labor proceeded.

These data suggest that the relationship between labor complications and maternal stress response may be curvilinear. Excessive or deficient stress response may be related to labor complications. A moderate amount of maternal stress, as exhibited by those women in the sustaining environment, may be desirable. Excessive depression of stress response may also lead to abnormalities of labor. Therapeutic interventions to moderate stress should be used that do not interfere with normal physiologic responses.

Therefore, the ideal childbirth environment would neither depress stress response through technology nor excessively increase maternal stress response through lack of support for the normal psychophysiologic processes. Although all of the women in the study seemed to experience good person-environment fit, however, the sustaining environment appears to be more ideal with its woman-centered focus, close support persons and intensive psychological and physical support. The protecting: disengaged environment seems less than ideal with its technological focus, far away support persons and lack of psychological support. The protecting: engaged environment appears to be on a continuum between the

sustaining environment and the protecting: disengaged environments.

The psychosocial environment was clearly the most important environmental dimension to the subjects in the study. When asked what helped them cope with the stress of labor all subjects mentioned the people present. Examples of their comments follow.

"The people there and what they did helped me cope with the stress of labor" (Subject 1).

"The people helped me through it" (Subject 2).

"My husband being there helped me cope" (Subject 3).

"The people there helped me. Their quiet talking helped me relax" (Subject 4).

"The people there helped me to avoid panicking and had knowledge about the process" (Subject 5).

"The presence of my husband and nurse helped me cope; the nurse helped almost more than my husband because of her knowledge and soothing voice" (Subject 6).

"The presence of my husband and a doctor I trusted helped me cope" (Subject 7).

"Knowing that people were there, that I wasn't alone, but was also not bothered by them, helped me" (Subject 8).

"People helped me cope; my husband was there for me and the nurses and doctors were available and supportive" (Subject 9).

"Having my partner there was very important; having the nurse jump in and take control when I needed it also helped me" (Subject 10).

These comments and those reported under the description of the study setting support the relative unimportance of the childbirth physical environment. This finding is congruent with the work of Lazarus and Hagens (1968) and Frankenhaeuser (1981) who found that physical factors did not affect stress response significantly. Therapeutic strategies aimed at stress modulation should therefore focus on the psychosocial dimension of the childbirth environment, not the physical.

Implications of the Study for Perinatal Health Care

The underlying ideology of the two distinct childbirth environmental types and their implications will be examined next. Katz-Rothman (1989), a sociologist, suggests that there are three deeply rooted ideologies, or ways of organizing our thinking about the world, underlying modern American motherhood and childbirth: patriarchy, technology and capitalism. The ideology of technology underlies the protecting: disengaged childbirth environment. Technology is the application of science, in this case to childbirth. However, technology in childbirth is not just the invention and use of ultrasound, fetal monitors, and in-vitro fertilization. The ideology of technology promotes a way of thinking about oneself in dehumanized, mechanical

industrial terms (Katz-Rothman, 1989). Efficiency and production are highly valued, feelings are not. In the protecting: engaged childbirth environment women's bodies are managed as machines, hooked up to other machines for monitoring, and managed with pain relievers and labor stimulants to efficiently produce a baby. The goal is to make labor more efficient, predictable and manageable. Pain is removed as it is not desirable and adds to inefficiency. Childbirth is viewed as a pathological and dangerous condition to be monitored and treated. The values of a technological society are evident in the protecting: disengaged environment: mind-body separation, rationality, efficiency, systematic organization, predictability and control. Depersonalization and dehumanization result. Childbirth technology robs women of power and control by conferring it to those who control and apply the technology. This disempowerment is both intellectual and physical. Technologies, such as the fetal monitor, impose physical restrictions. Intellectual disempowerment is extensive with women themselves depending solely on the technology and health care providers to guide them through the childbirth experience.

On the other hand, technology does not appear to be the dominant underlying ideology of the sustaining environment. While the sustaining environment is not anti-technological, it is woman-focused and wholistic, avoiding

the Cartesian dualism of the protecting: disengaged environment. The ancient and worldwide tradition of woman-centered, wholistic care for childbearing women is called midwifery. The word midwife means "with the woman." Ideologically, this is more than a physical stance. The woman is seen as the central figure to be supported through the childbirth process by other people. Midwifery provides an alternative ideology to technology. Midwifery rejects dualism of the mind and body and sees unity. Childbirth is viewed as a normal and integrated psychophysiologic experience. Childbirth is seen as more than a mechanical process, it is process of learning about the self. It is not completely controllable or predictable. Pain in childbirth is viewed as inherent and explainable, and does not need to be relieved by drugs. Bergum (1989) points out that suggesting pain medication validates a woman's fear that she can't get through labor without it and once given, takes away not only the painful sensations but prevents her from drawing on fundamental sources of life and spirit. She suggests that validation of the autonomy of the woman and the reality of her pain and difficulty may be more helpful. Therefore, psychological and physical support measures may encourage women to use their special capacities to deal with pain more than an offer of medication. This is not to say that women never need pain

medication, but it would not be the first or only support extended in a midwifery model environment.

The ideology of midwifery appears to underlie the sustaining childbirth environment. Women in the sustaining environment were closely surrounded by support persons who provided them with intensive physical and psychological support and helped them cope with an unmedicated experience of labor. Such an environment may empower women to help themselves, foster sense of mastery, increase self-esteem and maternal autonomy.

These ideological differences between the sustaining and protecting environments may represent a broader societal paradigmatic shift. Society's beliefs and values about childbirth were at one time based on a midwifery ideology. Gradually, with the development of childbirth technology, male domination of obstetrical practice and movement of childbirth to hospitals rather than homes, midwifery declined and the medical technological ideology prevailed (Oakley, 1980; Wertz & Wertz, 1979). The protecting environment was more relevant in the study with 7 of 10 women experiencing it. Only 3 of 10 women experienced the sustaining environment. Will perinatal care of the future be even more technologically focused? What are the implications for women, their families, perinatal nursing practice and research?

Pregnancy and childbirth were once social events with people playing a central role in the care and support of the woman. Today, they have primarily become technological events with social significance. Dehumanization, depersonalization, and iatrogenic complications are side effects of the technological focus in perinatal care. Long term psychological sequelae for women are possible but have not been studied. A litigious climate has also been produced by the technological ideology. Society has been convinced that childbirth technology is refined and applied to such a degree that control of pregnancy and birth outcome is possible. When less than optimum outcomes occur, human error is assumed.

Perinatal nursing practice has been influenced by a technological ideology as well. Perinatal nursing today demands a high level of technological expertise. Nurses in the study spent a large proportion of the time observed proving procedural interactions relating to the technological aspects of care during labor. Only a few of the nurses spent a large proportion of the time observed providing positive interactions, including touching, physical and psychological support. As Naisbitt (1982) points out, we must try to balance high tech with high touch in health care, as well as the workplace and other environments, in order to maintain balance between our physical and spiritual reality. Nursing care during labor

has become so technological, complex and intense that nurses may not have the time or expertise to provide both high tech and high touch care. The role of the labor and delivery nurse has been changed by the technological spiral of obstetrical care (Jordan, 1987). Perinatal nursing has also been drawn into the current medical-legal crisis in obstetrical care. Patterns of nursing care observed in this study were predominantly focused on procedural aspects. Nursing means to provide nurturance. Further examination and future alteration of these patterns may be necessary to refocus care on nurturance as well as technical skill.

A technological ideology also has important research implications. Oakley (1979) made the following observation:

The criteria of reproductive success within the medical paradigm are defined in terms of perinatal and maternal mortality rates, and, to a lesser extent, certain indices of maternal and infant morbidity. This restricted interpretation of successful reproductive outcomes insists that maternal satisfaction with the childbearing experience should be complete if both mother and baby survive without major impairment of their physical health. Other measures of success, such as a woman's emotional reactions to the experience of childbirth and management, are not considered relevant. In general, the medical separation of reproduction from its social context ensures a limited status for the reproducer herself (p. 610).

In other words, outcome measures are restricted by a technological ideology. Objective data, not subjective, are acceptable (Jordan, 1987). If care were defined in

other than technological terms, other outcome measures based on the woman's and families experiences, would be used. A woman's knowledge about her body, her competence and confidence as a result of the birth experience, psychological trauma, and a couple's feelings about the birth experience could all be assessed as outcome measures (Katz-Rothman, 1989).

Implications of the Study for Nursing Science

The results of this study contribute to the knowledge of individual adaptations and environments, as fields of nursing science. The study supports the idea that the interpersonal dimension of the environment more profoundly influences individual adaptation than the physical dimension. The study also supports the notion that the primary components in determining environmental support/nonsupport were the social interactions.

The study also points out the need to study individual responses in health/illness in context. Individual adaptations and environments as fields of study are complimentary and intertwined, necessitating concurrent measurement of variables. Multiple methods and repeated measures facilitated the study of both person and environmental variables simultaneously in this study.

The study also points out the need to employ bidirectional hypotheses for stress research. Too much or too little stress may be maladaptive.

The study utilized objective and subjective data to check validity and to obtain a full answer to questions posed. Nursing science recognizes multiple ways of obtaining knowledge about phenomena. Such studies demand intensive organization and planning, multiple experts and equipment, expense and time.

Limitations of the Study

A review of the limitations of the study has implications for the future research:

1. The study design called for a small number of subjects (n=10). Therefore, conclusions are based on this small sample size and must be generalized with caution.
2. It was not possible or desirable to randomly select subjects or investigate more than one hospital setting for this study. Therefore, results may not be representative of all childbearing women and/or all hospital childbirth environments.
3. Fetal and maternal heart rate did not appear to be sensitive indicators of maternal stress response. Other measures of stress, such as cortisol and the catecholamines are intervening variables and appear to be more sensitive indicators. However, they can not be measured frequently (e.g., concurrently with social interactions) due to technological limitations and human subjects considerations.

4. The measure of state anxiety (STAI) proved to be awkward and inappropriate to administer during labor. Future research may benefit from the testing of alternatives such as a visual analogue anxiety scale.

5. Patterns of social interaction, medication use, state anxiety, cortisol response, pain perception and negative affect covaried. Data should be interpreted as a "package" not by variable. Complex causal pathways are evident among and between these variables. This study did not seek to identify causal pathways but to describe variables occurring concurrently.

6. Directionality in the relationship of social interaction and negative maternal affect was assumed. It is possible that social interaction type influenced negative maternal affect. Future research or subsequent sequential analysis of the study data would be helpful in determining direction and significance of various types of social interaction by the nurse and partner and their relationship to maternal negative affect.

Recommendations for Future Study

The findings of this study and the comments of participants have suggested several areas for future study:

1. Sequential analysis of this study data examining the conditional probabilities of the most frequent social interaction types and negative maternal affect would be

useful to determine if these variables are conditionally related.

2. A larger n clinical trial, randomly assigning a nurse-support person to provide intensive physical and psychological care during labor, could be tried. Maternal stress parameters, such as anxiety, pain, cortisol and catecholamines could be assessed at various intervals, as well as labor outcome and maternal satisfaction.

3. Almost all of the women in the study commented about childbirth pain as a major source of stress during labor. They were shocked by the intensity of the pain and their inability to control it despite the breathing and relaxation learned in childbirth classes. Many complained about lack of information about pain. Are women ill prepared for childbirth pain and as a result opt for medication? A study of various methods of preparation for the pain of childbirth might be informative.

4. Other outcome measures following the experience of childbirth should be examined in addition to traditional measures. Maternal satisfaction, marital adjustment and long term psychological effects may be different following the experience of childbirth in different social environments.

Conclusions

This research concurrently described maternal social interactions and selected parameters of stress response.

The relationship between the childbirth social environment and maternal stress response was explored. Ten subjects were studied using an intensive within subject design, multiple methods and repeated measures. Social interactions of all present were observed and recorded every 60 seconds, along with maternal affect and contraction status. Maternal and fetal heart rate were also recorded every 60 seconds through a computerized data acquisition system. Additional measures of maternal stress response, including maternal state anxiety, pain perception, plasma for cortisol and catecholamine level were collected during labor at 5-6 centimeters of dilation and 90 minutes later. Women were interviewed to obtain their impressions of the physical and psychosocial childbirth environment during labor. Data were analyzed descriptively and graphically. Social interaction data exhibited three childbirth environmental patterns--the sustaining environment, the protecting: engaged environment and the protecting: disengaged environment. Maternal stress parameters covaried with environmental type. Labor outcome was related to environmental type.

Since perinatal nursing and nursing science are concerned about health/illness outcomes in childbearing women, this person-environmental transaction is of interest. Nursing interventions and nursing research may

need to focus on environmental manipulation in order to
improve childbirth outcomes.

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Appendix A
Background Information Sheet

Background Information Sheet - Maternal Stress Study

Date _____ Chart/Hospital Number _____

Date Baby is Due _____

Mother's Name _____

Father's Name _____

Home Address _____

Phone Number(s) _____

Doctor's Name _____

Doctor's Office Address _____

Mother's Age _____ Race _____

Eye Color _____

Marital Status (Circle one)

- (1) Married (2) Single, with partner (3) Single,
without partner

Mother's Occupation _____
(If not working now, give the date you quit work and the
title of your previous occupation) _____

Approximate Family Income _____

Mother's Years of Education _____

Father's Age _____

Father's Occupation _____

Father's Years of Education _____

Have you ever delivered a baby before? Yes No

Have you ever been pregnant before? Yes No

If yes, how many times? _____ Did any of these
pregnancies end in miscarriage? Yes No

How many? _____

As far as you know, do you have any serious medical or obstetrical problems that might complicate your pregnancy or delivery?

Yes No

If yes, describe them to the best of your ability:

Do you and your partner plan to attend childbirth classes?

Yes No

Does your partner plan to attend the labor and delivery of the baby?

Yes No

What physical and psychological properties do you think are important in the labor and birth suite to decrease your stress level during childbirth?

Are you planning to use analgesia/anesthesia during labor?

Yes No

If yes, what kind?

Appendix B
Spielberger State Trait Anxiety Inventory

SELF-EVALUATION QUESTIONNAIRE

Developed by Charles D. Spielberger
in collaboration with
 R. L. Gorsuch, R. Lushene, P. R. Vagg, and G. A. Jacobs

STAI Form Y-1

Name _____ Date _____ S _____
 Age _____ Sex: M _____ F _____ T _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel *right now*, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

VERY MUCH SO
 MODERATELY SO
 SOMEWHAT
 NOT AT ALL

- | | | | | |
|--|---|---|---|---|
| 1. I feel calm | 1 | 2 | 3 | 4 |
| 2. I feel secure | 1 | 2 | 3 | 4 |
| 3. I am tense | 1 | 2 | 3 | 4 |
| 4. I feel strained | 1 | 2 | 3 | 4 |
| 5. I feel at ease | 1 | 2 | 3 | 4 |
| 6. I feel upset | 1 | 2 | 3 | 4 |
| 7. I am presently worrying over possible misfortunes | 1 | 2 | 3 | 4 |
| 8. I feel satisfied | 1 | 2 | 3 | 4 |
| 9. I feel frightened | 1 | 2 | 3 | 4 |
| 10. I feel comfortable | 1 | 2 | 3 | 4 |
| 11. I feel self-confident | 1 | 2 | 3 | 4 |
| 12. I feel nervous | 1 | 2 | 3 | 4 |
| 13. I am jittery | 1 | 2 | 3 | 4 |
| 14. I feel indecisive | 1 | 2 | 3 | 4 |
| 15. I am relaxed | 1 | 2 | 3 | 4 |
| 16. I feel content | 1 | 2 | 3 | 4 |
| 17. I am worried | 1 | 2 | 3 | 4 |
| 18. I feel confused | 1 | 2 | 3 | 4 |
| 19. I feel steady | 1 | 2 | 3 | 4 |
| 20. I feel pleasant | 1 | 2 | 3 | 4 |



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SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name _____ Date _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

NEAREST NEVER
SOME TIMES
ALMOST ALWAYS

- | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| 21. I feel pleasant | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 22. I feel nervous and restless | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 23. I feel satisfied with myself | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 24. I wish I could be as happy as others seem to be | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 25. I feel like a failure | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 26. I feel rested | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 27. I am "calm, cool, and collected" | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 28. I feel that difficulties are piling up so that I cannot overcome them | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 29. I worry too much over something that really doesn't matter | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 30. I am happy | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 31. I have disturbing thoughts | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 32. I lack self-confidence | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 33. I feel secure | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 34. I make decisions easily | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 35. I feel inadequate | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 36. I am content | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 37. Some unimportant thought runs through my mind and bothers me | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 38. I take disappointments so keenly that I can't put them out of my mind | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 39. I am a steady person | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 40. I get in a state of tension or turmoil as I think over my recent concerns and interests | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Appendix C
Visual Analogue Scale Pain Line

PAIN MEASURE



Question asked at T1 and T2: What is your level of pain during labor at this point? Draw a line.

Appendix D
Prenatal Plasma Collection Procedure

Prenatal Plasma Collection Procedure

After obtaining informed consent and administering the STAI, blood samples for cortisol, epinephrine and norepinephrine were obtained in the following manner:

- 1) A heparinized needle was inserted in the dorsal aspect of the nondominant hand or medial aspect of the forearm, following office/hospital policy for aseptic technique for venipuncture. It was secured in place with tape.
- 2) The woman was asked to rest in a semi-recumbant or lateral recumbant position for 20 minutes following venipuncture, as this procedure alone can alter plasma epinephrine for up to 20 minutes (Caruthers, Taggart, Conway, Bates & Somerville, 1970). Postural changes, physical activity or exercise may also alter norepinephrine levels (Kopin, Lake & Ziegler, 1978).
- 3) One-half ml. of blood was drawn and discarded to avoid heparin contamination of the specimens. A second syringe will be used to withdraw 4 mls. of blood to be separated and assayed.
- 4) Samples were placed in heparinized glass tubes and placed on ice until separated.
- 5) Plasma was separated by centrifugation, decanted and frozen to -60°C until all samples were available for assay.
- 6) The needle was withdrawn and the venipuncture site dressed per office/hospital protocol.
- 7) Participants were asked to notify the investigator by telephone or pager when labor has begun.

Appendix E
Friedman Graphic Analysis of Labor

Friedman Graphic Analysis of Labor

Name _____

Onset of Labor A.M. _____ P.M. _____ 19____

CLOCK TIME HOURS

10	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
9																	
8																	
7																	
6																	
5																	
4																	
3																	
2																	
1																	
0																	

DILATATION (RED) _____

STATION (BLACK) _____

Position _____

Examiner _____

Effacement _____

Comments: _____

Appendix F
Labor Physical Environment Checklist

Labor Physical Environment Checklist

Labor:

- Combination Labor/Birth Room Bed type: _____
 Standard Labor Room
 Light level (Circle one: Bright Moderate Dim)
 Sound level (Circle one: Loud Moderate Quiet)
 Temperature (Circle one: Hot Moderate Cold)
 Number of people present
 Other (Specify: _____)

Birth:

- Combination Labor/Birth Room Bed type: _____
 Standard Delivery Room
 Operating Room
 Light level (Circle one: Bright Moderate Dim)
 Sound level (Circle one: Loud Moderate Quiet)
 Temperature (Circle one: Hot Moderate Cold)
 Number of people present
 Other (Specify: _____)

Note: Labor portion to be completed at T1; Birth portion to be completed at time of delivery.

Appendix G

Labor Social Environment Observational Code

Labor Social Environment Observational Code

Labor Social Interaction Codes:

- 0 No Social Interaction (ignoring)
- 1 Negative Interaction (negative emotional support, teasing, arguing, annoying, insulting, fighting, hitting)
- 2 Controlling/Correcting Interaction (giving/receiving commands, direction, correction; "you should do" with a negative connotation)
- 3 Procedural Interaction (technical procedures, labor and procedural related touching and discussion, examinations, assessment of vital signs, doing for or to the woman)
- 4 Informational/Instructional Interaction (experiential and/or factual information given, "how things work"; information or actions that helps the woman help herself, such as information or action to help stay on track with her breathing; enabling the woman)
- 5 Personal Interaction (sharing personal information; use of the name of the person; actions or verbalizations that indicate knowledge of the person's preferences and show individual regard; joking, telling stories; interactions that indicate knowledge of or a desire to know the person)
- 6 Active Listening (presence at woman's side; attending to the woman's needs; no talking, usually accompanied by eye contact or touching; taking time with the person; being with the woman)
- 7 Positive Interaction (positive emotional and physical support; comfort measures, encouragement, reassurance, actions and verbalizations that help the person maintain belief in themselves)
- 8 Intimate Interactions (kissing, hugging, crying together)
- 9 Other Social Exchanges (talking on the phone, watching TV, other-specify)

Affect Codes

- 1 Negative Affect (used when the observer notes a clear expression of anger, pain, sadness, disappointment, disapproval, hostility, resentment, anxiety or fear or notes body language such as an angry expression or face)
- 2 Neutral Affect (used when a flat emotional tone is present or expression is void of emotional content; includes a sleeping/resting state)
- 3 Positive Affect (used when positive emotions such as feelings of happiness, gaiety, enthusiasm, affection, warmth, curiosity, caring, loving or empathy are expressed; or the observer notes body language such as relaxed posture, smiling or other expression of positive emotions)

Proximity Codes

- 1 Together (within two feet of the woman; touching or positioned so that eye-to-eye contact is possible)
- 2 Near (greater than two feet, but less than five, from the woman's side; also includes positions at the foot of the bed or behind the head of the bed)
- 3 Distant (greater than five feet from the woman and positioned away from the woman or not facing her)

Use of the Labor Social Environment Code

The purpose of the Labor Social Environment Code is to capture four dimensions of the social interactions that occur during labor. These dimensions are: 1) who interacts with the laboring woman; 2) the content or type of the social interaction; 3) the affect or emotional tone of the laboring woman with each interaction; and 4) the proximity of the persons interacting with her. In addition, it will be noted whether or not the woman is experiencing a contraction (C), no contraction (C), beginning a contraction () or ending a contraction () during the observation cycle. A (-) will be used if the observer is unsure of contraction status.

The observer sits in the corner of the room and records the data using paper and pencil. Modified frequency recording will be used every 60 seconds. Time periods will be marked with a hand-held stop watch. At the mark, the observer notes for the first 5 seconds who is present within the labor room, what they are doing and

where they are located in relation to the woman. Then she/he records the variables for each person, as simultaneous interactions are possible. A special form is used to record behaviors. It has preprinted categories representing contraction status of the woman, proximity codes (1, 2 and 3) and affect codes (1, 2 and 3). Space is available to record pairs of interaction codes and proximity codes, which will be identified by lettering shorthand, (S1 - support person 1, N - nurse, D - doctor, etc.). All social interactions, with the woman as the focal subject, will be recorded, in consecutive order during each 60 second observation cycle. (Interactions will be one way for the purposes of this study with the woman receiving.) after the 5 second observation period, the observer would first of all code the contraction status of the woman at the beginning of the observation period. Secondly, the observer attends to the persons present (who) and the nature of the social interaction, using one of the nine codes to describe the type of interaction in the labor situation. Thirdly, the observer attends to the proximity of the person(s) interacting with the woman by giving a score of (1) together, (2) near, or (3) distant. Fourthly, the observer attends to the affect or emotional tone of the woman at the time of the interaction by scoring each as (1) negative affect, (2) neutral affect or (3) positive affect. A contraction status code, and sets of identification letters with three digits should result for each interaction within a 60 second block, indicating who interacted, the nature of the social interchange(s), proximity and maternal affect respectively. A heavy line will be drawn between each sixty second interval.

Data Collection Sheet - LSEOC

Subject No. _____
Observer _____
Date _____
Subject Status: Age _____
Gravida _____ Para _____
Marital Status _____
Other: _____

Dilatation observation
began: _____
Time started: _____
Time stopped: _____
Duration of observation: _____

Person codes: _____

Appendix H
Interview Guide

Interview Guide - Maternal Stress Study

Within 24 hours of delivery, participants will be asked the following questions:

- 1) What things, if any, did your partner (nurse/doctor/other support persons) do that were helpful in reducing your stress during labor? (on admission, in early active labor, in late active labor, and at delivery)
- 2) What things, if any, did your partner (nurse/doctor/other support persons) say that were helpful in reducing your stress during labor? (on admission, in early active labor, in late active labor, and at delivery)
- 3) What things, if any, did your partner (nurse/doctor/other support persons) do that were not helpful in reducing your stress during labor? (on admission, in early active labor, in late active labor, and at delivery)
- 4) What things, if any, did your partner (nurse/doctor/other support persons) say that were not helpful in reducing your stress during labor? (on admission, in early active labor, in late active labor, and at delivery)
- 5) Were you satisfied or unsatisfied with your labor and birth experience? Why or why not? What animate and inanimate things in the immediate surroundings made you feel this way?
- 6) Labor and delivery of a child is stressful for most women. What are the sources of this stress during labor? What things helped you cope with the stress?

Appendix I
Consent Form

The Childbirth Environment and Maternal Stress

Katherine Camacho Carr, RN, CNM, Ph.D Doctoral Candidate,
Nursing Science, University of Washington
543-7431 or 323-8986

Dr. Nancy Woods, RN, Ph.D, Professor and Chair,
Parent-Child Nursing, University of Washington
543-8775

Dr. Marcia Killien, RN, Ph.D, Associate Professor,
Parent-Child Nursing, University of Washington
543-8243

Investigator's Statement

PURPOSE AND BENEFITS

This is to request your participation in a nursing research project. The purpose of this study is to gain a better understanding of the physical and psychological responses a woman experiences during the labor and birth of her child. We want to learn more about these responses, including certain hormonal levels, your perceptions of pain and anxiety. We are also interested in learning how the people around you (your partner, nurse or other support persons) interact with you during labor to reduce your stress. By learning more about these responses and how we can influence them through our social interactions, women and their infants may receive better nursing care in the future.

PROCEDURES

Participation in this study would involve the following. You would be asked to complete a questionnaire that asks general information about you, including age, marital status and health status, for example. Based on your responses to these questions, you may be asked to participate in the study. This questionnaire takes about 5-10 minutes to complete. If asked to participate further, one meeting in your doctor's office during the last 6 weeks of your pregnancy would be required. This would last about 45 minutes. During that time you will be asked to fill out a questionnaire and have 4 ml. (about a teaspoon) of blood drawn. I will be on call for your labor and birth in order to be present there to administer additional questionnaires, draw two more 4 ml. blood samples (about two teaspoons) and observe your labor. Questions would be asked of you twice in active labor. They are brief and aimed at obtaining your ideas and feelings of any anxiety or pain you are experiencing. The blood samples during

labor will be drawn from your intravenous line or a very small needle in place in your vein throughout labor. An IV line is usually required by your physician anyway and will involve no additional needle sticks for this study. The total amount of blood obtained for the study during the prenatal period and labor is 12 ml. or about two and one-half teaspoons. This is less than most routine lab tests done on admission in labor. In addition, I will ask to record your baby's heart rate (from the fetal monitor that you already will have in place) and your heart rate (from a special cardiac monitor that I will ask you to wear) during a 90 minute period of labor. The cardiac monitor involves wearing a button-sized monitoring device taped in place under your left breast over the heart. It is a standard piece of hospital equipment frequently used during surgery. In addition, to these measures, I will be present for approximately 90 minutes of your active labor to observe the social interactions between you and your partner, nurse and others that may be present. Within 24 hours of your baby's birth, I would like to ask you about your experiences during labor and get your opinion on what helped you cope or did not help. These interviews will be audiotaped. You may refuse to answer any question on the questionnaires - before, during or after delivery. Data concerning the health status of you and your baby will be obtained from your medical record following delivery.

RISK, STRESS OR DISCOMFORT

You will receive the same care as other women in the maternity department. The investigators do not know of any risk to your baby because of your participation in this study. The IV line that you will have will be flushed with a substance that prevents blood from clotting in the tube (heparin).

You may consider the presence of a researcher during your labor to be uncomfortable. However, the presence of an unobtrusive, female researcher has not been found to be uncomfortable for women in past research. In addition, the researcher is an experienced nurse-midwife. All observations and responses will be kept confidential to respect your privacy. You may ask the observer to leave the room at any time.

OTHER INFORMATION

In order to evaluate the results of this study, your medical records may need to be available to other researchers associated with the research project. These other researchers are listed at the top of this form. The National Center for Nursing Research, National Institutes of Health, may also have access to identifiable research data. All precautions to maintain confidentiality of medical records will be taken. Your personal identity will not be revealed in any publication or results. Identifiable written data will be kept until the data are analyzed and reported (June, 1989). The audiotapes will be used at a later date by the same researchers to verify the observations made during your labor. They will be retained indefinitely. You may request to review the tape(s) and delete any portion. You may choose to withdraw from the study at any time without jeopardy to your health care.

No additional costs should be incurred by you due to the equipment or procedures associated with the study. It is understood that all medical expenses relating to, or arising from these procedures will be paid by you and/or your insurance company. Financial compensation is not available for this study or in the event of physical injury or death. I will be glad to answer any other questions you have about the study. Or, if you have any questions about your rights as a research participant, please contact Karen Hansen in the Institutional Review Office of Swedish Hospital at 206/467-4867.

Participant's Statement/Authorization

The study described above has been explained to me and I voluntarily consent to participate in this research. I have had an opportunity to ask questions and understand that future questions that I may have about the study or my rights will be answered by the investigators listed above. I understand that my participation in this study will be terminated if in the opinion of my personal physician that this is in my best interest.

Signature of participant Date

Signature of partner/spouse Date

Signature of Witness Date

Investigator's Statement

I have provided an explanation of the above study and have encouraged the participant to request additional information regarding this research project. A copy of this consent form has been given to the participant.

Investigator's Signature Date Katherine Camacho Carr
Investigator's Printed Name

University of Washington
Affiliation

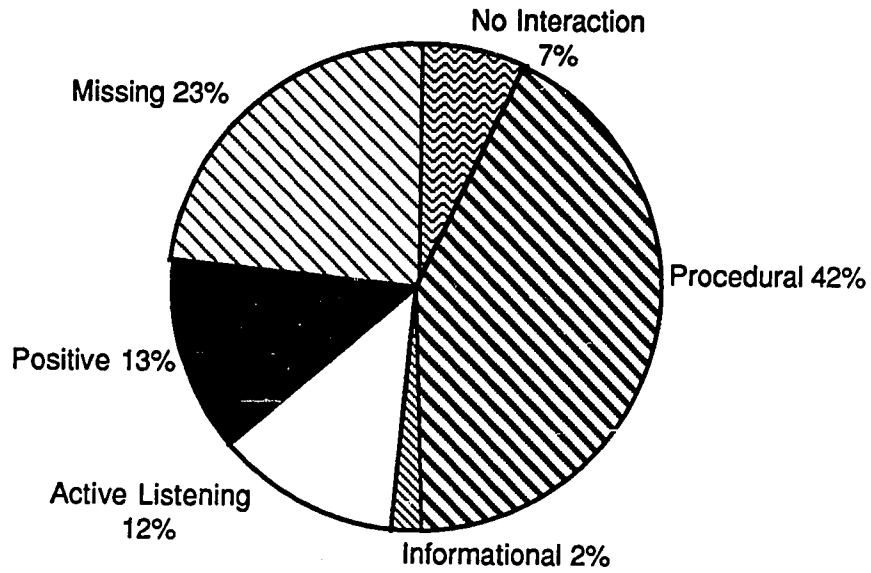
Pager: 998-8207 (Call from a touch tone phone. After the beep, beep, slowly enter the number you wish the researcher to call.)
Emergency Phone Number

cc: Participant
Investigator file

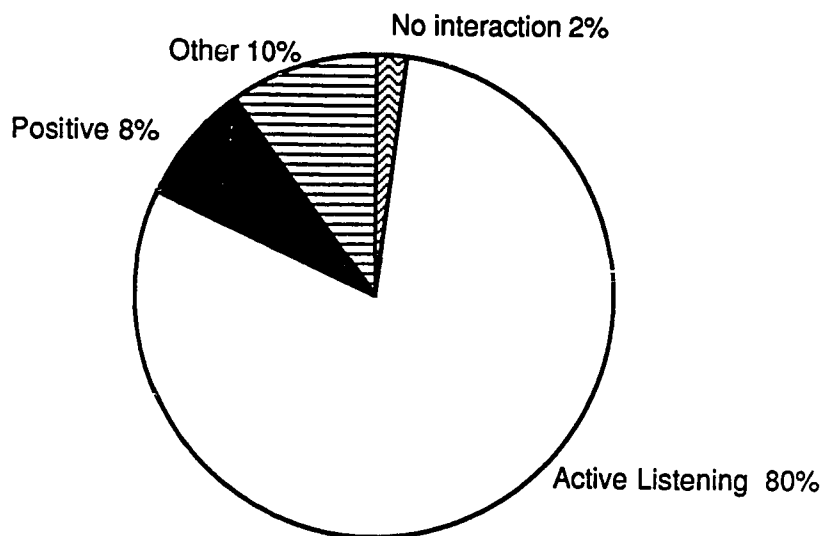
Appendix J

Pie Graphs of Social Interaction Types by
Nurse and Partner: Subjects 1-10

Percent Social Interaction by Nurse: Subject 1

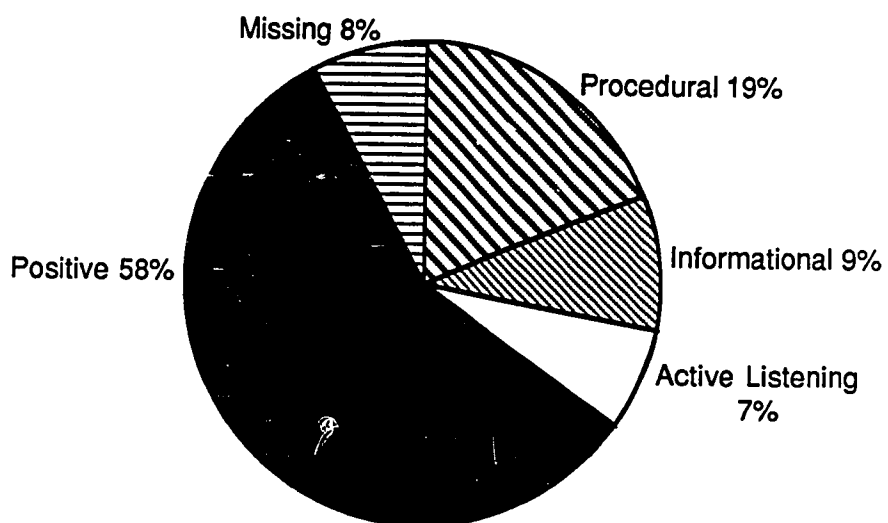


Percent Social Interaction Type by Partner: Subject 1

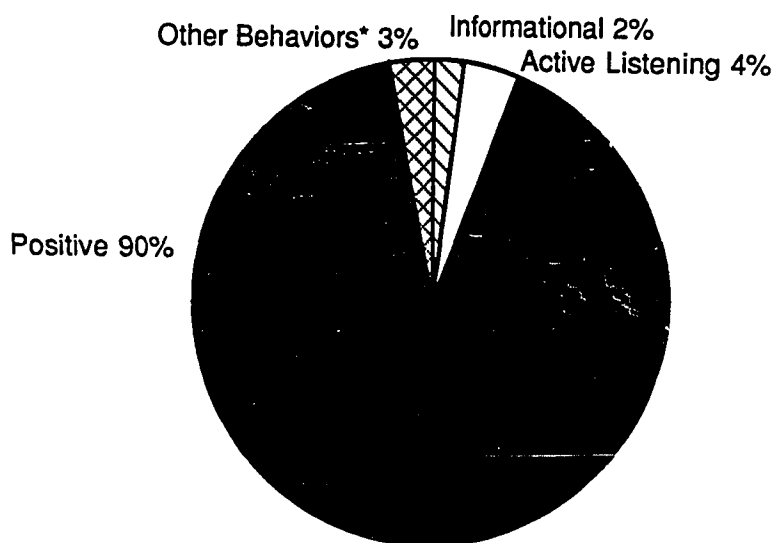


Total Observation Time = 90 Minutes

Percent Social Interaction Type by Nurse: Subject 2

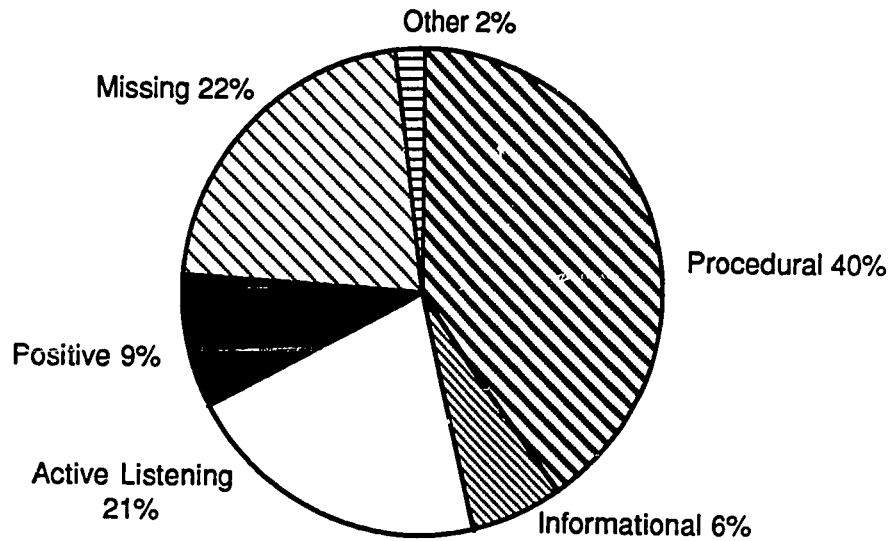


Percent Social Interaction Type by Partner: Subject 2

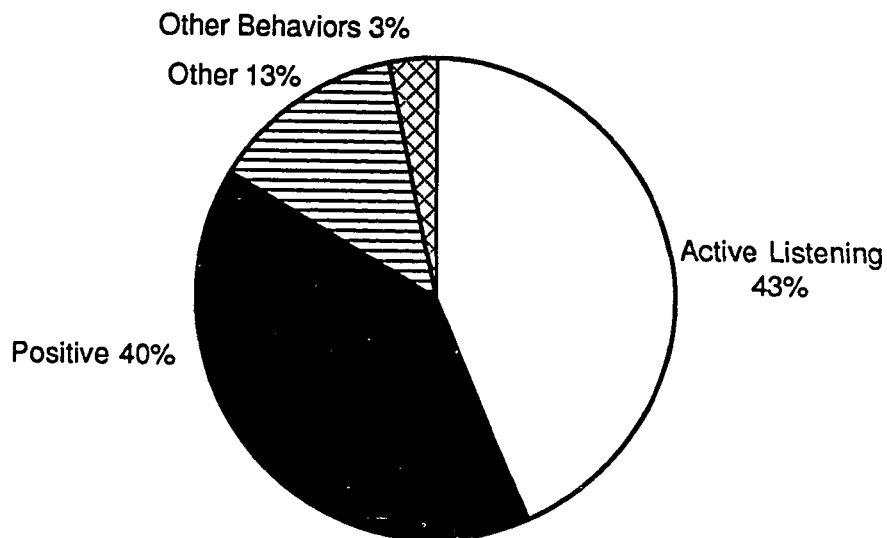


Total Observation Time = 90 Minutes
 *Categories less than 2% collapsed into Other Behaviors

Percent Social Interaction Type by Nurse: Subject 3

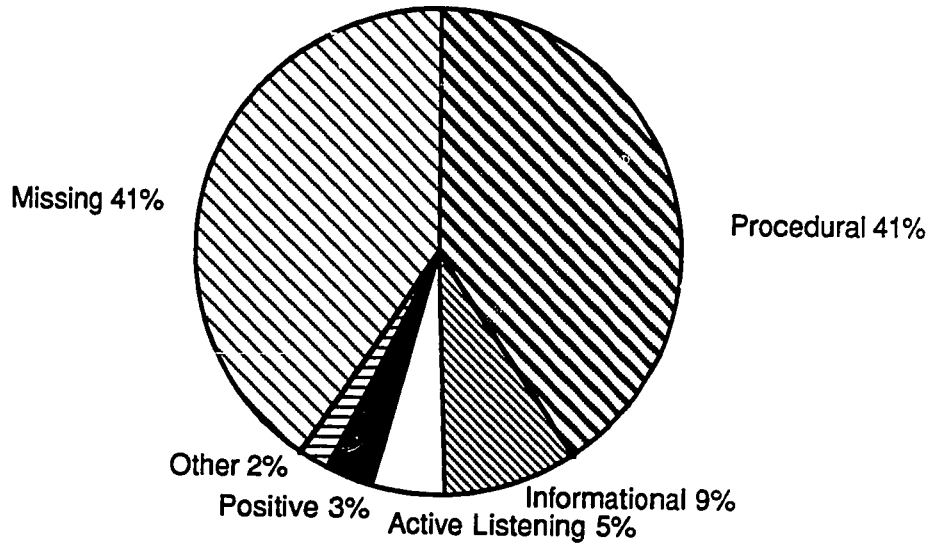


Percent Social Interaction Type by Partner: Subject 3

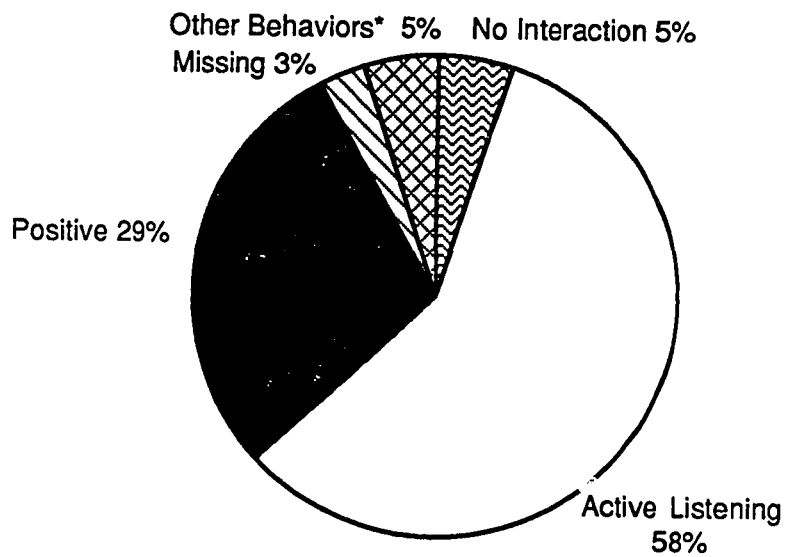


Total Observation Time = 90 Minutes
 *Categories less than 2% collapsed into Other Behaviors

Percent Interactional by Nurse: Subject 4



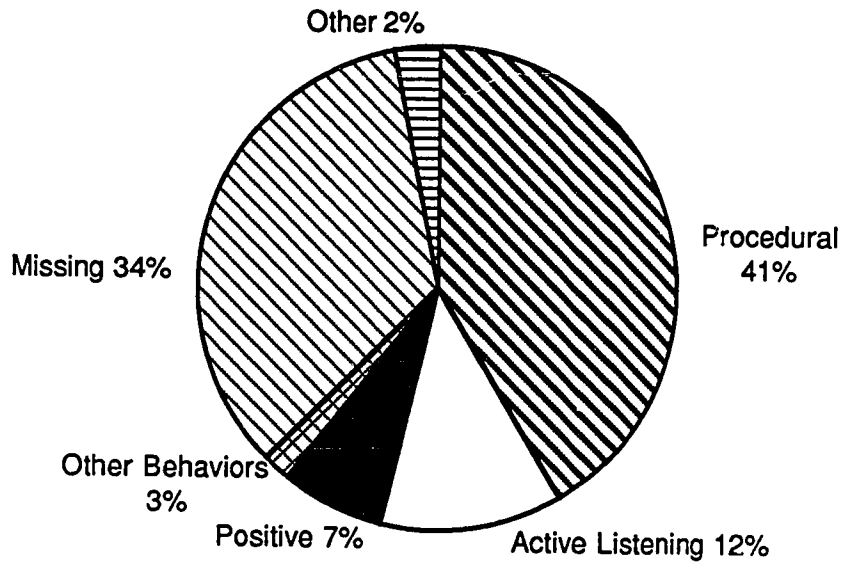
Percent Social Interaction Type by Partner: Subject 4



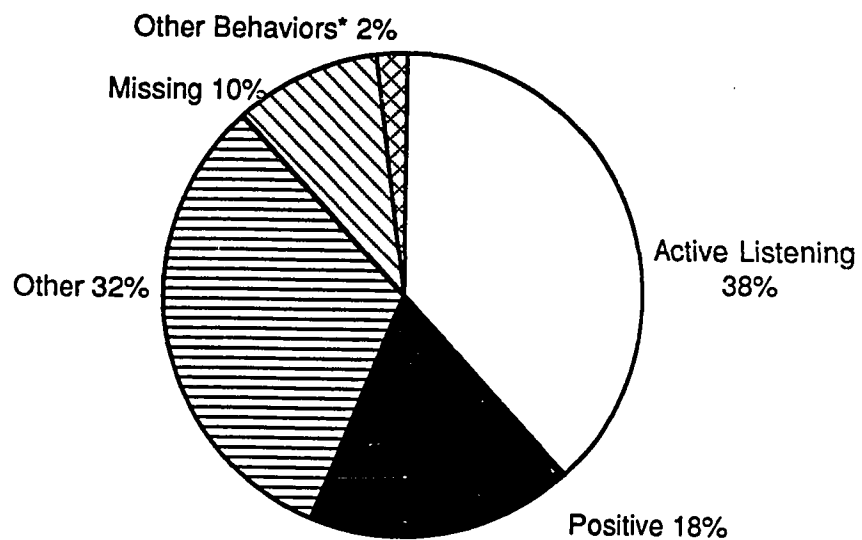
Total Observation Time = 59 Minutes

*Categories less than 2% collapsed into Other Behaviors

Percent Social Interaction Type by Nurse: Subject 5



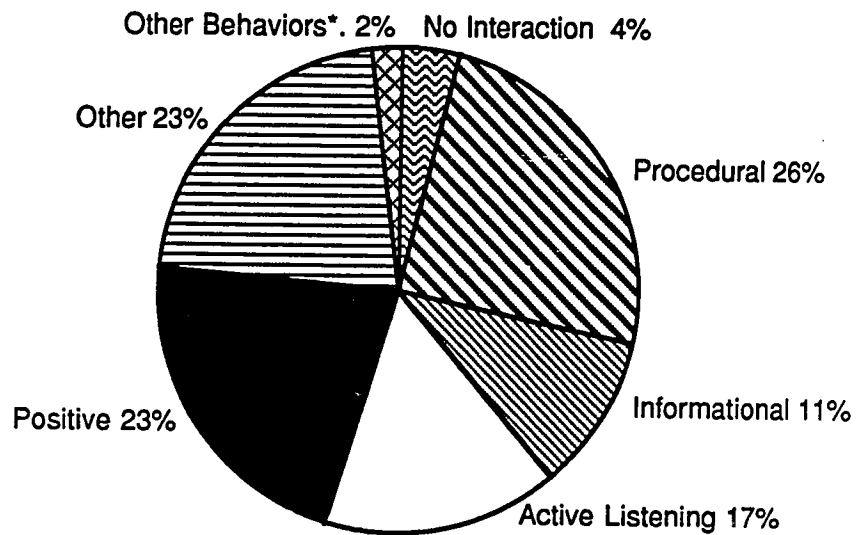
Percent Social Interaction Type by Partner: Subject 5



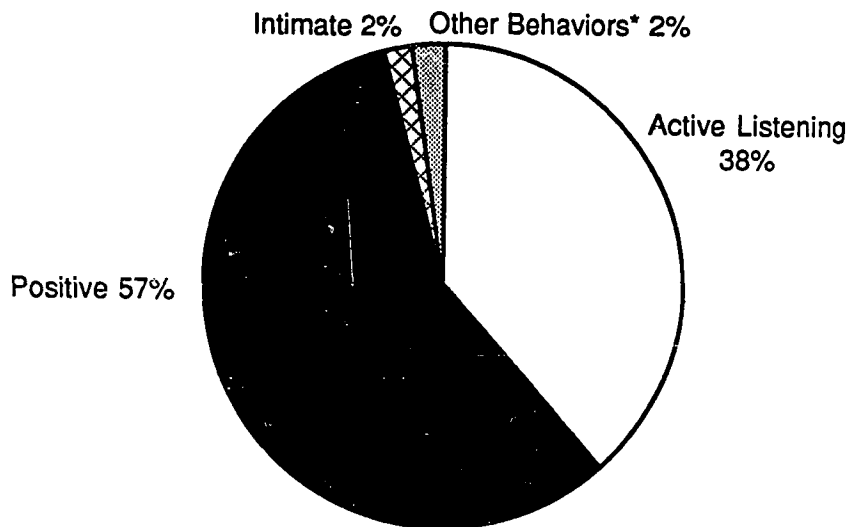
Total Observation Time = 90 Minutes

*Categories less than 2% collapsed into Other Behaviors

Percent Social Interaction Type by Nurse: Subject 6

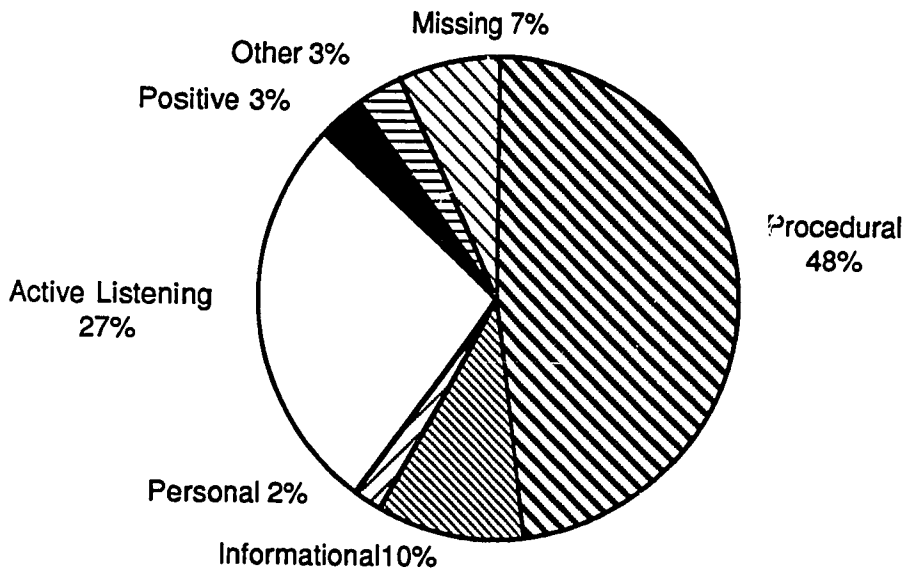


Percent Social Interaction Type by Partner: Subject 6

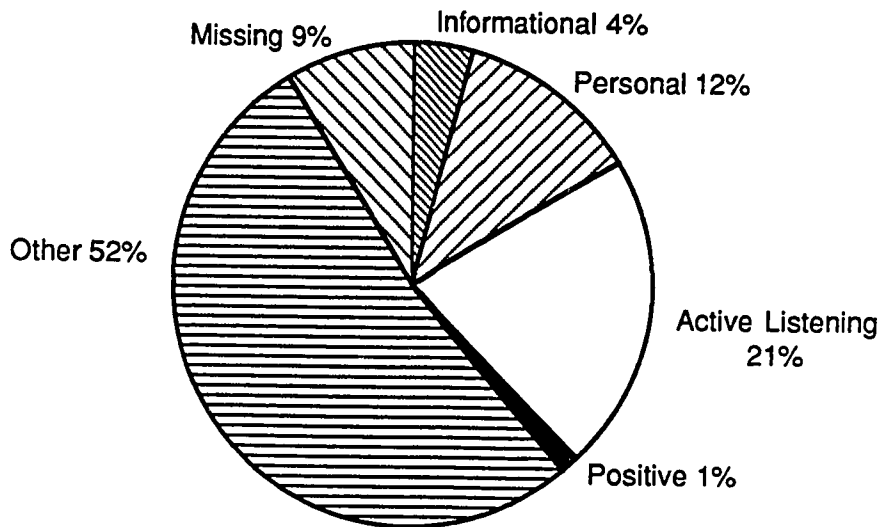


Total Observation Time = 82 minutes
 *Categories less than 2% collapsed into others

Percent Social Interaction Type by Nurse: Subject 7

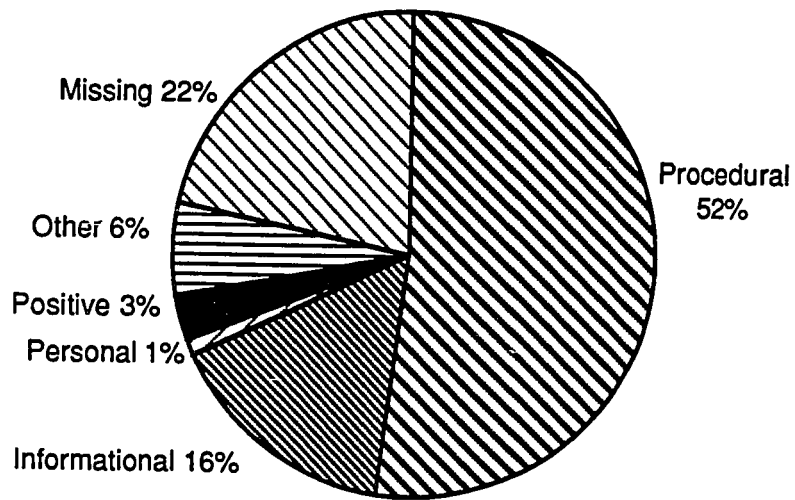


Percent Social Interaction Type by Partner: Subject 7

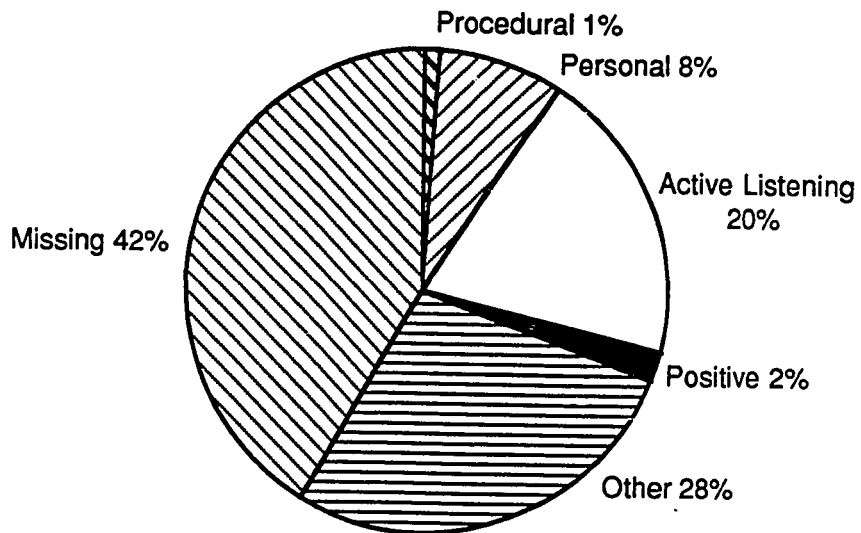


Total Observation Time = 90 Minutes

Percent Social Interaction Type by Nurse: Subject 8

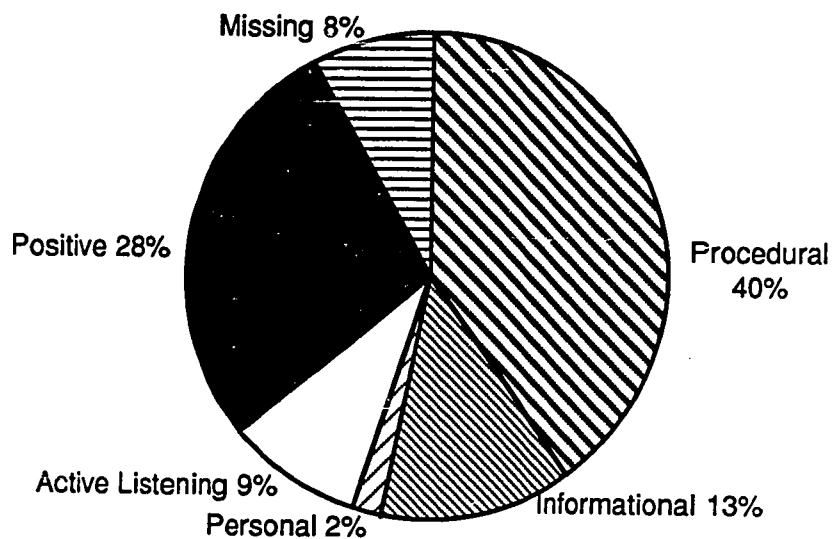


Percent Social Interaction Type by Partner: Subject 8

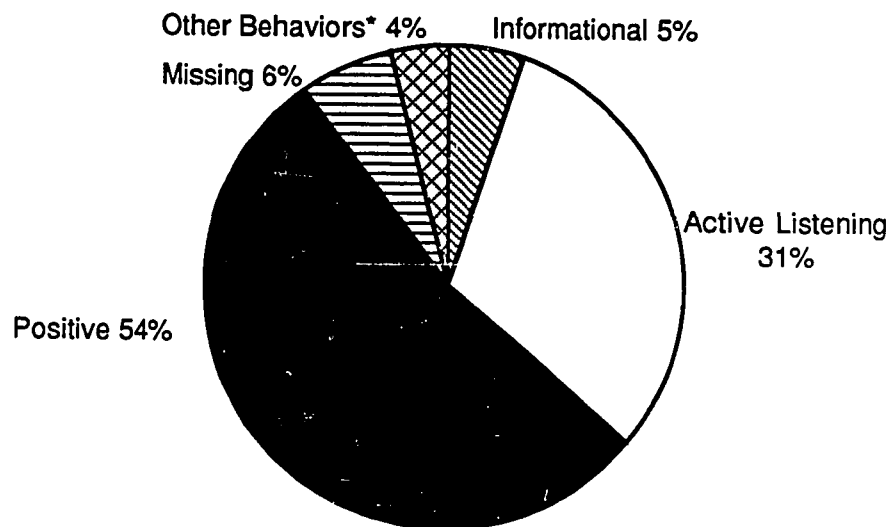


Total Observation Time = 90 Minutes

Percent Social Interaction Type by Nurse: Subject 9

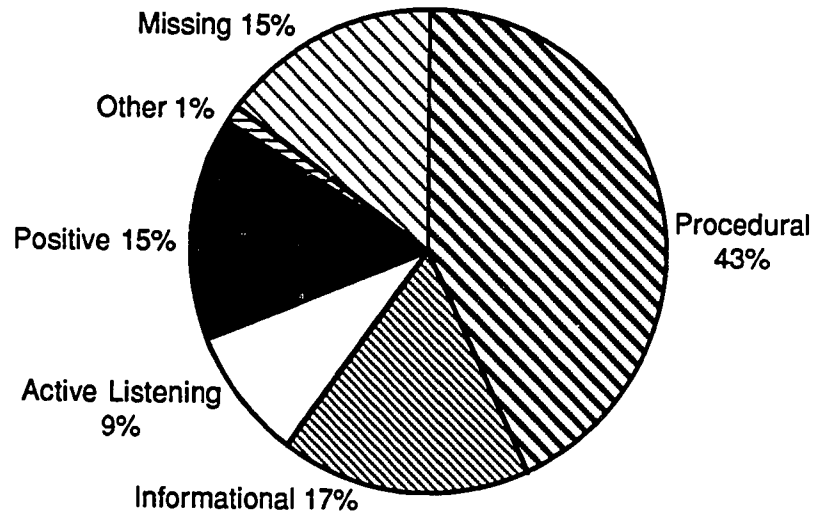


Percent Social Interaction Type by Partner: Subject 9

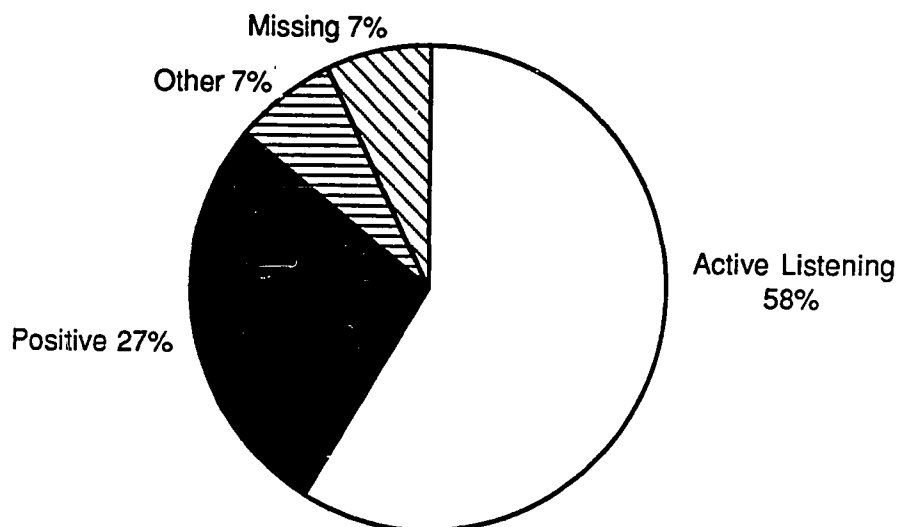


Total Observation Time = 67 Minutes
*Categories less than 2% collapsed into others.

Percent Social Interaction Type by Nurse: Subject 10



Percent Social Interaction Type by Partner: Subject 10

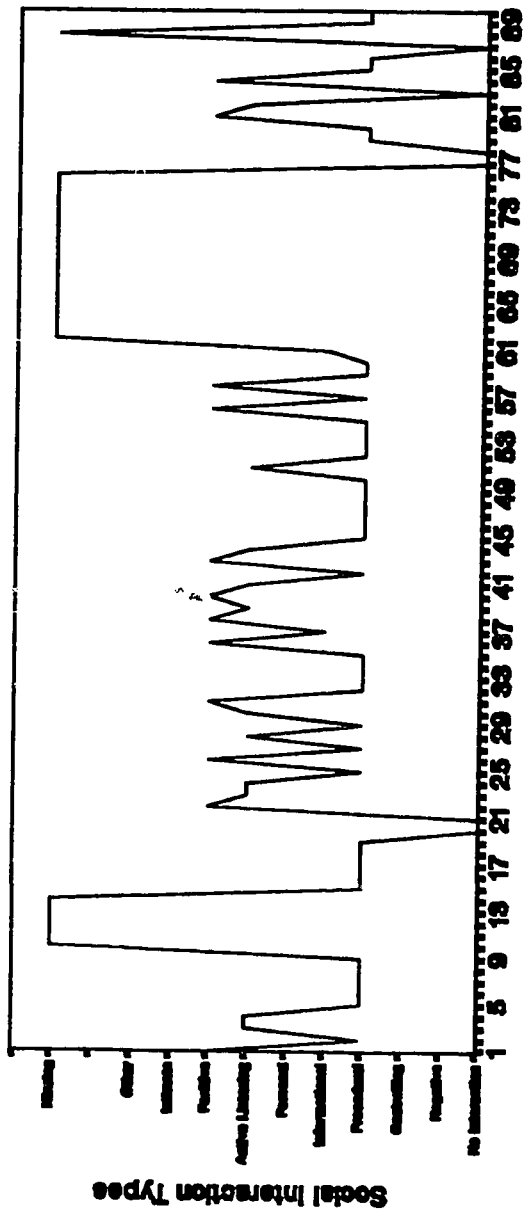


Total Observation Time = 81 Minutes

Appendix K

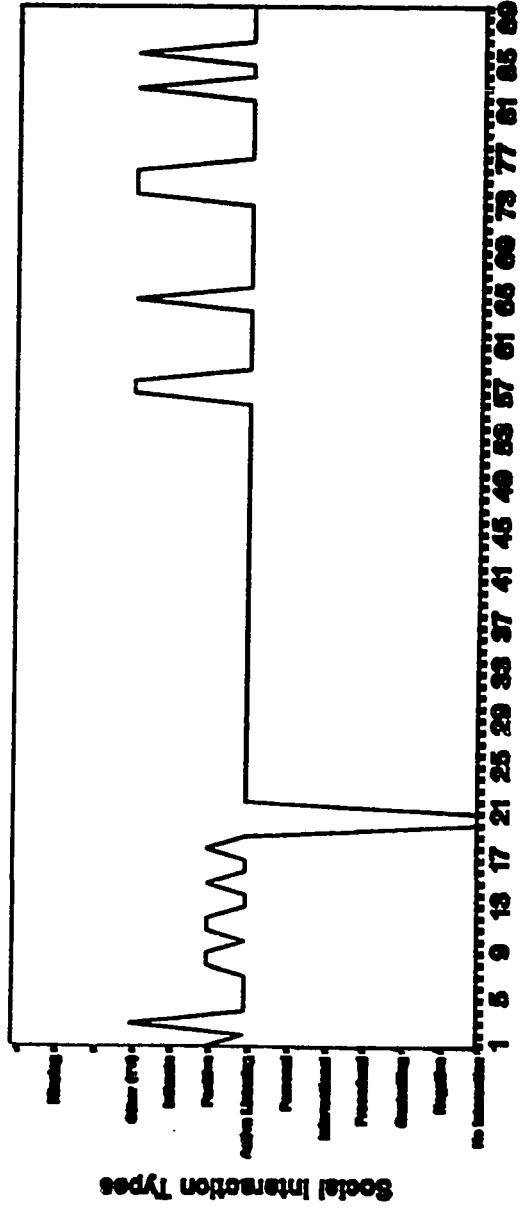
Line Graphs of Social Interaction Types
by Nurse and Partner: Subjects 1-10

Social Interaction Types by Nurse Over Time: Subject 1



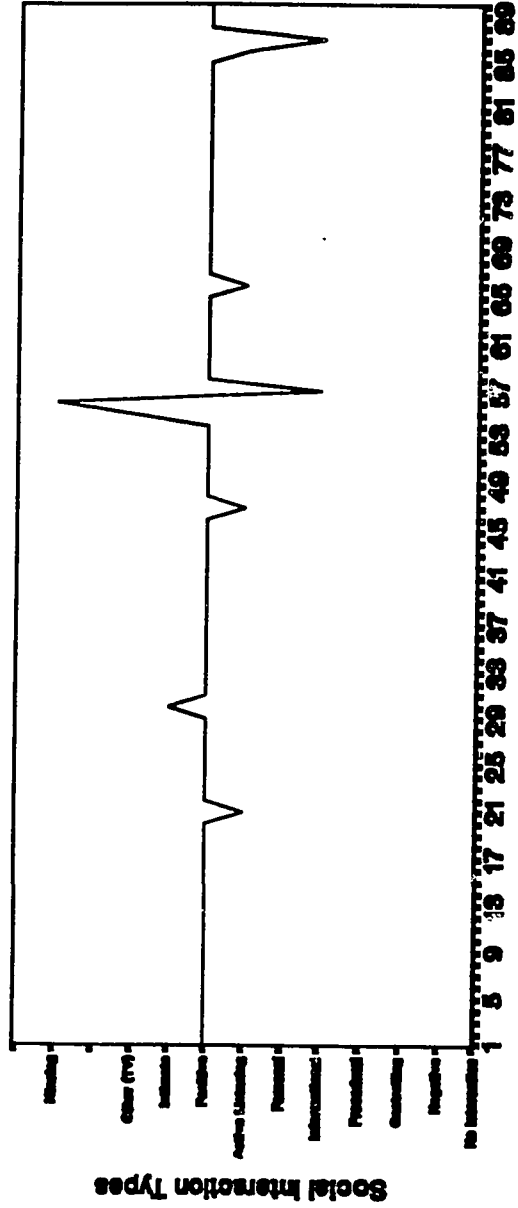
Time in minutes

Social Interaction Types by Partner Over Time: Subject 1



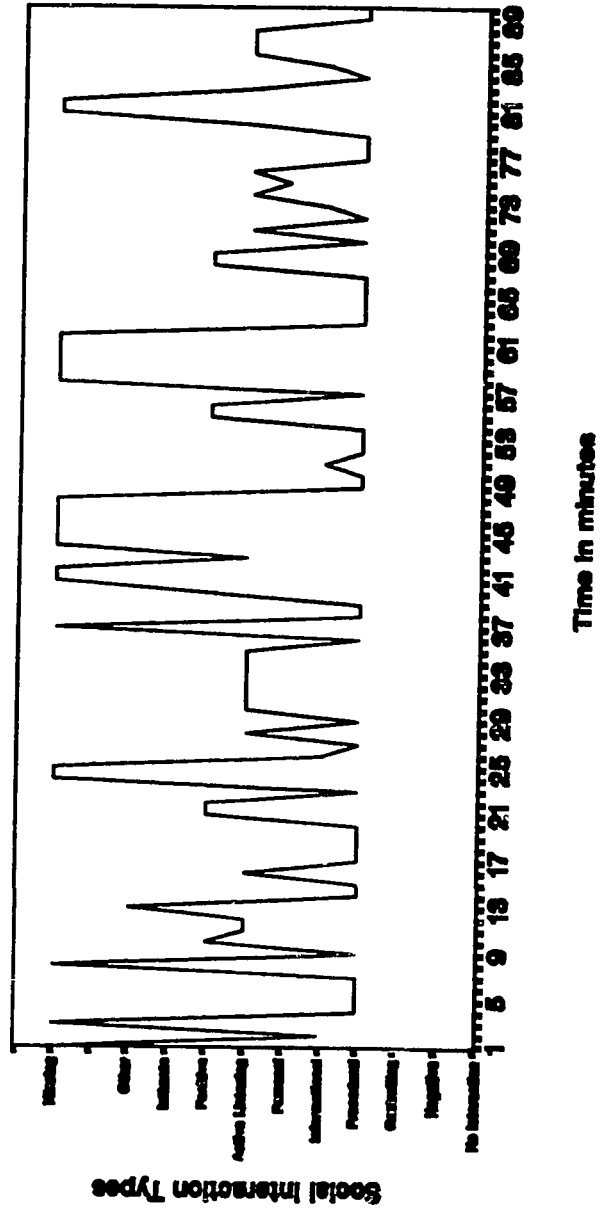
Time in minutes

Social Interaction Types by Partner Over Time: Subject 2



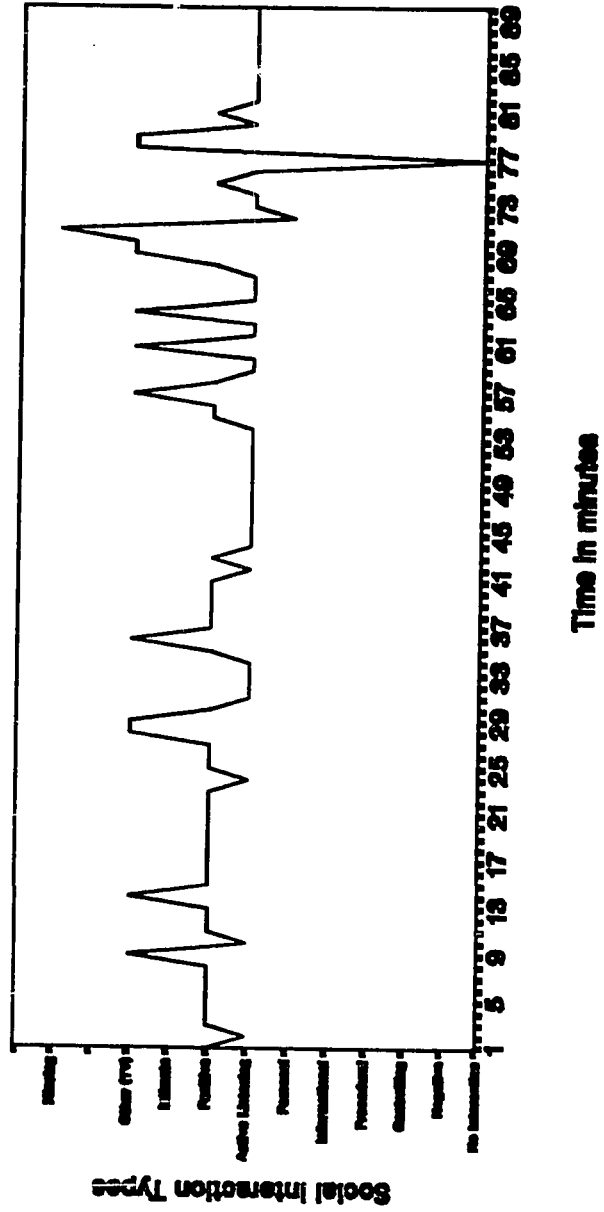
Time in minutes

Social Interaction Types by Nurse Over Time: Subject 3

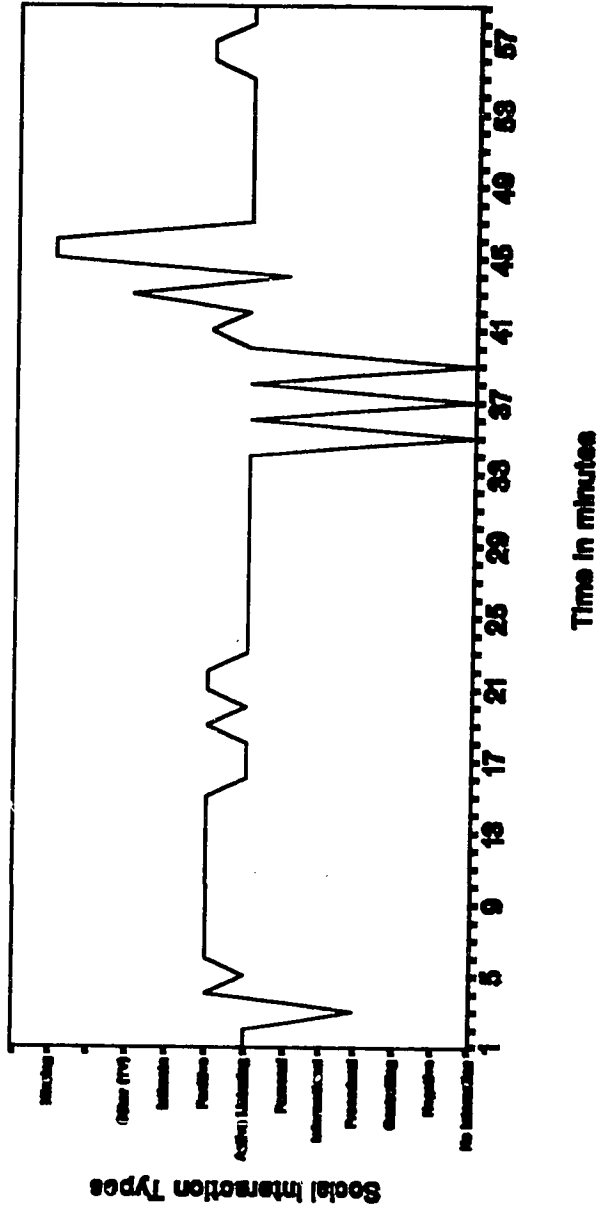


Time in minutes

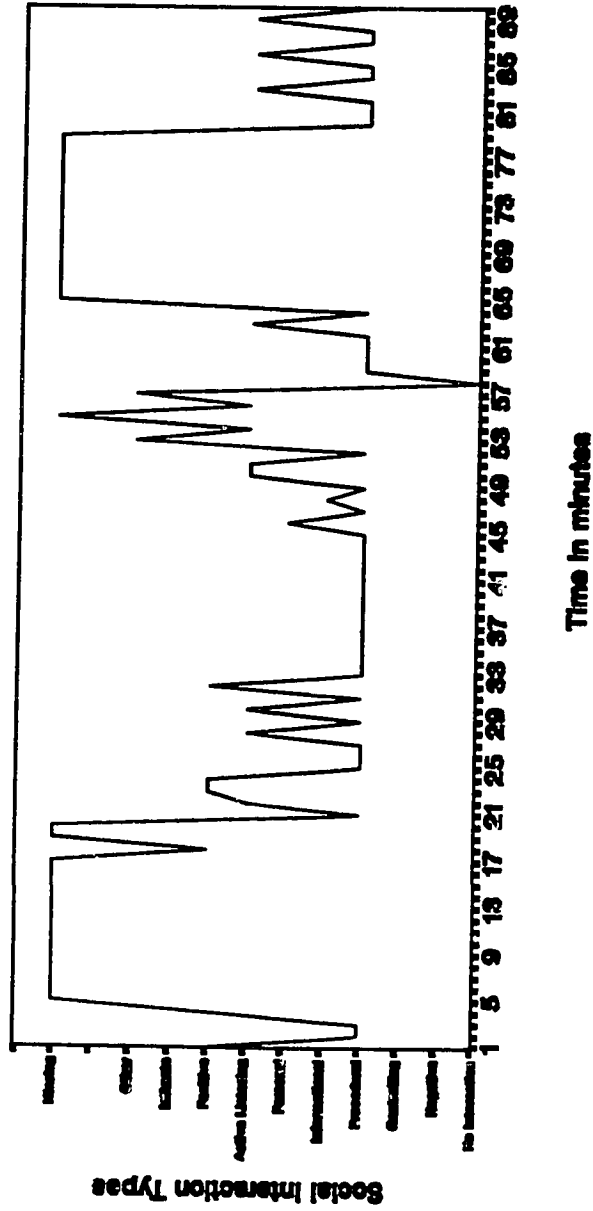
Social Interaction Types by Partner Over Time: Subject 3



Social Interaction Types by Partner Over Time: Subject 4

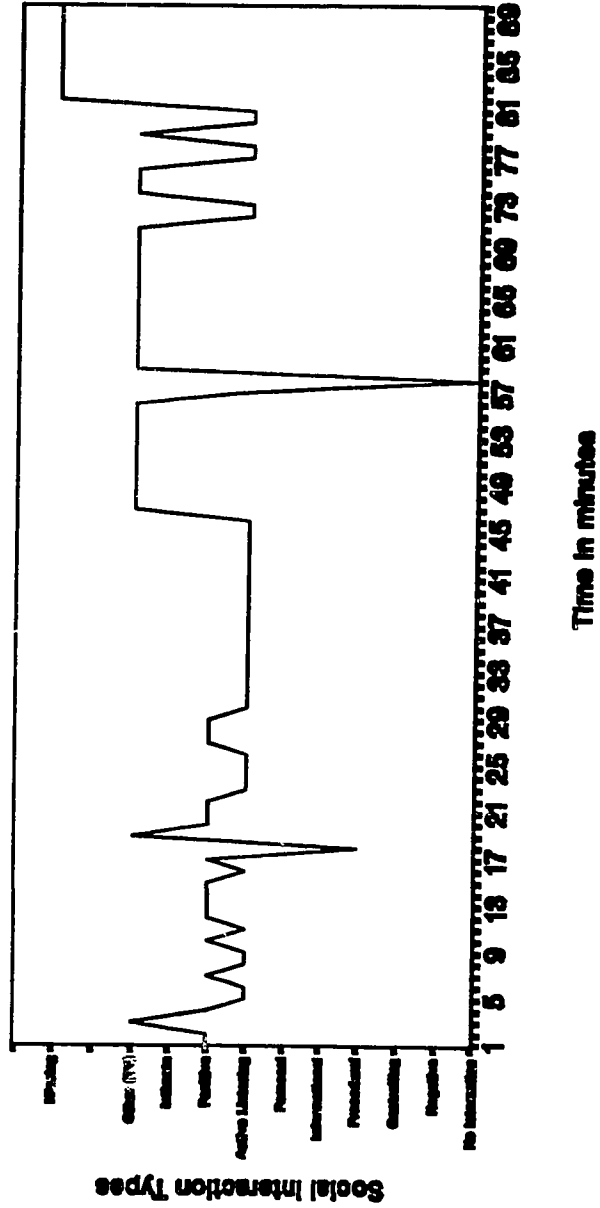


Social Interaction Types by Nurse Over Time: Subject 5



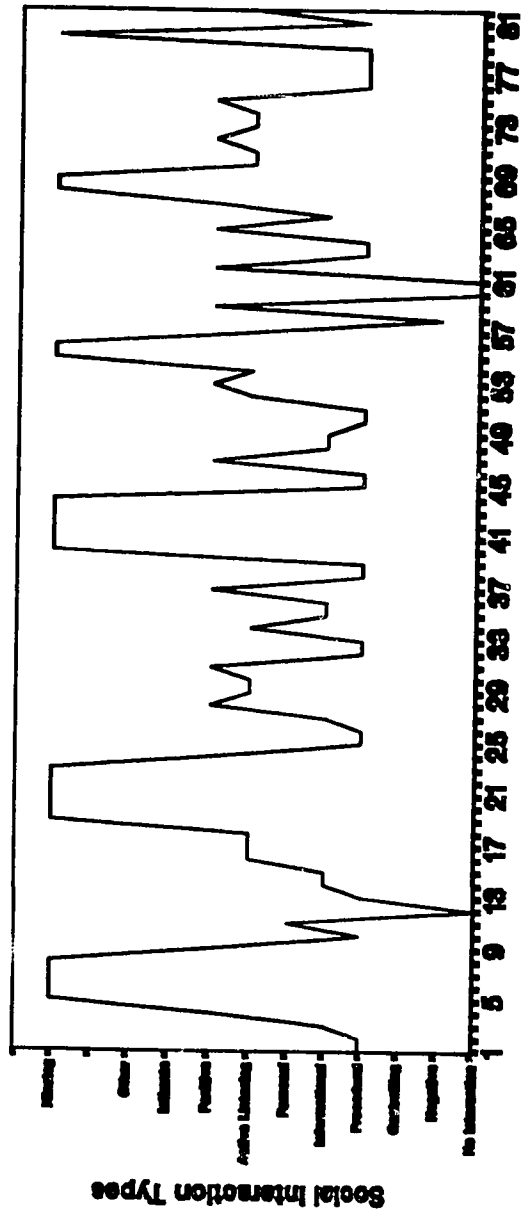
Time in minutes

Social Interaction Types by Partner Over Time: Subject 5



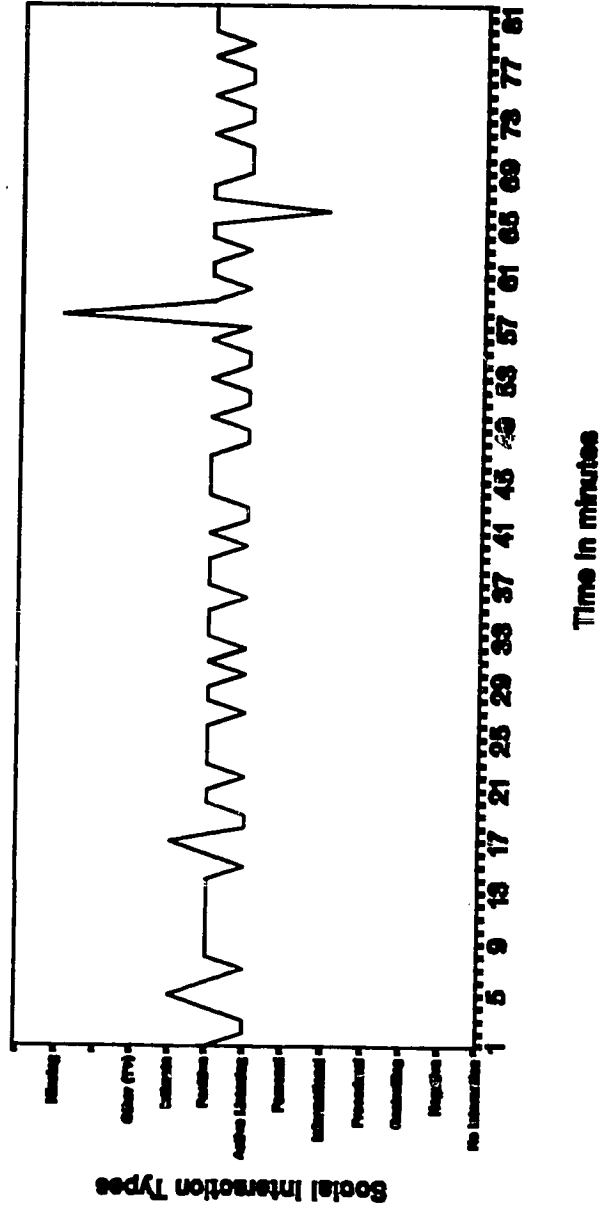
Time in minutes

Social Interaction Types by Nurse Over Time: Subject 6



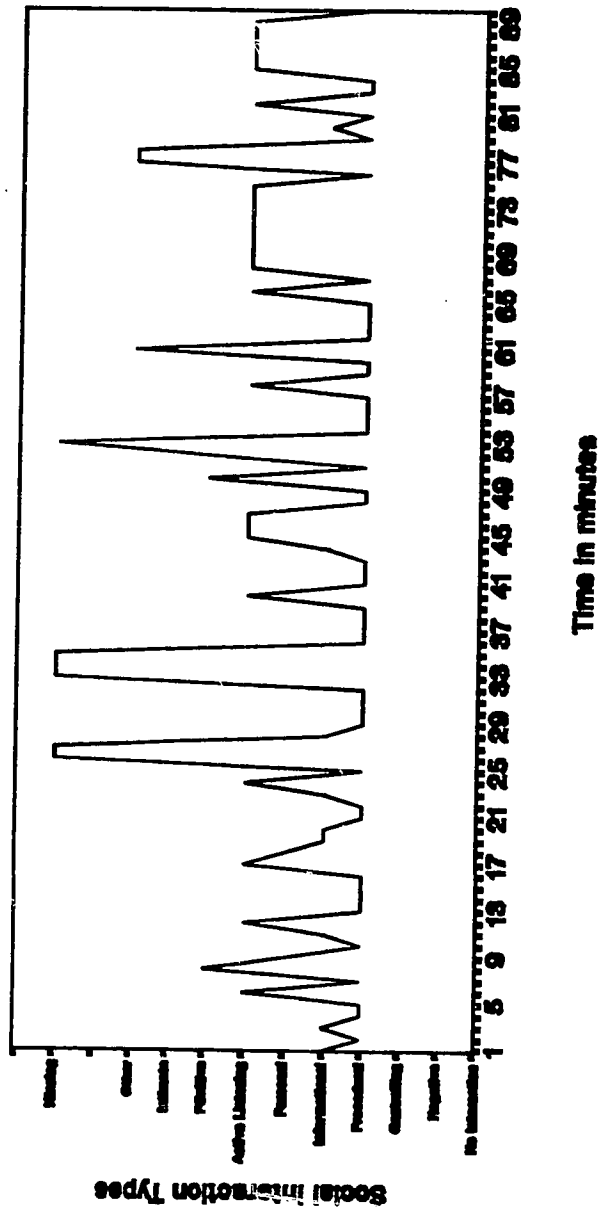
Time in minutes

Social Interaction Types by Partner Over Time: Subject 6



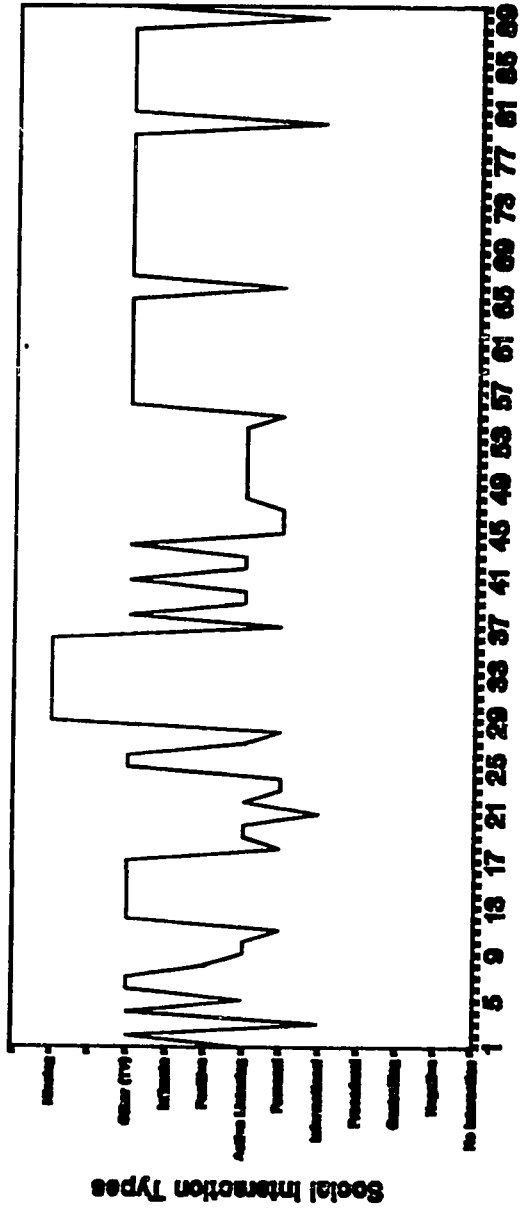
Time in minutes

Social interaction Types by Nurse Over Time: Subject 7



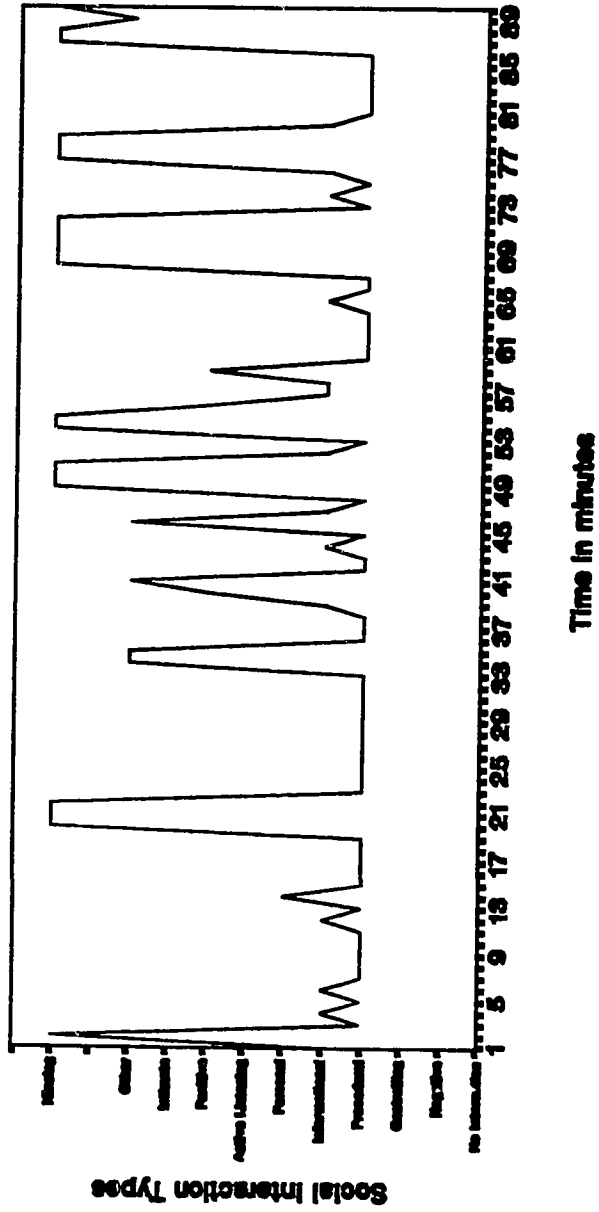
Time in minutes

Social Interaction Types by Partner Over Time: Subject 7



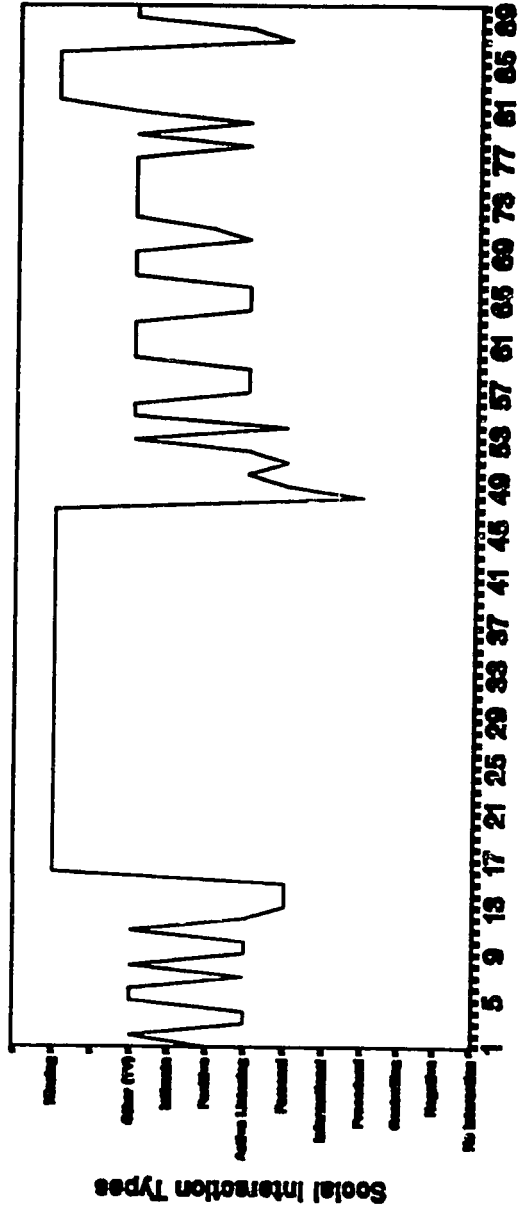
Time in minutes

Social Interaction Types by Nurse Over Time: Subject 8



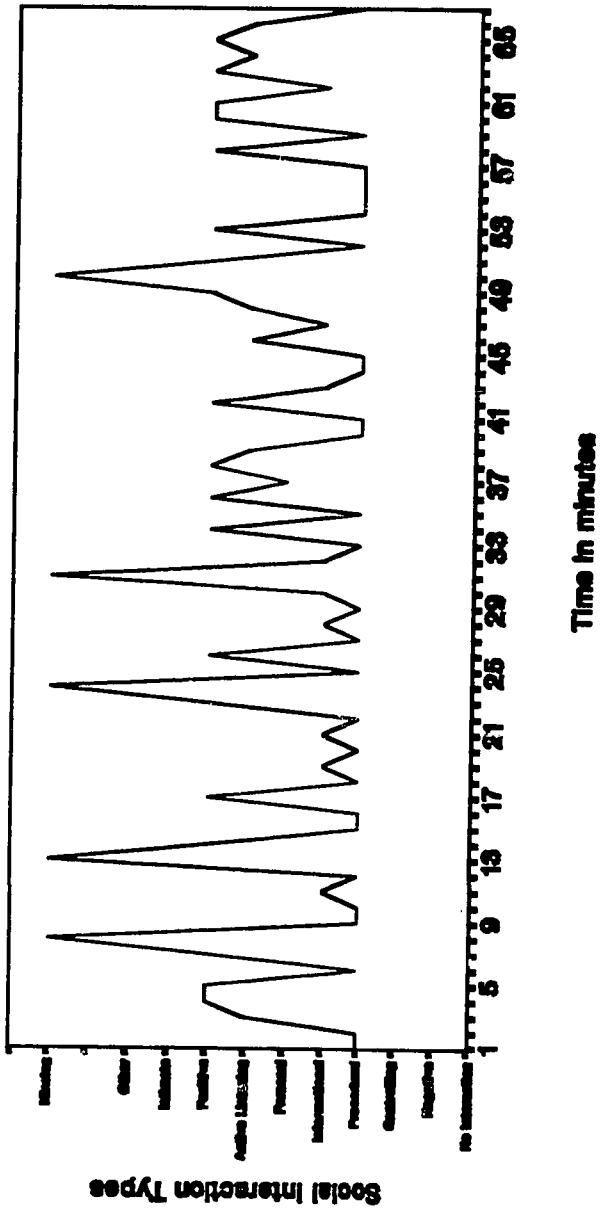
Time in minutes

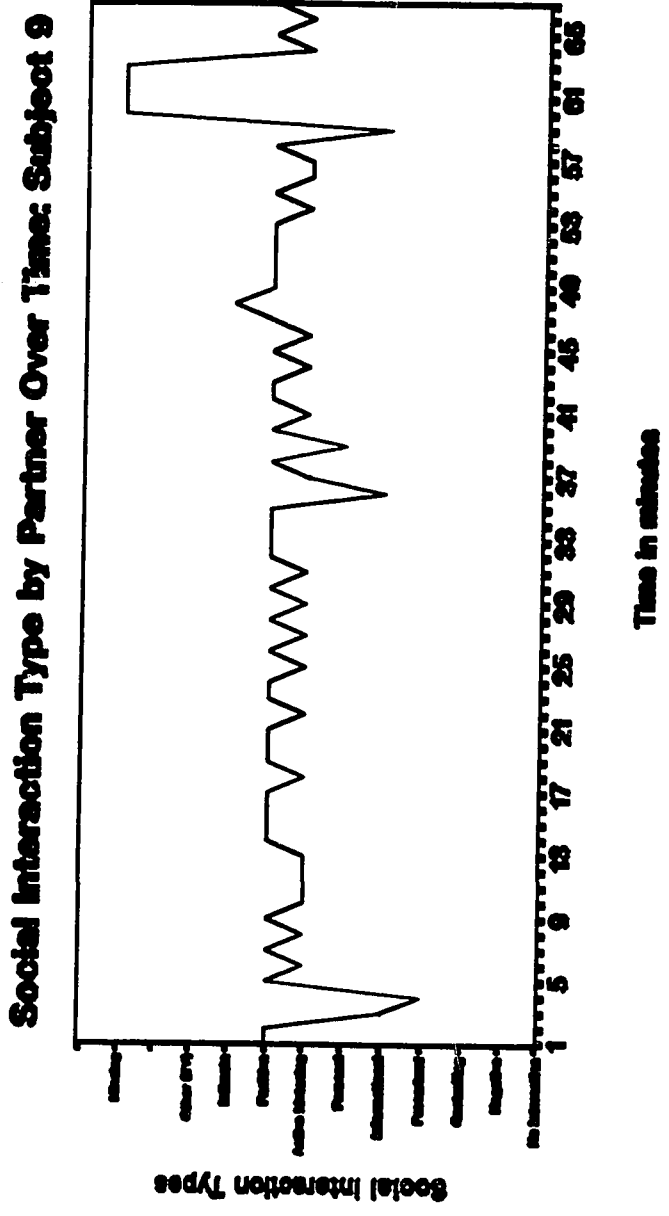
Social Interaction Types by Partner Over Time: Subject 8



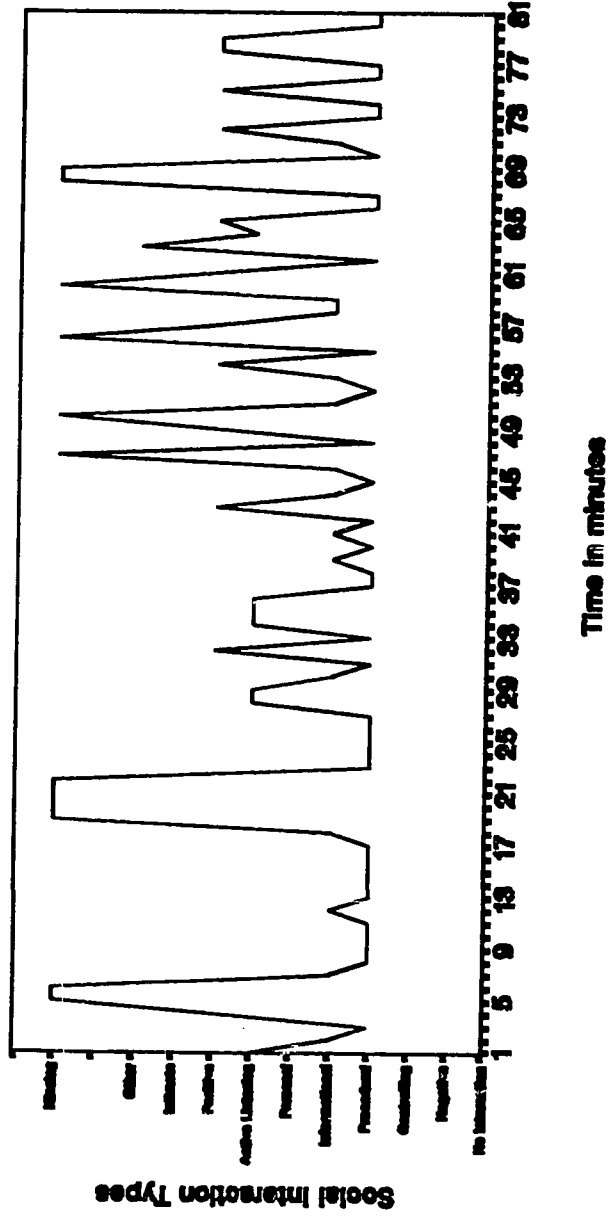
Time in minutes

Social Interaction Types by Nurse Over Time: Subject 9



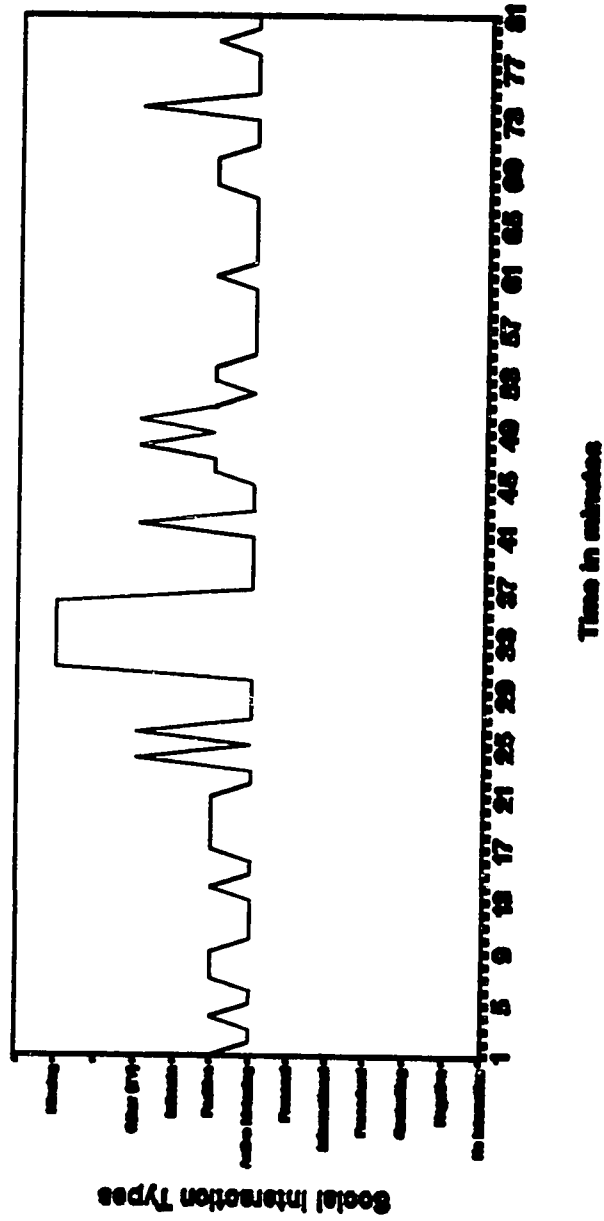


Social Interaction Types by Nurse Over Time: Subject 10



Time in minutes

Social Interaction Types by Partner Over Time: Subject 10



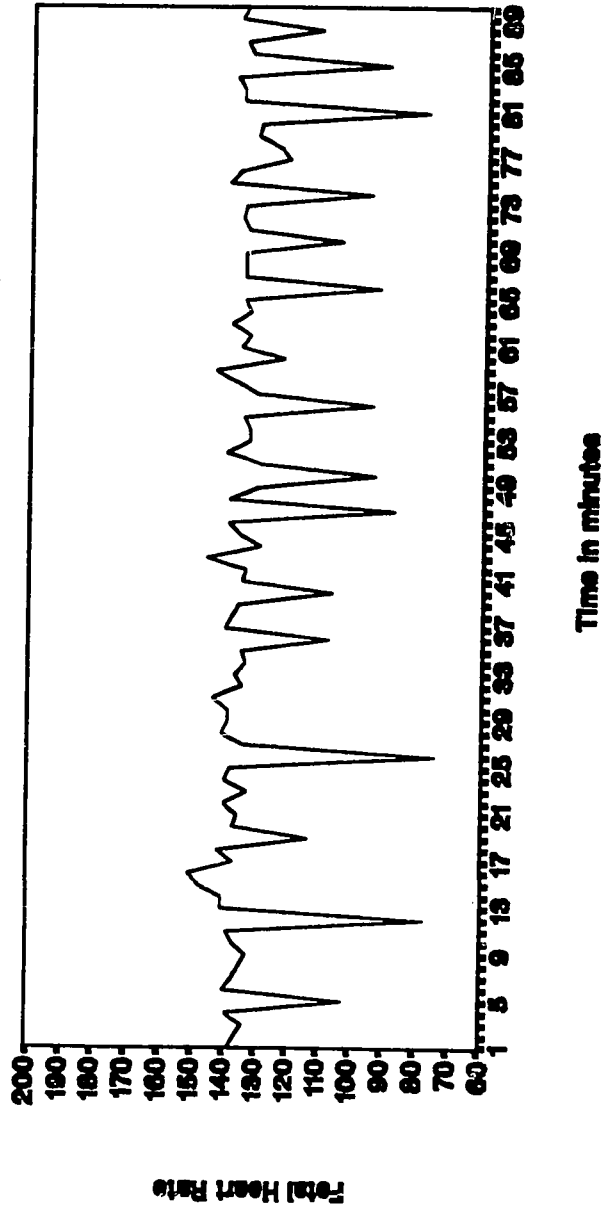
Social Interaction Types

Time in minutes

Appendix L

Line Graphs of Fetal Heart Rate and Maternal
Heart Rate: Subjects 1-10

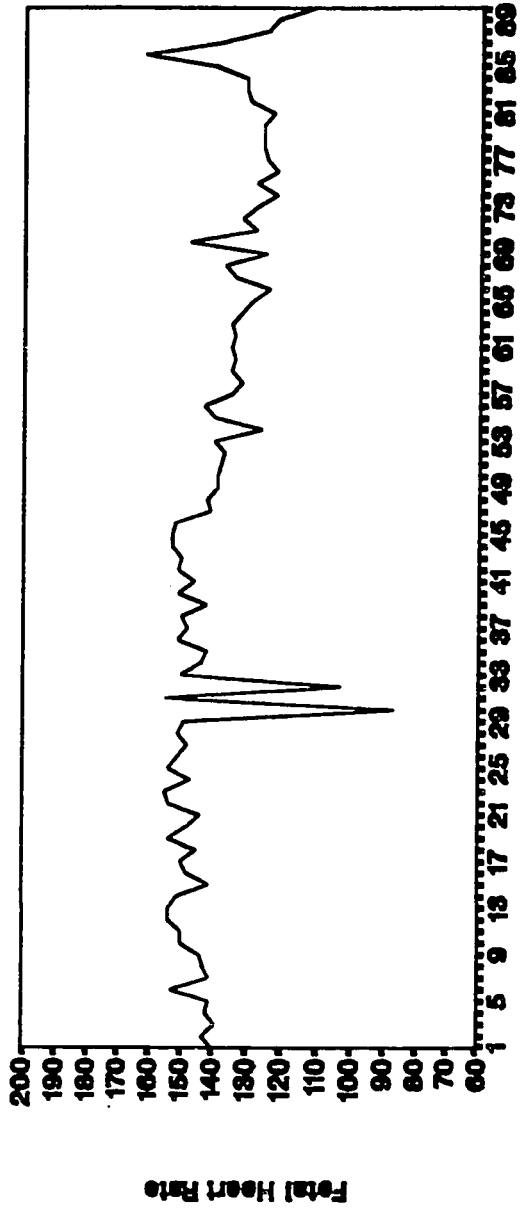
Fetal Heart Rate Over Time: Subject 1



Fetal Heart Rate

Time in minutes

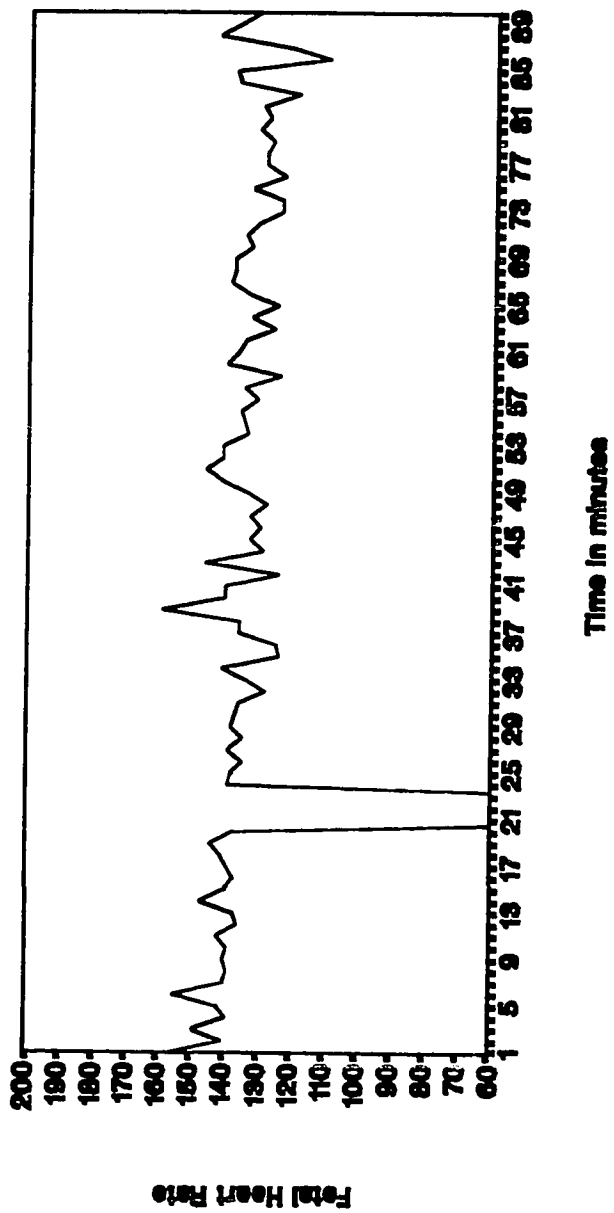
Fetal Heart Rate Over Time: Subject 2



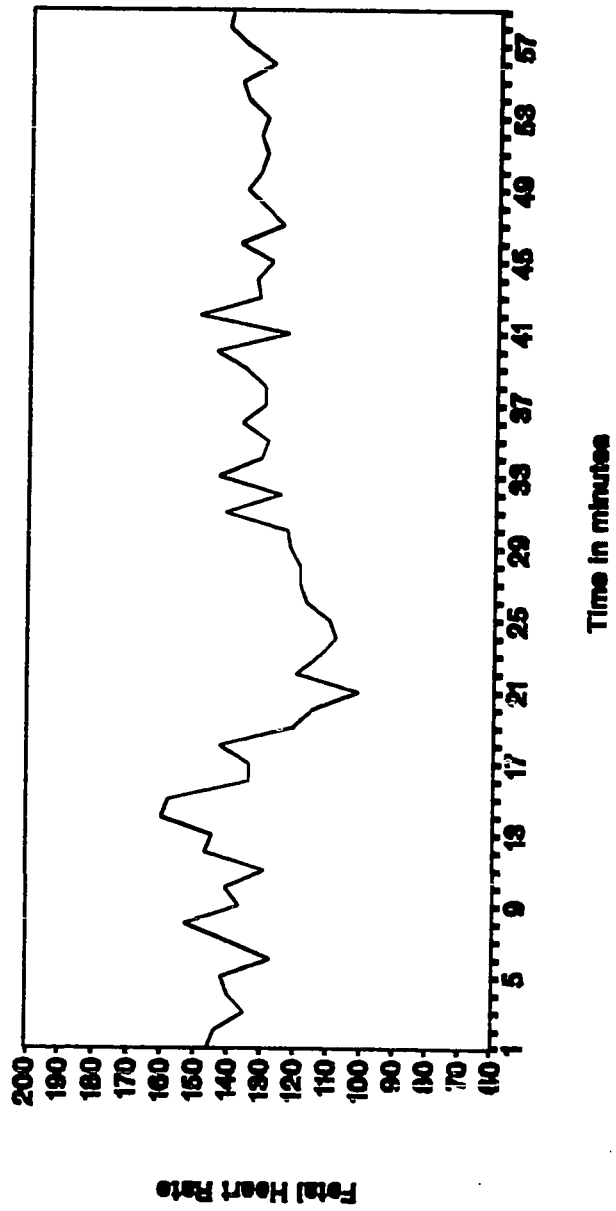
Time in minutes

Fetal Heart Rate

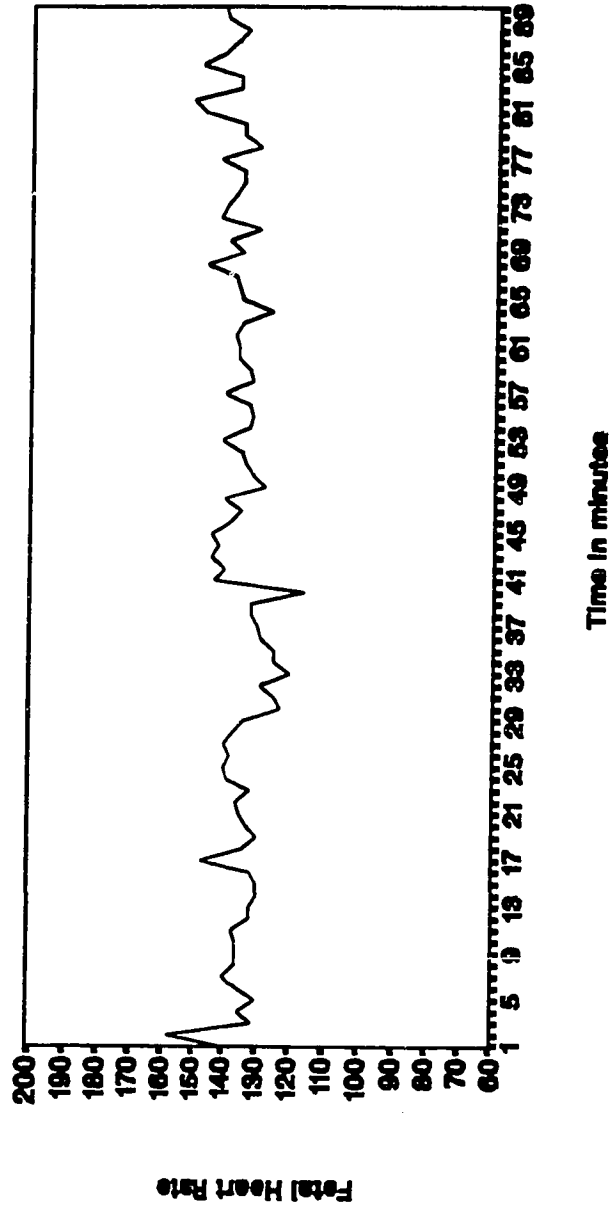
Fetal Heart Rate Over Time: Subject 3



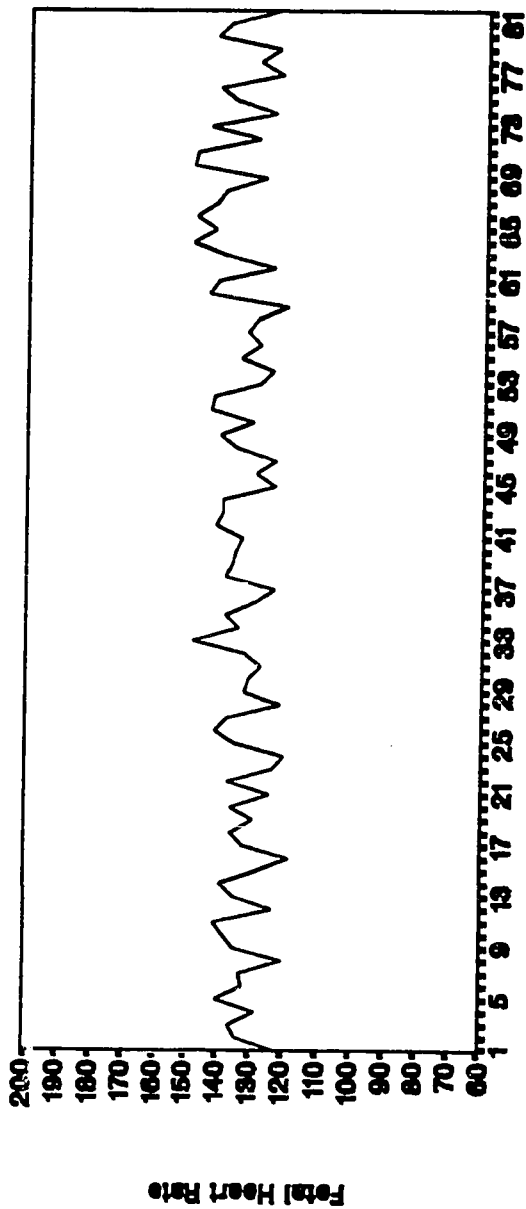
Fetal Heart Rate Over Time: Subject 4



Fetal Heart Rate Over Time: Subject 5

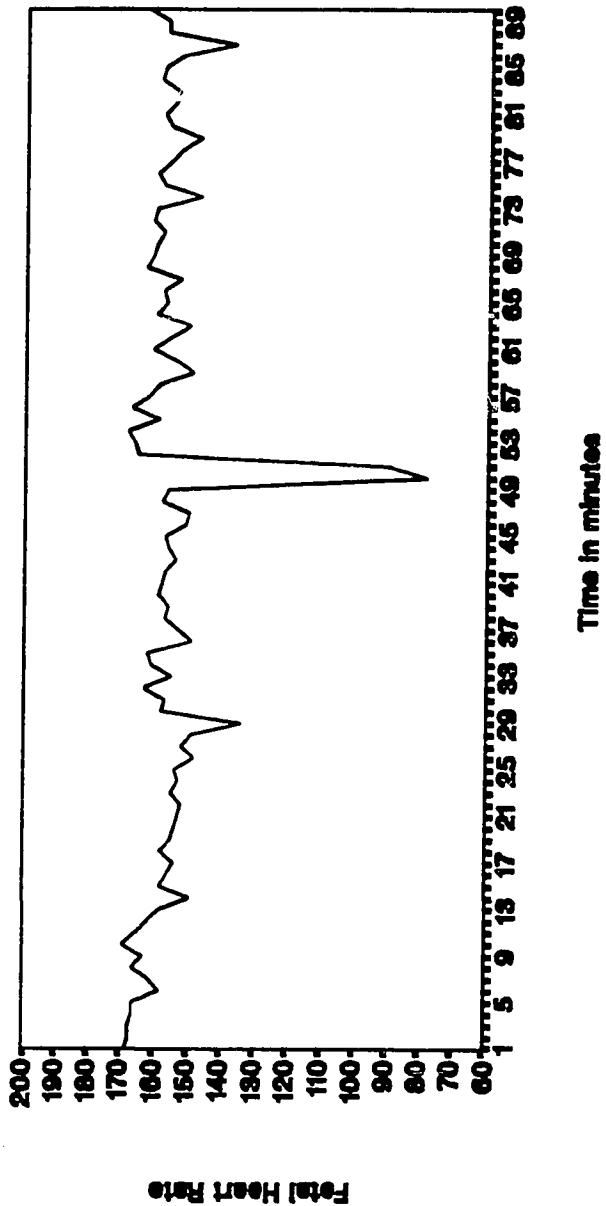


Fetal Heart Rate Over Time: Subject 6

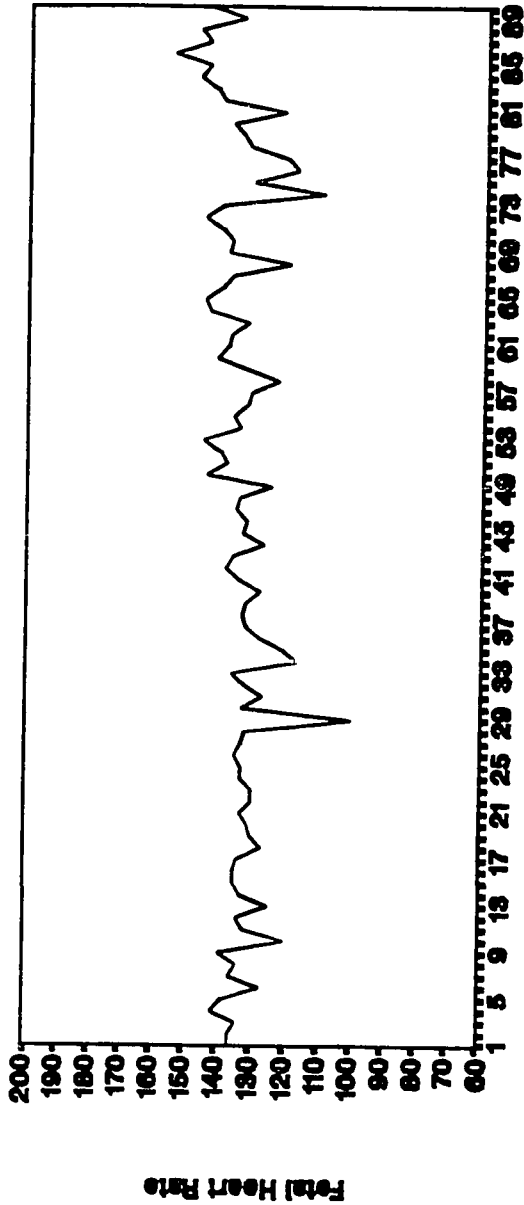


Time in minutes

Fetal Heart Rate Over Time: Subject 7

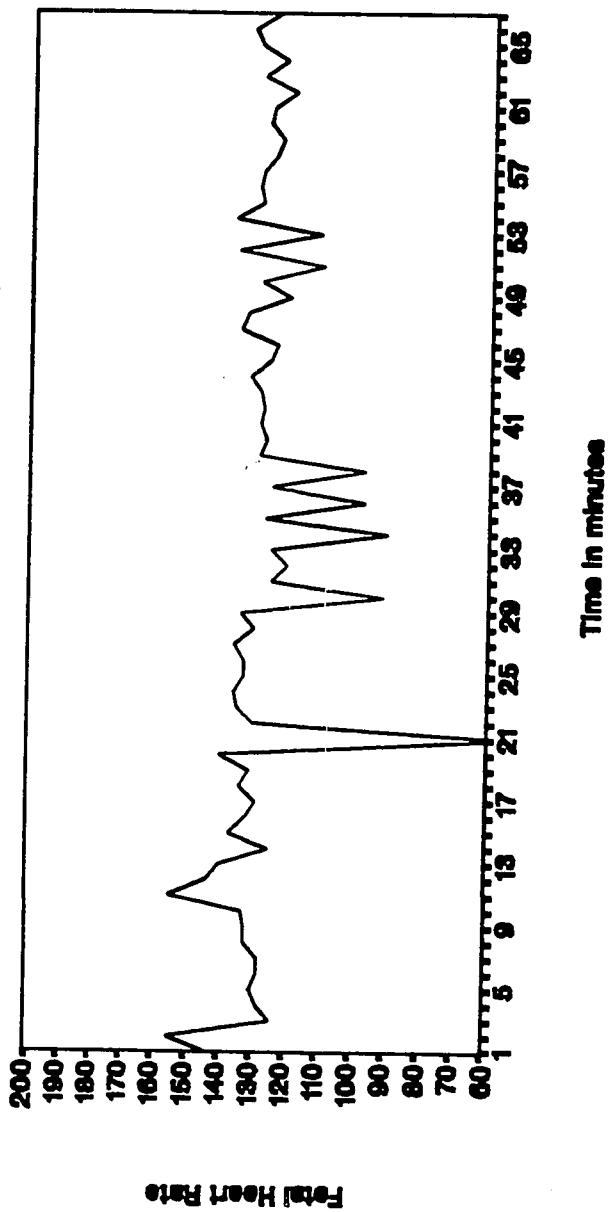


Fetal Heart Rate Over Time: Subject 8

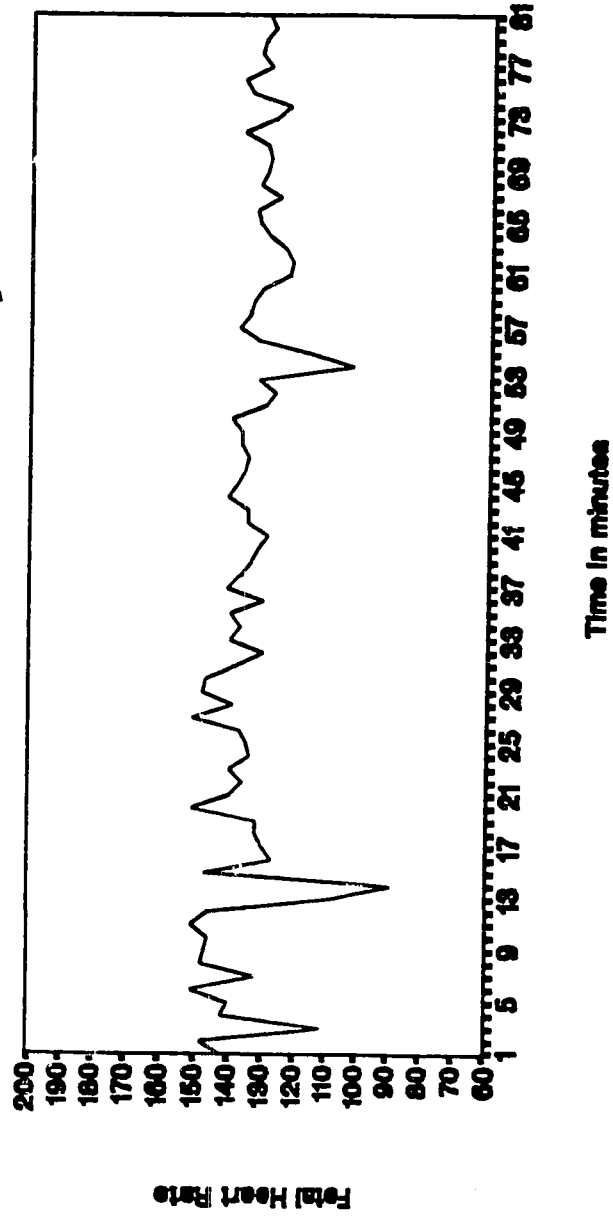


Time in minutes

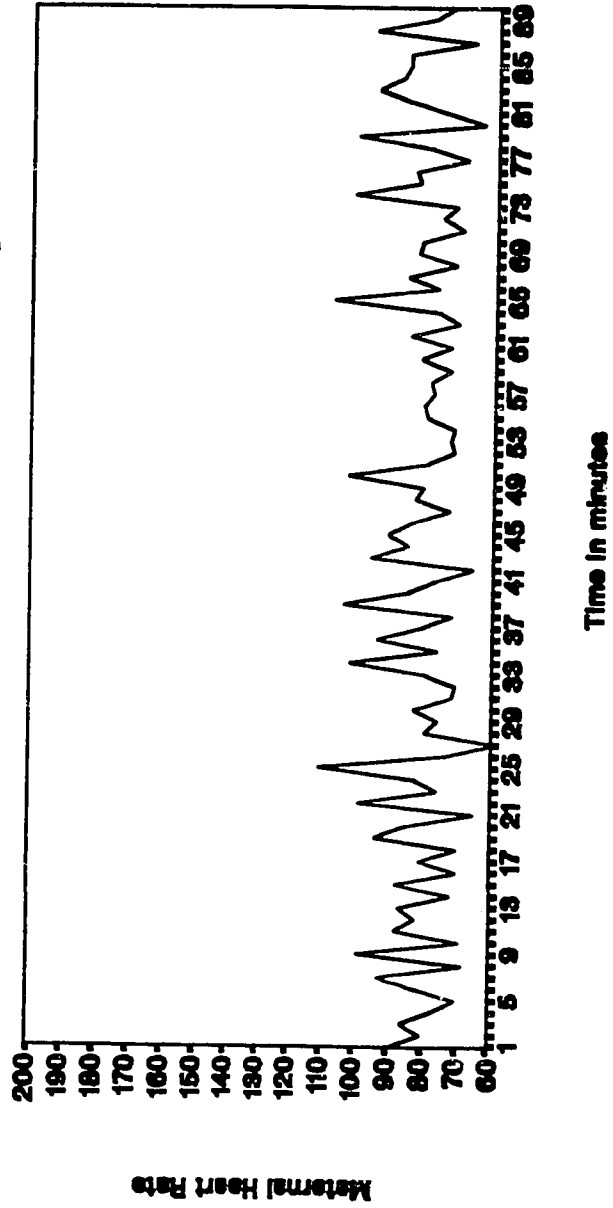
Fetal Heart Rate Over Time: Subject 9



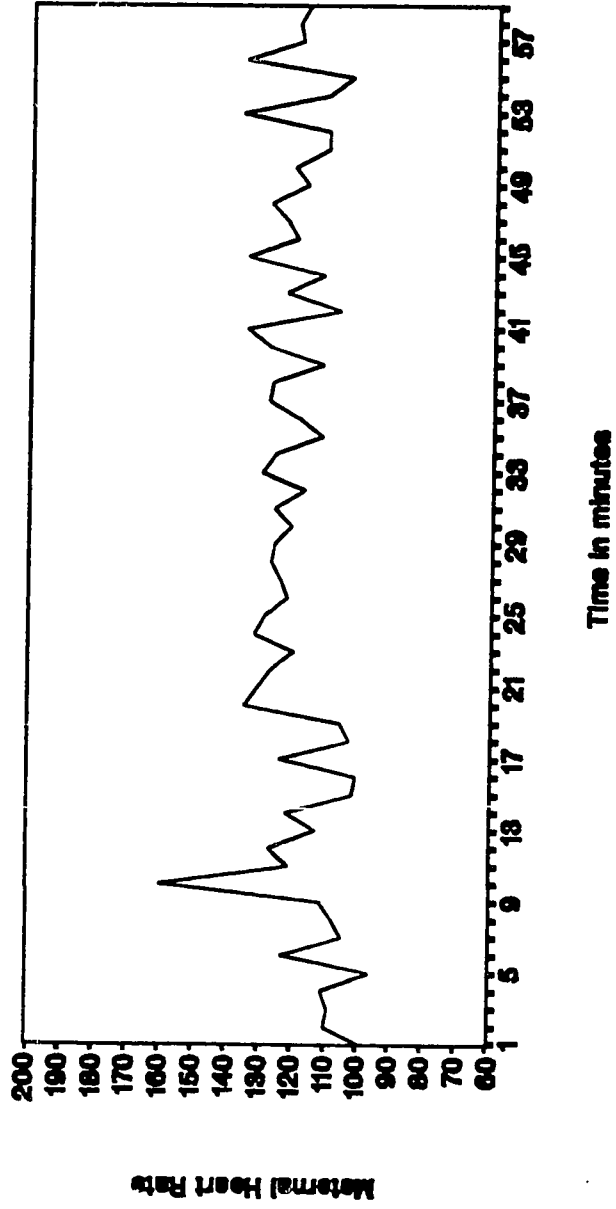
Fetal Heart Rate Over Time: Subject 10



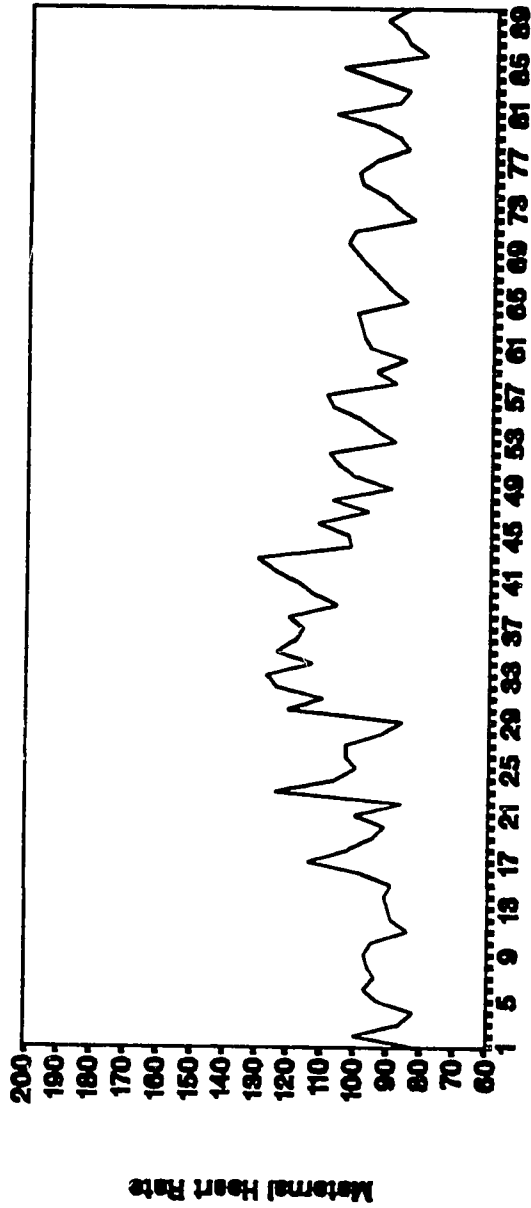
Maternal Heart Rate Over Time: Subject 2



Maternal Heart Rate Over Time: Subject 4

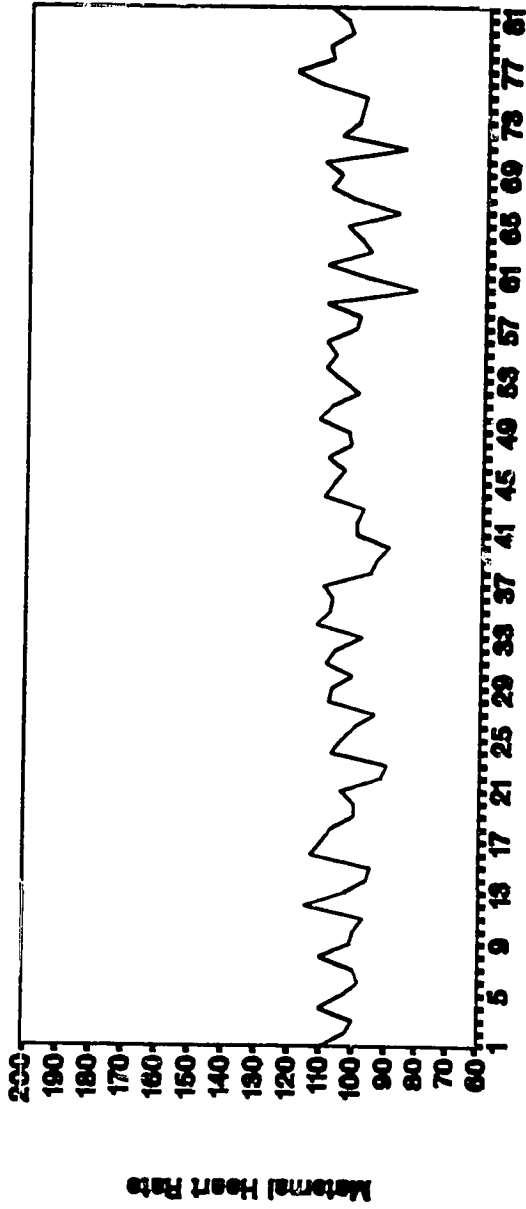


Maternal Heart Rate Over Time: Subject 5



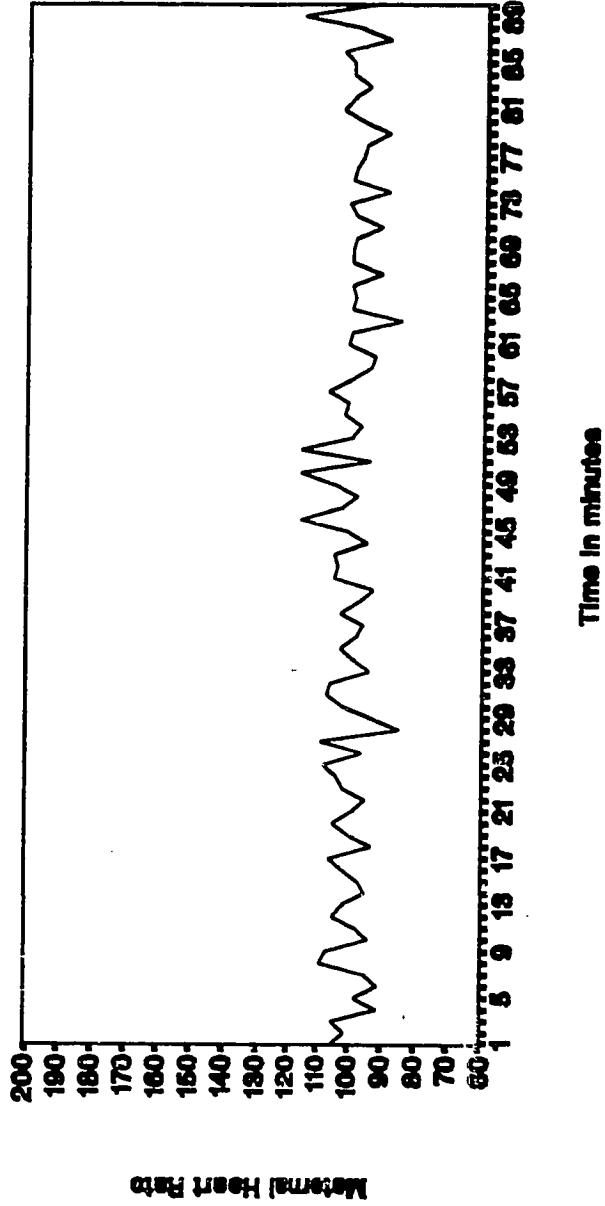
Time in minutes

Maternal Heart Rate Over Time: Subject 6

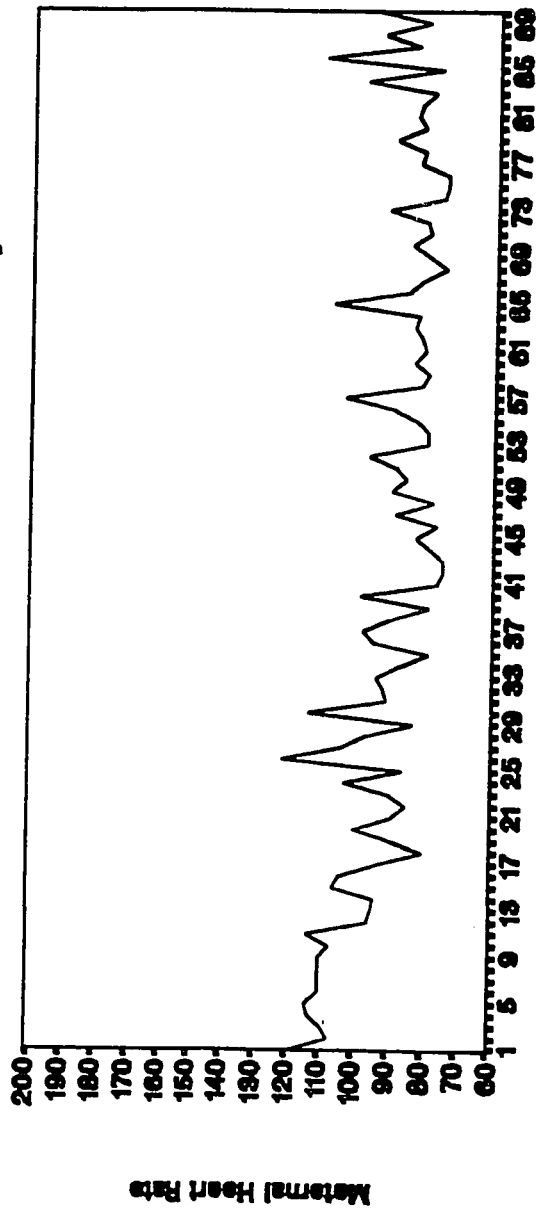


Time in minutes

Maternal Heart Rate Over Time: Subject 7



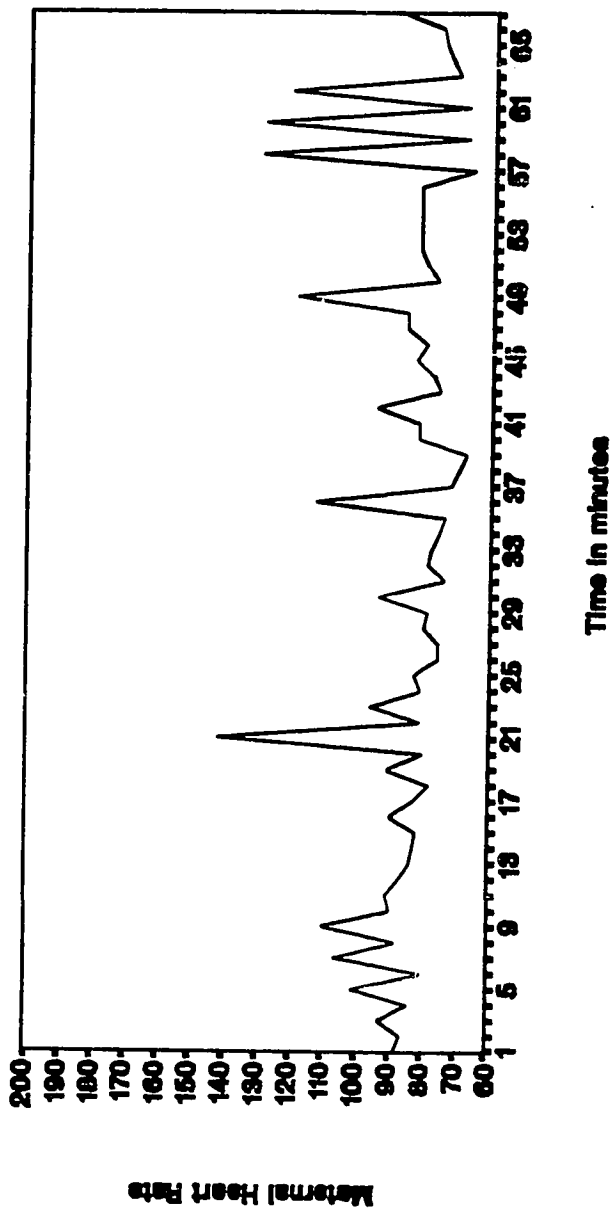
Maternal Heart Rate Over Time: Subject #1



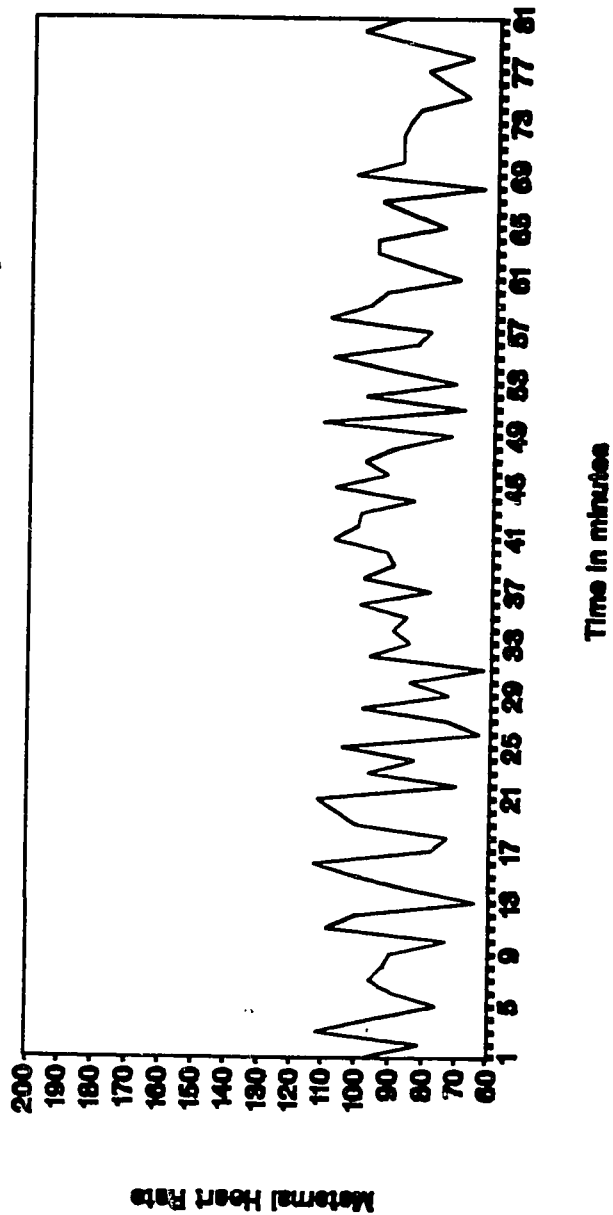
Time in minutes

Maternal Heart Rate

Maternal Heart Rate Over Time: Subject 9



Maternal Heart Rate Over Time: Subject 10



Biographical Note

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