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BREASTFEEDING AND THE INDIVIDUAL: THE IMPACT OF EVERYDAY STRESSFUL EXPERIENCE AND HORMONAL CHANGE ON BREASTFEEDING DURATION AMONG WOMEN IN SÃO PAULO, BRAZIL

A Dissertation Submitted by
Alanna Rudzik, M.Sc.

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

February 2010

Department of Anthropology

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BREASTFEEDING AND THE INDIVIDUAL: THE IMPACT OF EVERYDAY STRESSFUL EXPERIENCE AND HORMONAL CHANGE ON BREASTFEEDING DURATION AMONG WOMEN IN SÃO PAULO, BRAZIL

A Dissertation Presented

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ABSTRACT

BREASTFEEDING AND THE INDIVIDUAL: THE IMPACT OF EVERYDAY STRESSFUL EXPERIENCE AND HORMONAL CHANGE ON BREASTFEEDING DURATION AMONG WOMEN IN SÃO PAULO, BRAZIL

FEBRUARY 2010

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Breastfeeding offers significant benefits to the breastfed infant as well as the breastfeeding woman. The World Health Organization now recommends exclusive breastfeeding until six months, followed by supplementation and continued breastfeeding to two years or more. Around the world, public health programs endeavour to promote breastfeeding through educational programs. In Brazil, such programming is widespread, and yet less than 30% of women in São Paulo breastfeeding exclusively even to four months post-partum. This study uses a qualitative-quantitative bio-experiential approach to explore the way that stressful experiences and circumstances in the lives of low-income women from the Eastern Zone of São Paulo, Brazil, influence their decision to wean or supplement their infant before 12 weeks post-partum.

Sixty-five first-time mothers participated in a 12-week longitudinal study of life stressors and breastfeeding practice. Participants were asked to complete one pre-partum and six post-partum interviews. Narrative and biological data were collected from each participant at each interview. Statistical analysis revealed that among these participants the breastfeeding hormone oxytocin did not mediate breastfeeding duration. Oxytocin

appeared to act as a biomarker of stressful experience, while Epstein-Barr Virus antibody titre, a commonly used biological measure of psychosocial stress, did not. Unplanned pregnancy, older age and higher mean oxytocin level were statistically associated with weaned outcome at 12 weeks. Unplanned pregnancy, older age, higher mean oxytocin level, higher mean satisfaction score regarding financial situation and lower mean satisfaction score regarding interpersonal factors were associated with decreased duration of *any* breastfeeding. Unplanned pregnancy, older age and lower mean satisfaction score regarding interpersonal factors were associated with decreased duration of *exclusive* breastfeeding.

Ethnographic analysis revealed that the effect of unplanned pregnancy may be connected to the discourse of the self-sacrificial, child-centric "good mother." Exclusive breastfeeding was seen as a hallmark of this idealised maternal type. Single women with unplanned pregnancies expressed a great deal of ambivalence towards their own maternity and toward the somewhat unobtainable good mother ideal, especially with relation to the physical and psychological challenges breastfeeding. Women's ambivalence appeared to influence their decisions to supplement or wean their infants by or before 12 weeks post-partum.

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CHAPTER I

INTRODUCTION

Current biomedical recommendations state that for optimal infant health and growth, women should breastfeed their infants exclusively for the first six months of life, then introduce appropriate supplemental foods, and continue to breastfeed until 2 years and beyond (World Health Organization 2001). Given the influence of such scientific discourses on the wider society, breastfeeding has become an important criterion for determining a woman's status as a good mother (E. Murphy 2000). While the ability to breastfeed is virtually universal among women (J. Riordan 2005), the experience of breastfeeding is particular to each woman. Her biological systems provide the capacity for lactation, her structural and cultural milieux often define the parameters for decisions about infant feeding, and her individual experience shapes her own breastfeeding practice.

Generally as breastfeeding has been examined in the past, biological anthropologists have focused on the mechanisms of breastfeeding and consequences for women's reproductive fitness; public health researchers have focused on the consequences for infant health, as well as the determinants of women's breastfeeding behaviour; and feminist researchers in a variety of fields have described women's experiences in terms of the physical and psychological demands of the practice of breastfeeding. Little research has been conducted that examines biological, structural and cultural components of breastfeeding through the lens of individual experience.

Problem Statement

The objective of this research was to examine a central question: what stressful life experiences (structural, cultural, experiential) lead women from the Eastern Zone of São Paulo to supplement and/or wean their infants before 12 weeks post-partum when they planned to breastfeed for longer? With this aim in mind, I approached my dissertation research from a bio-experiential perspective, which recognises the experiencing/biological body-subject as enmeshed in a web of structural and cultural factors related to breast feeding. This approach views the biological aspects of lactation as inextricably part of women's experience of breastfeeding. Thus, the interconnections between life conditions and events, biological processes, and eventual breastfeeding outcome can be examined. This first chapter presents some background for the study, the central question of interest, and a brief overview of the theoretical perspective and the methods used.

Background to the Study

Brazilian society shows a high degree of socio-economic inequality. Access to reproductive services, maternity benefits, clean water, and appropriate weaning foods alike are determined by income level. Evidence of the benefits of breastfeeding have been increasing steadily throughout the last 20 years: women pass live immune cells to their infants through their breastmilk, which confers active immunity against various infectious illnesses (Dewey, Heinig, & Nommsen-Rivers 1995; Espinoza, Paniagua, Hallander, Hedlund, & Svensson 1997; Labbok, Clark, & Goldman 2004; Lopez-Alarcon, Villalpando, & Fajardo 1997; Raisler, Alexander, & O'Campo 1999); where water quality is compromised, breastfeeding infants prevents infection with pathogens

from contaminated foods (Glass, Svennerholm, Stoll, et al. 1983; Vanderslice, Popkin, & Briscoe 1994); in the long term, breastfeeding shows a negative correlation with future development of allergies (Hanson 1998), diabetes (Owen, Martin, Whincup, Smith, & Cook 2006) and obesity (Armstrong, Reilly, & Child Health Information Team 2002). Research in Brazil has shown that women's choices about breastfeeding have long-term impacts on the health and well-being of their children (Victora, Barros, Horta, & Lima 2005)

Since infants born to less affluent and less educated women in Brazil are much less likely to be breastfed, the negative health consequences of early weaning "mark out a dividing line between the 'haves' and the 'have-nots'" (Sellen 2001a; Sellen 2001b; Sellen 2001b). In the city of São Paulo less than 30% of women breastfeed exclusively to 4 months post-partum (Venancio, Escuder, Kitoko, Rea, & Monteiro 2002). In order to minimise health inequalities based on income it is to important to understand why women who intend to breastfeed decide to supplement and/or wean their infants earlier than they intended to, and earlier than is recommended.

At the same time, feminist scholars have pointed out that the messages in educational programs that encourage women to "choose" breastfeeding tend to erase the ways in which structural constraints and power relations restrict the freedom of some women to make this choice (E. Murphy 2000), and ignore the individual challenges that often arise when women first begin breastfeeding. In much of the promotional material, as well as the scientific research that is used to support it, the assumption is made that women's main function should be to maximise physical and psychological outcomes for their children (Hays 1996) and "any suggestion that mothers are not energetically

pursuing this goal leaves them, at least potentially, vulnerable to criticism" (Murphy 2000:295). This vulnerability exists for middle-class women in wealthy nations; it is even more prominent in the lives of poor, urban women.

In São Paulo it is not uncommon to hear health professionals ascribe the low rate of breastfeeding not only to a lack of knowledge, which can be remedied through somewhat dictatorial breastfeeding advice, but also to laziness and stupidity on the part of the new mothers, which is perceived as innate (personal observation). It is important, therefore, to conduct research in this population to understand the reasons that women cease to breastfeed prematurely, by their own and by biomedical standards.

Within biological anthropology the biocultural approach to breastfeeding has been gaining ground in recent years (McDade & Worthman 1998; Obermeyer & Castle 1997; Sellen 2001b; Stuart-Macadam 1995). Studies are designed to "approach the topic of breastfeeding with a perspective that views breastfeeding within a biocultural, cross-cultural and evolutionary framework" (Stuart-Macadam & Dettwyler 1995:1). In an early review of biocultural work on breastfeeding, Allen and Pelto (1985) proposed that "biological, socio-behavioral, and biocultural factors should be examined simultaneously" (1985:103) in order to begin to understand the impact of the various factors on breastfeeding outcome.

In the course of my dissertation I developed a bio-experiential approach designed to examine multiple factors that influence breastfeeding, using both biological and ethnographic data. A bio-experiential approach asserts the importance of the experience of the individual woman in breast feeding, and studies the ways in which her physiology may moderate the impact of her experiences on her breastfeeding decisions.

The objective of the research project was to understand the ways that personal, experiential and structural forces in women's lives influenced their decisions about breastfeeding. One line of investigation involved the place of the breastfeeding hormone oxytocin (OT) as a moderator between stressful life experience and breastfeeding outcome. Research has shown that exposure to acute stress suppresses the release of oxytocin, a key breastfeeding hormone responsible for releasing milk from the breast (Cross 1955; M. Newton & Newton 1948; Ueda, Yokoyama, Irahara, & Aono 1994). In has been argued that the chronic presence of stress and subsequent suppression of OT could impair the ability of women to breastfeed successfully and cause women to wean ahead of schedule (Lau 2001). Stressful life experiences from a woman's everyday life, arising from structural, cultural or personal sources are reflected in altered bodily functioning and the suppression of OT. Allen and Pelto suggested an investigation into the connection between maternal anxiety, lack of support, and OT suppression, as one of four promising avenues for truly biocultural research (Allen & Pelto 1985).

By examining the biological mechanisms of breastfeeding as part of the embodied experience of the subject, a bio-experiential approach has the potential to improve the analytical power of breastfeeding research. Recent advances in field methods (McDade 2002) now allow for the collection of biological data that earlier would not have been possible, thus enabling research protocols that combine biological and ethnographic analyses.

Professional Significance

This research project provided an opportunity to assess the validity of a bio-experiential approach to breastfeeding research on the ground, among a group of women

breastfeeding for the first time. Drawing together ethnographic data and biomarkers creates a more complete picture of the experience of the breastfeeding woman as an embodied subject. This study also allowed for the opportunity to examine the relevance of OT as a moderator of the effect of stressful life experiences on breastfeeding duration.

Most breastfeeding research conducted by anthropologists has been conducted in non-industrialised, natural fertility populations (Ellison 1995; Sellen 1998). The vast majority of experiential research has been conducted in highly industrialised countries such as Australia, the UK and Canada (Flacking, Ewald, & Starrin 2007; Hall & Hauck 2007; Hauck, Langton, & Coyle 2002; Nelson & Sethi 2005). Studies conducted among urban poor populations in developing countries tend to be focused on socio-behavioural factors, such as women's work, education and income status (Allen & Pelto 1985). By taking an approach that combines poor urban women's accounts of their experiences with biological data relevant to the impact of stressors on physiological function, I hope to contribute to a more nuanced and holistic understanding of early breastfeeding cessation among these women.

Methodology

In order to investigate the relationship between structural context, experiential factors in a woman's life and breastfeeding duration, I collected biological and ethnographic data from a group of 65 low-income urban women. These participants were recruited by community health workers from six neighbourhood clinics in the Eastern Zone (*Zona Leste*) of São Paulo, Brazil. All participants were delivering their first child and breastfeeding for the first time. The mean age of participants was 22 years, 37% were single mothers and 68% of the pregnancies were unplanned. Reported household monthly

income for the sample ranged from no income to an extremely unusual R$2500 (USD1100 in June 2006). With each participant, the protocol involved completing one interview prior to the delivery, followed by six interviews post-partum. The post-partum interviews began at two weeks post-partum and continued until 12 weeks post-partum. All interviews were digitally recorded.

The pre-partum interview, lasting 25-35 minutes, consisted of structured questions regarding demographics, living situation, and expectations and plans regarding breastfeeding. The post-partum interviews were semi-structured, pursuing certain themes, but following up on topics introduced by the participant. Post-partum interviews lasted between 20 and 70 minutes. Some of the themes examined included: life changes experienced post-partum; challenges faced during breastfeeding; stressful experiences in life; body image issues; and family relationships.

Data on women's mental state and breastfeeding behaviour were also collected using two psychometric scales to assess the participant's post-partum depression score (Cox, Holden, & Sagovsky 1987) and self-esteem level (Rosenberg 1965). Reported stress scores were recorded using one international (Cohen, Kamarck, & Mermelstein 1983) and one context-specific scale. Scales were administered to participants at various points during the 12 weeks of their participation in the study. At each interview participants were asked how often they breastfed during the day and at night, and for how long the infant remained at the breast. Biological measures were also taken at each interview: breastmilk samples for oxytocin analysis; blood spots for the measurement of Epstein-Barr Virus antibody (EBV-ab) titres in the blood (a commonly used biomarker of psychosocial stress—Glaser, Pearson, Jones, et al. 1991; Yang & Glaser 2002) and

anthropometrics of the participant and of the infant. All data collection for the dissertation was completed between January 2006 and January 2007.

Hypothesis Testing

In order to investigate the relationships between OT, stressful life experience and breastfeeding outcome I tested four hypotheses. First, that women's day-to-day stress may impact breastfeeding duration in part through changes in levels of the breastfeeding hormone oxytocin; therefore, women with higher levels of self-reported stress will show lower levels of OT. Second, women who show higher levels of biological stress, as measured through EBV antibody levels, will have lower OT levels. Third, that women with lower OT levels will be more likely to have ceased breastfeeding by 12 weeks post-partum. And, finally, that women with more stressful life experiences, according to self-reports, will be more likely to have weaned by 12 weeks. The methodology used in the study will be described in more detail in Chapter V.

Definitions of Key Terms

Accuracy in describing the extent of breastfeeding is extremely important, both in research on factors that determine breastfeeding duration, and in those studies measuring the health consequences of different infant feeding practices (Labbok & Krasovec 1990). Labbok and Krasovec outlined the following widely-used definitions for breastfeeding: Exclusive breastfeeding—No liquid other than breastmilk and no solids are given to the infant. Whether or not participants were exclusively breastfeeding at 12 weeks was one of the key outcomes of interest in this study.

- Predominant breastfeeding—"vitamins, minerals, water, juice, ritualistic feeds given infrequently" (Labbok & Krasovec 1990). In this study, infants who were

fed formula during post-partum hospitalisation, but whose mothers fed them from the breast were included in this category.

- Partial breastfeeding—Breastfeeding continues on a regular basis, along with regular supplementation. Although partial breastfeeding can be defined as high, medium or low, depending on percentage of feeds that are breastmilk (Labbok & Krasovec 1990), these distinctions were impossible to make accurately without 24 hour observational data and so distinctions in degree of partial breastfeeding will not be used here.
- Token breastfeeding—The infant has "minimal, occasional, irregular breastfeeds" (Labbok & Krasovec 1990).
- Supplementation—Related to partial breastfeeding. Regular supplementation of the infant's diet with liquids or solids other than breastmilk (including cow's milk, formula, cereal gruel etc). For some women supplements were used to complement breastfeeding, while others began supplementing as a prelude to complete weaning. The timing of the introduction of supplementation during the first 12 weeks post-partum was another outcome of interest in the study.
- Weaned—Infants were considered weaned when the participant stated that she was no longer breastfeeding at any time during the day or night.

Chapter Summary and Outline of Dissertation

This chapter has provided an overview of the conceptualisation and execution of the dissertation project. Chapter II outlines the most recent data regarding the anatomy of the breast and the physiology of lactation. Chapter III describes the range of research on breastfeeding duration. This research is drawn from the fields of anthropology, nutrition,

public health, nursing, women's studies and others. Chapter IV provides an overview of the development of the phenomenologically-based bio-experiential approach used in this dissertation in comparison to other theories of the body. Chapter V provides a comprehensive description of the background and methodology for the study. Chapter VI presents the statistical analyses of structural, anthropometric, biological and stress scale data. In Chapter VII the results of the statistical analyses are discussed and elaborated. Chapter VIII presents key ethnographic data from the research. Chapter IX draws together the conclusions from Chapters VII and VIII and outlines the implications of the research for anthropological theory and for breastfeeding promotion practice.

CHAPTER II

BREAST EVOLUTION, ANATOMY AND PHYSIOLOGY

The chapter presents an overview of the functioning of the breast. The evolution of the mammary gland is outlined in the opening section, followed by an outline of the biology of breast development and the characteristics and components of human breastmilk. The central section of the chapter reviews in detail research regarding the evolution, physiological functions and behavioural implications of oxytocin, the hormone responsible for releasing breastmilk from the breast to the infant. A detailed examination of the relationship between OT and stress is included. The final section of the chapter discusses the implications of this research for the current study.

The Evolution of the Breast

The taxonomic classification "Mammalia" is derived from the centrally distinguishing feature of the Class, the mammary glands (Blackburn 1993). These glands provide nourishment to the young through a crucial period in which the infant is unable to procure and process food independently. The earliest mammals emerged ~210 million years ago, and the phylogenetic split between placental mammals and marsupials occurred around 100 million years ago. Lactation is a highly conserved trait (Sellen 2001b): complex lactation is thought to have developed before the divergence of the mammalian stocks. Mammary glands are thought to have evolved from the eccrine, apocrine or sebaceous glands of the skin or possibly from a mosaic effect of genes which produced a novel gland (Blackburn 1993). The sequence of evolution of lactation is thought to have involved the following steps: 1) mammal-like reptiles evolved an

incubation area for their eggs, following the development of homeothermy; 2) survival of offspring was enhanced through secretions released by a maternal skin gland present in the incubation area (possibly used to adhere the eggs to the mother, to maintain the moisture balance in the eggs or to bond the offspring to the mother by scent); 3) accidental ingestion/absorption of the secretions of the gland, and subsequent use of these secretions as food/drink by the off-spring; and 4) co-evolution of an active areolar region, suckling behaviour and increased nutritional value of the secretions (Hayssen & Blackburn 1985; Long 1972). It has also been suggested that it was the antimicrobial action of the secretions, rather than their nutritional content that would initially have provided the adaptive edge to the offspring (Blackburn 1993; Hayssen & Blackburn 1985). Mammalian infants are dependent on energy derived from the mother's stores from birth until weaning (P. C. Lee 1997).

The Biology of the Breast

In humans, breast tissue begins to form in the embryo at approximately four to six weeks gestation, along the "milk lines", which run from the armpit to the groin (Geddes 2007; J. Riordan 2005). By 18-19 weeks gestation, the epithelial mammary bud is present in the fetus (Biancuzzo 2003). As girls enter puberty and begin to menstruate, the breast structures of lobes and alveoli begin to develop and regress during each ovulatory cycle (Biancuzzo 2003; Geddes 2007; J. Riordan 2005) and the ductal network extends in length (Geddes 2007). The mature breast is composed of adipose and glandular tissue arranged in a duct and lobe system, which only fully develops during the first half of the first pregnancy (Biancuzzo 2003; Ramsay, Kent, Hartmann, & Hartmann 2005; J. Riordan 2005; J. Riordan & Auerbach 1998), at which time the hormonal changes cause

extension and branching of the ductal system, along with intensified lobular-alveolar growth, causing the breast to become capable of producing and expressing milk (Geddes 2007; Glasier & Mcneilly 1990; J. Riordan 2005; J. Riordan 2005; J. Riordan & Auerbach 1998). The areola darkens and the Montgomery glands (sebaceous glands that open onto the surface of the breast) increase in size (Geddes 2007).

Recent ultrasound investigations have altered long-held understandings of the structures of the lactating breast (Ramsay, Kent, Hartmann, et al. 2005). It was found that each lactating breast contains approximately nine milk ducts, rather than the 15-20 described in Gray's Anatomy based on anatomical dissections conducted in the mid 19th century (Ramsay, Kent, Hartmann, et al. 2005). Also in contrast to the early work on the subject, Ramsay and colleagues found that milk ducts in lactating breasts are not enlarged beyond the size of those in non-lactating breasts (Ramsay, Kent, Hartmann, et al. 2005). The organisation of the milk ducts is more similar to "the intertwined roots of a tree" than the simple radial organisation generally shown in illustrations (Figure 2.1: all Tables and Figures located at the end of the text). Further more, the ducts do not end in the commonly described "lactiferous sinuses", but rather maintain a constant diameter when approaching the nipple surface, suggesting that the main function of the ducts is the transport rather than the storage of milk (Ramsay, Kent, Hartmann, et al. 2005). This finding "further emphasises the critical nature of milk ejection for successful breastfeeding, because only small amounts of milk are available before the stimulation of milk ejection" (Geddes 2007).

On average, Ramsay and colleagues found that 64% of the lactating breast is composed of glandular tissue, while 36% is composed of fatty tissues spread through

different areas within the breast (Ramsay, Kent, Hartmann, et al. 2005). In the non-lactating breast the ratio is 1:1. The lobes consist of grape-like clusters of alveoli, which contain lactocytes, the epithelial cells that synthesize and produce breastmilk (Glasier & Mcneilly 1990; J. Riordan 2005). These are surrounded by myoepithelial cells covered with OT receptors (Buhimschi 2004). By about the 5th month of pregnancy, lactogenesis I is complete, meaning that the woman's breasts are capable of synthesising milk to support the infant (Lilius & Marnila 2001; Neville 2001; J. Riordan 2005).

The Biology of Breastmilk

When a woman's hormonal balance changes at the end of pregnancy prompting the onset of labour, the change also initiates the production of colostrum, the antibody-rich substance that precedes mature milk. Compared to mature milk, colostrum is high in carbohydrates and protein, and low in fat (J. Riordan 2005). It appears to act as a natural laxative that helps to clear the intestines of the metabolic waste (meconium) that the infant has been storing during gestation, and helps to prevent neo-natal jaundice (J. Riordan 2005). The colostrum provides important immune protection against pathogens, since the infant's immune system is not functional at birth (Lilius & Marnila 2001).

Human newborns appear to be instinctually programmed to seek out the breast and begin suckling in the first minutes of life, and will wriggle towards the breast unaided if placed in direct contact with the mother's abdomen in the 30 minutes immediately following the birth (Ransjo-Arvidson, Matthiesen, Lilja, Nissen, Widstrom, & Uvnas-Moberg 2001). After this initial period of alertness, the infant will enter a sleepy stage that can last up to 20 hours. Thus, if the early breastfeeding window is missed, the infant tends to have a much more difficult time learning to breastfeed (J. Riordan 2005). For

this reason, early newborn-feeding practices in which the infant is prevented from consuming colostrum and is instead fed non-breastmilk substances can undermine the initiation of breastfeeding (Perez-Escamilla, Segura-Millan, Canahuati, & Allen 1996).

The production of colostrum continues until the onset of lactogenesis II, usually three to four days after the delivery (Grajeda & Perez-Escamilla 2002; Neville 2001). At lactogenesis II, the body begins to synthesise mature milk, which differs substantially from colostrum (J. Riordan 2005). While in most cases lactogenesis II takes place in the first three to four days after birth it can occur anywhere between two and 14 days, and in rare cases even longer (Neville 2001).

Human milk is a dynamic food that provides both macro- and micronutrients to infants. The three primary macronutrients groups are fat, protein and carbohydrates. The mature milk that replaces colostrum is on average higher in fat and lower in protein and carbohydrates than colostrum (Pridham, Kosorok, Greer, Kayata, Bhattacharya, & Grunwald 2001), though the exact ratio of fat, protein and carbohydrate components in a woman's breastmilk has been shown to shift and change in response to a particular infant's growth (J. Riordan 2005). The fat component in breastmilk is drawn directly from the woman's fat stores and provides fatty-acids essential to the infant's brain growth, visual acuity and cognitive ability (J. Riordan 2005). Human milk is much lower in fat than milk produced by other members of the mammalian class. Due to this lower fat content, it is less energetically expensive for the mother to produce than the milk of most other mammals (Picciano 1998). Humans produce 710-800 g/day of milk with an efficiency of around 90% (Dufour & Sauther 2002) meaning that 10% of the energy

drawn from the maternal stores is used up in the conversion from body stores into breastmilk, leaving 90% for infant consumption.

A woman's diet during breastfeeding has a limited impact on the composition of the breastmilk (A. Prentice, Prentice, & Whitehead 1981). Even severely malnourished women continue to produce breastmilk with a relatively normal composition (Brown, Akhtar, Robertson, & Ahmed 1986; A. M. Prentice & Prentice 1988). In essence, this means that during lactation the infant of a malnourished mother obtains milk of "normal" quality, at the expense of the the woman's own bodily stores. Health professionals emphasise the need for a nutritionally sufficient diet during the breastfeeding period, so that women can buffer themselves against the demands of nourishing another human. However, this advice presents a problem where family resources are insufficient for women to enhance their diet during lactation (Brown, Akhtar, Robertson, et al. 1986).

The ratio of fat to protein and carbohydrates in breastmilk varies with the age of the infant, showing a progressive decrease in fat percentage with infant age (J. Riordan 2005). The highest fat content in human milk is generally found among women who have delivered prematurely (International Society for Research in Human Milk and Lactation & Davis 2002); since the fetus lays down its store of subcutaneous fat in the last few weeks of pregnancy, the fat stores of premature infants tend to be inadequate. Therefore, the unusually high milk-fat concentration appears to be adapted to make up the shortfall (J. Riordan 2005). Usually, by the time the infant has reached the equivalent of 40 weeks gestational age, the woman's milk-fat level has reached a "normal" level for a newborn infant.

In addition to changes to breastmilk fat content due to age of the infant, the amount of fat available to the infant during a given nursing bout can vary substantially, mostly as a result of breastfeeding behaviour. When milk is present in the breast, the milk-fat separates out and lodges in the deeper breast tissues such that the milk with the highest concentration of milk-fat is furthest from the nipple (Lawrence & National Center for Education in Maternal and Child Health 1997). In order for the infant to access this "hind" milk (higher milk-fat breastmilk), it must be released from the deeper breast tissues. Infant suckling does not draw milk out of the breast mechanically, like vacuum, but rather stimulates the release of OT, which causes the milk to move through the breast and become accessible to the infant (Dewey 2001). For the hind-milk to become accessible, therefore, a sufficient level of OT must be released. This important role of OT in breastfeeding will be discussed more extensively, below.

Carbohydrates and proteins make up the other two main macronutrient groups in human breastmilk. The principal carbohydrate in human milk is lactose, which provides the infant with its most readily processed energy source (J. Riordan 2005). There are three main protein components in human milk: whey, casein, and the immunoglobulins. Whey proteins are easily digestible and make up the majority of the protein fraction of the milk. Casein, which is more difficult for human infants to digest, is found in lower concentrations in human milk than in other mammalian milk (J. Riordan 2005). This contrast between human milk and cow's milk, for example, becomes important in societies that use cow's milk as the basis of infant food. Casein requires much higher energy expenditure to digest on the part of the infant than whey (J. Riordan 2005) so infants fed with cow's milk-based formulas appear to remain contented for longer, while

infants fed with human milk become hungry more quickly following a breastfeed. This can lead women and their families to conclude that human milk is less “sustaining” for the infant, and therefore less healthy. In fact, the extra energy required to digest the casein fraction of cow’s milk is drawn away from other bodily functions.

The third type of protein in breastmilk is the immunoglobulin (Ig) family. There are five human Igs: A, D, E, G, and M (Brandtzaeg 1995; Hennart, Brasseur, Delognedesnoeck, et al. 1991). Since the infant has no functioning immune system at birth, an important contribution of breastmilk to infant health is through the provision of both passive and active immune protection (M. Groer, Davis, & Steele 2004; Xanthou 1998). Passive immune components are vital to protect the infant from pathogens and to minimise inflammatory immune processes and the activation of the energy-expensive active immune system. Ig proteins are a central component of the passive immune system (Corthesy 1997). Igs are produced by the woman as a part of her own immune response to pathogens in her environment. Hence, when she passes these Igs to her infant as a component of her breastmilk, the Igs can provide a tailored immune response to the pathogens most likely to affect the infant (Corthesy 1997; Xanthou 1998).

IgA is the most important of the Igs in breastmilk, accounting for 90% of the Igs present (Xanthou 1998). IgA is produced by B cells in response to particular pathogens (Brandtzaeg 1995) and has three main protective functions: it binds to microorganisms, bacterial toxins, and other potentially harmful antigenic material, neutralizing them and clearing them from the body (Brandtzaeg 1995); it prevents adherence of pathogens to the intestinal epithelial cells, which, in infants, allow a much greater up-take of antigens than in adults (Sheard & Walker 1988); and it suppresses the inflammatory complement

defence system (Ogundele 1999). While the complement response is an important component of immune response in adults, the inflammatory nature of the response can result in damage to tissues and is energetically taxing to the infant system (Goldman, Thorpe, Goldblum, & Hanson 1986; Russell, Sibley, Nikolova, Tomana, & Mestecky 1997). If IgA can neutralize the pathogen before it has contact with the infant's intestinal epithelial cells, the complement reaction becomes unnecessary (Loureiro, Frankel, Adu-Bobie, Dougan, Trabulsi, & Carneiro-Sampaio 1998).

Breastmilk also offers active immune protection, in the form of phagocytes and lymphocytes. Phagocytes are large cells, such as macrophages and neutrophils that engulf and absorb pathogens that enter the infant's body. In addition, they produce IgA, as well as lactoferrin and lysozyme, two other passive components of the immune system[1] (Hennart, Brasseur, Delognedesnoeck, et al. 1991). Lymphocytes are the T and B cells that attack and disable bacteria and viruses (Xanthou 1998). The T and B cells provided from a single dose of breastmilk survive and continue to provide protection to the intestinal tract for up to 24 hours. Special "memory" T cells will remain in the infant's body and continue to protect against the pathogens already encountered (J. Riordan 2005). This means that the infant does not have to generate a new immune response each time it encounters the pathogen.

Breastmilk is a source of several important micronutrients, both vitamins and minerals. Breastmilk is particularly rich in Vitamin E and Vitamin A, which is important for vision and can prevent A deficiency blindness. Vitamin E is particularly high in

[1] Lactoferrin and lysozyme are also passed to the infant as a part of breastmilk (Hennart, Brasseur, Delognedesnoeck, Dramaix, & Robyn 1991). Lactoferrin stimulates the lymphatic system, reduces inflammatory response, and kills bacteria, viruses and fungi that enter the infant's body, while lysozyme also kills bacteria, and reduces inflammatory response.

colostrum, the first milk that is produced after birth. Vitamin K, important for blood clotting, is not produced internally by the infant until the intestines have been colonised by bacteria, so what is provided through the breastmilk is vital. Vitamin B12 aids in the development of the central nervous system. Human breastmilk also contains minerals like iron, zinc, sodium, magnesium, and calcium that infants require only in small amounts but which are vital to normal bodily functioning (regulation of the heart, haemoglobin production, etc.).

Oxytocin: A Neurohypophysial Hormone

Oxytocin is an oligopeptide hormone, composed of a base of nine amino acids (Crowley & Armstrong 1992; Gimpl & Fahrenholz 2001) with a molecular weight of 1007 daltons. OT is an extremely ancient hormone type (Wagner, Young, Liu, et al. 1997); the ancestral gene for the OT/vasopressin family was present in Archaemetazoa, the species from which vertebrates and invertebrates diverged 600 million years ago (Evans 1997). The persistence of this gene in both vertebrates and invertebrates suggests a strong selective pressure acting to conserve the gene (Gimpl & Fahrenholz 2001) likely due to effects beyond its role in milk production and expression in mammals (Wagner, Young, Liu, et al. 1997).

OT is the most abundant neuropeptide in the hypothalamus (Buhimschi 2004) where it is produced centrally by the specialised cells in the supraoptical and paraventricular regions (De Coopman 1993; Gimpl & Fahrenholz 2001; Lippert, Mueck, Seeger, & Pfaff 2003). OT is known to act on adipose cells, osteoblasts, the adrenal glands, the pancreas and is involved in thermoregulation and motility (Gimpl & Fahrenholz 2001). OT participates in a wide variety of activities in diverse locations

throughout the human body and is an element of the physiology of both sexes (Evans 1997).

Classically, it has been thought that from the hypothalamus OT is transported through the pituitary stalk to the posterior lobe of the pituitary gland (the neurohypophysis), where it is stored in neurosecretory granules in the axon terminals until required (De Coopman 1993; Gimpl & Fahrenholz 2001; Liu, Rebar, & Yen 1983). More recently, research has complicated the understanding of the pathways for production and release of OT. It has been shown that OT can enter the circulatory system directly from the hypothalamus, rather than having to first pass through the pituitary (De Coopman 1993). Research has shown that uterine tissues produce small amounts of OT specifically for paracrine[2] action on receptors within the uterus (Lippert, Mueck, Seeger, et al. 2003). Recent work has also demonstrated that OT is produced locally in other body tissues, including the breast, heart, and thymus, suggesting that OT may be involved in a wide range of functions until recently unsuspected (De Coopman 1993; Lippert, Mueck, Seeger, et al. 2003).

Oxytocin and Affiliative Bonding

OT has been measured in response to physical contact, social bonding, pair bonding and particularly mother–offspring bonding (Feldman, Weller, Zagoory-Sharon, & Levine 2007; Grewen, Girdler, Amico, & Light 2005; Jansen, de Weerth, & Riksen-Walraven 2008; Levine, Zagoory-Sharon, Feldman, & Weller 2007; Light, Grewen, & Amico 2005; Uvnas-Moberg 1998). In rodents, post-partum OT activates behavioural responses in the mother that promote infant survival and suppress behaviour that might

[2] Paracrine functioning occurs when the hormone is produced and has its effect in the same or closely adjacent tissues.

threaten infants, while in non-human primates OT facilitates maternal care-giving (Jansen, de Weerth, & Riksen-Walraven, et al. 2008). Based on their findings that OT levels during pregnancy were associated with post-partum bonding behaviours in humans, Feldman and colleagues suggest a “cross-species continuity in the mechanisms that underlie the species-specific expressions of bonding” (2007: 969). Since many human behaviours are linked to early learning and social cues, it is thought that OT may link external social signals to brain structures involved in motivation and reward, rather than specifically maternal behaviours (Jansen, de Weerth, & Riksen-Walraven, et al. 2008).

In breastfeeding women OT appears to contribute to the capacity to adapt to life with a newborn and the physical challenges that accompany this new experience (Boutet, Vercueil, Schelstraete, Buffin, & Legros 2006). Feldman and colleagues suggest that OT may support the cognitive processes that organise bonding in humans, in much the same way as it stimulates maternal proximity in other mammals, and that the initiation of affiliative bonding may be the central role of OT in humans (Feldman, Weller, Zagoory-Sharon, et al. 2007). Their study (N=62) found that OT was associated with certain aspects of maternal bonding, including gazing, vocalisations, affectionate touching and positive affect, and not with the anxiety-provoking preoccupation measures (Feldman, Weller, Zagoory-Sharon, et al. 2007). The authors concluded that OT level across pregnancy and through the early post-partum period may contribute to the development of maternal behaviours.

However, the evidence to suggest that OT levels contribute to positive maternal-infant attachment is inconsistent. A recent meta-analysis of six studies concluded that

although the studies found associations between increased sociability, decreased anxiety and particular measures of OT, the evidence was not consistent enough to support the general conclusion that breastfeeding has a positive impact on mother-infant attachment (Jansen, de Weerth, & Riksen-Walraven, et al. 2008). Jansen and colleagues (2008) conclude that public health programs should focus on positive outcomes of breastfeeding that are well documented (e.g. effects on infant health), as assumptions about the role of breastfeeding in maternal-child attachment may "create unnecessary feelings of guilt in mothers unable to breastfeed" (Jansen 2008: 14). Consistency in definitions and methods used would contribute considerably to the understanding of the role of OT in maternal-child affiliation(Jansen, de Weerth, & Riksen-Walraven, et al. 2008).

Oxytocin and Reproduction

OT is implicated in multiple aspects of sexual behaviour and reproduction in humans and other animals (Gimpl & Fahrenholz 2001). OT receptors are present in various tissues in the male and female reproductive systems including the ovary, breast, uterus, testicle, epididymus, and prostate (Lippert, Mueck, Seeger, et al. 2003). In male rats, OT has been shown to be involved in spermatogenesis (Lippert, Mueck, Seeger, et al. 2003), while in human males the complete OT system is present in the testes, epididymus and prostate (Gimpl & Fahrenholz 2001). OT has been shown to advance the LH surge in women when administered during the pre-ovulatory period, suggesting that OT may play a part in the hormonal control of the menstrual cycle (Gimpl & Fahrenholz 2001; Lippert, Mueck, Seeger, et al. 2003). In both men and women OT levels increase at orgasm (Gimpl & Fahrenholz 2001); in women, the uterine tissues respond to the release of OT at orgasm by reversing the direction of pressure within the reproductive tract

towards the fundus of the uterus; this is thought to favour the transport of sperm towards the fallopian tubes (Lippert, Mueck, Seeger, et al. 2003).

As a uterotonic hormone—one that stimulates the contraction of the uterine muscle—OT is a key hormone in labour and delivery. The stimulation of uterine contractions during labour was one of the earliest functions identified for OT (Evans 1997; Gimpl & Fahrenholz 2001; Lippert, Mueck, Seeger, et al. 2003). As early as 1911 a crude pituitary extract was administered to women to induce labour and speed its progress. Once the structure and synthesis of OT was identified in 1953, the hormone was administered to labouring women in purified form (Evans 1997; Lippert, Mueck, Seeger, et al. 2003). The uterotonic effect of this exogenous OT is markedly increased in women towards the end of pregnancy because of up-regulation of OT receptors in the uterus (Evans 1997; Gimpl & Fahrenholz 2001).

Since OT release increases the pain threshold and decreases subjective pain and increased presence of OT is also associated with an increased level of endogenous opioid peptides β-endorphin and *L*-encephalin in the cerebrospinal fluid (Gimpl & Fahrenholz 2001; Lippert, Mueck, Seeger, et al. 2003), it is hypothesised that exposure to high levels of OT during labour may be responsible for women's post-partum forgetfulness of the pain of labour (Evans 1997).

Oxytocin and Breastfeeding

OT has been associated with breastfeeding for almost as long as it has been associated with labour and delivery. In mice, studies have shown that OT is required for post-partum alveolar proliferation and mammary-gland development (Wagner, Young, Liu, et al. 1997). In genetically modified "knock-out" mice that lack the OT gene, OT

was shown to be essential for letdown and continued milk production but not for parturition or the initiation of maternal behaviour; involution of the mammary tissue in the OT-deficient mice occurred despite continued suckling by the offspring and normal prolactin release (Nishimori, Young, Guo, Wang, Insel, & Matzuk 1996).

In the human breast, pulsatile OT release is responsible for the milk ejection reflex, also known as "letdown" (Dewey 2001). This physiological mechanism releases milk stored in the woman's breast, making it available to her infant. Research has shown that the initial OT release during a nursing bout can occur in response to the sight, sound, smell or thought of the infant, and not only to the direct tactile stimulus of suckling (Glasier & Mcneilly 1990). Some women have reported "letting-down" after hearing the cry of an infant in distress even if it was not their own (C. Britton 1998). The sensory impulses from stimuli are transmitted via the spinal cord to the OT-producing neurons in the hypothalamus (Gimpl & Fahrenholz 2001). As lactation becomes established, the OT neurons of breastfeeding women undergo structural changes in which the OT-releasing cells get closer together and begin to act synchronously to release large bursts of OT (Gimpl & Fahrenholz 2001; Uvnas-Moberg & Eriksson 1996). These bursts or "pulses" of OT occur about one per minute, resulting in a characteristic measurable pulsatile pattern in plasma OT (McNeilly, Robinson, Houston, & Howie 1983; Uvnas-Moberg & Eriksson 1996). Research in genetically-modified mice (Nishimori, Young, Guo, Wang, Insel, & Matzuk 1996) and in women (Buhimschi 2004; McNeilly, Robinson, Houston, et al. 1983; M. Newton & Newton 1948; Sala & Althabe 1968) has shown that these OT pulses are essential for successful milk removal by the offspring or infant.

As each pulse of OT enters the woman's blood stream, it passes through the body to the breasts where it binds to OT receptors present in the myoepithelial cells, in the walls of the lactiferous ducts, sinuses and alveoli (Gimpl & Fahrenholz 2001). Although always present in the breast, the number of OT receptors increases dramatically throughout pregnancy, reaching a peak number of receptors during the first week post-partum (Buhimschi 2004). When the OT molecules arrive in the breast they bind to the receptors in the epithelial cells, which contract (Gimpl & Fahrenholz 2001). As the cells contract, the pressure within the alveoli rises, expelling the milk from the alveoli into the duct system (Crowley & Armstrong 1992). As the myoepithelial cells along the ducts contract the ducts shorten and widen, which reduces the resistance and allows the milk to flow more easily. Milk then collects behind the nipple where the nursing infant can access it easily (J. Riordan 2005). Some women report that myoepithelial contractions brought on by OT release can be strong enough to spray milk some distance from the breast (C. Britton 1998). When the nursing bout ends, the pulses of OT stop, and the level of OT in the blood falls to baseline within as little as 6 minutes (J. Riordan 2005; Sala & Althabe 1968).

For milk production to continue, it is important to maintain the milk-ejection reflex during periods of separation of the woman from her child due to illness, work or other factors. Research has been done to investigate the effect of different types of breast stimulation on OT release. Contact with the breast, such as massage, does cause release of OT, but as a sustained elevation, rather than the pulsatile release characteristic of the suckling response (Yokoyama, Ueda, Irahara, & Aono 1994). Various manual and electric pumps also result in an increase of OT level, though it is unclear whether the

consequent OT release is pulsatile or steady (Zinaman, Hughes, Queenan, Labbok, & Albertson 1992).

The role of OT in milk removal is particularly important because when the alveolar cells of the breast are full of milk they become flattened, and in that state they do not produce milk (Buhimschi 2004). It has been theorised that prolonged exposure to a stressor that suppresses OT and disrupts milk ejection could lead to the suppression of milk synthesis, since the milk could not be drawn from the breast (Lau 2001). As a result, if the stressor were to remain chronic, lactation would eventually cease altogether (Lau 2001).

Oxytocin and Stress

From a biological perspective, stress is understood as the ensemble of psychological, physiological and behavioural responses to a potentially threatening stimulus (Boutet, Vercueil, Schelstraete, et al. 2006). The classic response to stress has been dubbed the "fight or flight" response. This response involves the activation of the hypothalamic-pituitary-adrenal (HPA) axis, with "secretion of catecholamines, mobilisation of energy and attention, and inhibition of sexual behaviour and appetite" (Boutet, Vercueil, Schelstraete, et al. 2006). The purpose of the fight or flight response is to decrease the energy being directed towards non-essential functions, in order to prioritise survival. While this response may be seen as adaptive in some situations, mediation of the HPA axis is important to prevent HPA over-reaction. The release of OT in response to stress has been seen as one important regulator of HPA axis activation (Courtney DeVries, Craft, Glasper, Neigh, & Alexander 2007).

OT released by the neurohypophysis under conditions of stress has been found to exert an inhibitory influence on the HPA axis at a wide range of doses and among a wide variety of species (Courtney DeVries, Craft, Glasper, et al. 2007). OT has been shown to lower blood pressure (BP), reduce corticosterone and raise insulin levels (Lippert, Mueck, Seeger, et al. 2003). Among men OT is found in higher concentrations in the adrenal gland than in the blood, suggesting that the OT may decrease cortisol release through its action on the adrenal gland (Gimpl & Fahrenholz 2001).

Among women, presence of OT in the blood due to nursing appears to dampen the reaction of the HPA axis to stress (Amico, Johnston, & Vagnucci 1994; Chiodera, Salvarani, Bacchimodena, et al. 1991; Heinrichs, Meinlschmidt, Neumann, et al. 2001). Some examples of this dampening effect were reduced duration of high blood pressure and lower heart rate (M. Altemus, Redwine, Leong, Frye, Porges, & Carter 2001; Light, Smith, Johns, Brownley, Hofheimer, & Amico 2000). Some studies suggest that as part of this dampening function among breastfeeding women OT may suppress the release of adrenocorticotropic hormone (ACTH) and cortisol in the face of psychologically and physically stressful conditions (M. Altemus, Deuster, Galliven, Carter, & Gold 1995; Evans 1997; Gimpl & Fahrenholz 2001), but the effect on ACTH and cortisol was not found in all studies of breastfeeding women (M. Altemus, Redwine, Leong, Frye, Porges, & Carter 2001; Chatterton, Hill, Aldag, Hodges, Belknap, & Zinaman 2000; M. W. Groer 2005). Other large releases of OT into the bloodstream, such as intranasal OT sprays were found to significantly suppress cortisol and anxiety responses to the Trier social stress test relative to controls, most effectively when combined with social support (Courtney DeVries, Craft, Glasper, et al. 2007).

Researchers have dubbed this mediating effect of OT on the HPA axis the "tend and befriend response", in contrast to the "fight or flight" response. The "tend and befriend" response has been thought to encourage affiliation and sociality as an alternate pathway for dealing with stress, especially stresses of a psychological nature (Boutet, Vercueil, Schelstraete, et al. 2006; Engelmann, Landgraf, & Wotjak 2004; Lippert, Mueck, Seeger, et al. 2003).

In studies of basal oxytocin levels, researchers have found associations of higher basal OT levels with *higher* rather than lower stress (Hoge, Pollack, Kaufman, Zak, & Simon 2008; S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006; R. A. Turner, Altemus, Enos, Cooper, & McGuinness 1999). Hoge and colleagues found that men and women with higher social anxiety symptom severity and greater dissatisfaction with social relationships showed higher basal OT levels (Hoge, Pollack, Kaufman, et al. 2008). Among college-aged women higher basal OT levels were associated with increased anxiety and greater interpersonal distress (R. A. Turner, Altemus, Enos, et al. 1999). Among post-menopausal women, when controlling for hormone therapy, basal OT was elevated among those who spent less time with contacts who were important to them[3] and among those who reported less warm and positive relationships with a primary partner (S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006). Women with high OT also showed *higher* levels of cortisol in the study (S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006).

Taylor and colleagues suggest that while OT may be associated with calm and companionable feelings when released in jolts or pulses (i.e. in breastfeeding or

[3] The lessened amount of time spent with contacts important to the participant (including her mother or a pet) was in almost every case caused by the death of that contact, meaning that a low OT level was unlikely to have been the cause of the interpersonal gap in the first place.

exogenous administration), persistent elevations in plasma OT do not appear to be protective against stress (S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006). Rather, in conjunction with hostile or unsupportive social contacts, OT may actually act to exacerbate biological and psychological stress responses (S. E. Taylor Gonzaga, Klein, Hu, Greendale, & Seeman 2006). Hence, we have a situation where increased OT can lead either to increased or decreased stress response, on the basis of as yet undetermined factors.

Engelmann and colleagues suggest that the source of this "Janus-faced effect" of OT on the HPA axis may be the source of release of the hormone; while direct release from the hypothalamic paraventricular nucleus (PVN) and supraoptic nucleus (SON) inhibit ACTH, release from axons and axon terminals may stimulate ACTH secretion (Engelmann 2004) but this has yet to be confirmed.

Oxytocin, Stress and Breastfeeding

While OT has been shown to both stimulate and suppress the HPA response to stress, exposure to some forms of stress have themselves been shown to suppress OT release. The theory that suppression of OT due to stress was responsible for the failure of dairy cows to "let-down" their milk was first outlined by Ely and Petersen in 1941 (Ely & Petersen 1941). Since that time, studies designed to investigate the mechanism of OT suppression have been conducted in a variety of animals, as well as human subjects.

Milk-ejection was suppressed in rats subjected to experimental fracturing of one hind-limb, as well as in those with bi-lateral incisions through the skull to the brain (Taleisnik & Deis 1964); intra-peritoneal injection of OT restored lactation in these cases. Social stress involving the separation of rat mothers from pups for 20 hours per

day resulted in decreased milk-ejection, but not in impaired maternal behaviour (Lau & Simpson 2004). Lactating rabbits that were forcibly restrained during nursing showed milk yield decreased by 20 to 100 percent, associated with an absent or reduced milk-ejection reflex (Cross 1955). Administration of exogenous OT reinstated normal milk flow in 29 of 35 cases.

Also in rabbits, it was shown that neural pathways important to OT release were coincident with pathways for stress responses such as fear and anger. When stimulation of the OT pathway occurred after stimulation of the stress pathways had begun, the release of OT was prevented (Aulsebrook & Holland 1969). Dairy scientists have shown that cows milked in unfamiliar surroundings produced high levels of β-endorphin as a component of stress response, and showed lowered OT levels. As the cows became used to the new location with subsequent milkings, the level of β-endorphin decreased and OT levels returned to normal milking levels (Bruckmaier, Pfeilsticker, & Blum 1996; Wellnitz & Bruckmaier 2001). It is theorised that neural pathways devoted to survival responses are prioritised over lactation pathways, resulting in suppression of lactation. In all these animal studies the lack of letdown was shown to be a function of central OT suppression, rather than a problem with OT binding sites peripherally (i.e. within the mammary tissue), since introduction of exogenous OT counteracted the inhibitory effect.

In women, it is anecdotally well accepted that stress that occurs before a particular bout of breastfeeding can suppress the letdown reflex (Lawrence 2008; J. Riordan & Auerbach 1998). The involvement of OT suppression in this effect was demonstrated decades ago. In their classic paper, Newton and Newton (1948) showed that emotional disturbance, pain stimulus and cold stimulus stressors administered during nursing bouts

suppressed a subject's milk yield even though her lactation was well established. Under the same stressors, injection with exogenous OT resulted in milk yield comparable to that obtained during non-stressed bouts of nursing, strongly suggesting that the relevant mechanism was central suppression of OT (M. Newton & Newton 1948). The amplitude of the OT pulses that women produced during nursing bouts when they were exposed to noise and time-constrained mental arithmetic have also been found to be significantly lower than in control bouts without stressors (Ueda, Yokoyama, Irahara, et al. 1994). In a separate study, women who were injected with morphine (the exogenous equivalent to the natural opioids released during anger or tension) showed a significant reduction in OT response (Lindow, Hendricks, Nugent, Dunne, & van der Spuy 1999). This suggests that these stress-related compounds may interfere with OT neuron function (Lindow, Hendricks, Nugent, et al. 1999).

OT release during breastfeeding can be significantly affected by experiences surrounding labour and delivery; women who delivered vaginally showed a pattern of pulsatile OT release two to three days post-partum, whereas women who delivered by caesarean section showed a constant rate of OT (Uvnas-Moberg 1998). Women who had delivered vaginally showed a pulsatile OT release pattern during a 10-min breastfeeding session two days after delivery while women who had undergone an emergency caesarean section did not (Nissen, Uvnas-Moberg, Svensson, Stock, Widstrom, & Winberg 1996). There are several possible explanations of this difference in OT level: women who deliver vaginally get exposed to the high level of OT release that is associated with Stage 2 of labour, whereas caesarean section women do not; immediate and prolonged skin-to-skin contact with the infant that is associated with an increase of

OT in the circulation is less likely to occur following caesarean section surgery due to the post-operative monitoring required for the woman and the infant; women who have an emergency caesarean section experience stress, as well as post-operative pain; and women who undergo caesarean section are often exposed to pain medications (exogenous opioids), which have been shown to suppress pulsatile OT release (Nissen, Uvnas-Moberg, Svensson, Stock, Widstrom, & Winberg 1996; Uvnas-Moberg 1998).

Discussion

OT is an ancient hormone that has been known for decades to play an important role in reproduction and lactation in humans, but which has recently been identified as playing roles in a wide variety of other systems in the body. These roles are yet to be fully understood, as is the relationship of OT and stress, where OT has been associated both with increased and decreased stress response.

Researchers in the field considered these results extremely unexpected, given commonsense notions of OT as the key hormone of affiliation and interpersonal relationships—the "love" hormone, so to speak. This characterisation of OT as "the tend and befriend" hormone has even been mobilised when discussing effects of OT that are in *opposition* to its warm and fuzzy reputation (DeAngelis 2008). As has been argued for the "sex hormones" (estrogen and testosterone: Oudshoorn 1994) particular hormones can tend over time to become associated with particular traits, characteristics or attributes. This is especially so when the hormone is most strongly associated with one or the other sex. Since the functions of OT that have been known for the longest are those that are firmly rooted in the female body (labour and breastfeeding), it could be argued that the view of OT strictly as a calm, nurturing, affiliative hormone naturalises those

characteristics as the product of women's biology. The work of Taylor and colleagues (2006) and Turner and colleagues (1999) destabilises such assumptions, by revealing a greater complexity to the functioning of OT.

In this study, the key aspect of OT to be investigated is the suppression of OT by stressful life experiences. The relationship between OT, breastfeeding and stress is one of the ways in which this project will examine the role of embodied experience as an influence on breastfeeding duration. While the literature on the effect of OT on stress *in general* has been contradictory, the fact that acute stress impedes the release of OT during breastfeeding has been clearly demonstrated, both in animals and in humans (Ely & Petersen 1941; N. Newton 1992; M. Newton & Newton 1948; Taleisnik & Deis 1964; Ueda, Yokoyama, Irahara, et al. 1994). On the basis of this solid work on acute stress and breastfeeding, it has been theorised that chronic stress may cause chronic OT suppression, followed by lactation failure (Allen & Pelto 1985; Lau 2001). Therefore, in a study that aims to account for early breastfeeding cessation from the perspective of embodied subjectivity, OT appears to be an excellent candidate, as an aspect of the body that may directly show the impact of the experiences, responses and stressors of a woman's day-to-day life.

Chapter Summary

This chapter reviewed the evolution and biology of the breast, the biology of breastmilk and the physiological functions of oxytocin. Chapter III will discuss this biology in the context of anthropological models of breastfeeding duration. Social/ structural and individual predictors of breastfeeding duration will also be examined.

CHAPTER III

BREASTFEEDING DURATION

This chapter presents research related to the duration of breastfeeding among humans. Research on breastfeeding duration has been conducted by scholars in a wide range of fields, including biological and cultural anthropology, sociology, nutrition and biology, medicine, nursing, and public health. The first section of the chapter deals with the work of biological anthropologists on breastfeeding duration focused on two main areas: life-history predictors of "natural" age at weaning; and conflict/constraint models for the age of weaning, centred around the energetic demands of breastfeeding. The second section of the chapter presents work on breastfeeding duration from a variety of the disciplines listed above. These studies examine the impact of many social/structural and personal factors on breastfeeding duration in many societies around the world. The chapter concludes with a discussion of the contributions of these various approaches to the design and development of my dissertation research on breastfeeding duration in São Paulo, Brazil.

Biological Anthropology and Age at Weaning

Through modern cultural interventions, human infants can now survive through the period of infancy without access to breastmilk. Especially in modern urban populations, the environment of evolutionary adaptedness may seem irrelevant when facing questions of morbidity and mortality of infants. However, even in technologically advanced nations with generally good sanitation and access to clean water, the consequences of early weaning onto breastmilk substitutes can be seen as one more

marker of inequality among less well educated, less affluent, less privileged groups. Breastfeeding research in urban populations in current environments should take into account the evolutionary pressures (costs and benefits to reproductive fitness) that have shaped the anatomy and physiology of lactation and breastfeeding. Biological anthropologists and zoologists working in a comparative framework have contributed greatly to our understanding of these pressures. Biological anthropologists have examined the length and nature of breastfeeding in natural fertility populations for many years (Allen & Pelto 1985; K. A. Dettwyler 1995b; Ellison 1995; Konner & Worthman 1980; Obermeyer & Castle 1997; Woolridge 1995).

Life-History Models for Age at Weaning

Life-history theory seeks to explain relationships between breastfeeding duration (often referred to as "age at weaning") and other aspects of the behaviour and physiology of humans and other mammalian species. Life-history theory suggests that various parameters of life history are related to one another in allometric ways; essentially "variation in most life-history measures is highly correlated with variation in body size and differences in body size are associated with differences in behaviour and ecology" (Harvey & Clutton-Brock 1985). In the past two decades, a wide variety of developmental mile-stones have been suggested as markers of the "natural" age at weaning for the humans. The use of cross-species comparison is particularly prominent in these studies.

Some of the developmental milestones that have been suggested as being correlated with weaning age across primates include length of gestation (i.e. the period of lactation = 1.5 times the period of gestation; Harvey & Clutton-Brock 1985), tripling of

infant birth length (Lawrence & National Center for Education in Maternal and Child Health 1997), quadrupling of infant birth weight (P. C. Lee, Majluf, & Gordon 1991), attainment of 1/3 of adult body weight (Charnov 1991), attainment of 1/3 of mother's weight (Harvey & Clutton-Brock 1985), and eruption of the first molar (Smith 1992). The same general evolutionary argument is made for many of these milestones: by waiting to wean the infant until it has developed to the specified point, the mother maximises the likelihood of offspring survival (P. C. Lee, Majluf, & Gordon, et al. 1991). In the first five cases, the size of the infant would allow for increased success in *procuring* food resources, while in the last example, the emergence of the first molar would allow the offspring to *process* food more efficiently (Smith 1992).

Drawing together the estimates from a wide range of such life-history studies, Dettwyler argues for an evolved "natural" age for weaning among humans (K. A. Dettwyler 2004; K. A. Dettwyler 1995b). Based on allometry in the Primate order, the "species norm" for human breastfeeding should run from a minimum of 2.5 years to a maximum of 7 years of age (K. A. Dettwyler 2004). Ceasing to breastfeed before 2.5 years of age should, therefore, be considered "premature weaning" and, in Dettwyler's view, women would be warned against it by their doctors (K. A. Dettwyler 2004).

In contrast to Dettwyler, Kennedy argues that the evolution of the large brain among humans has driven the selection for a weaning age between 2.5 and 3 years *at the latest* (Kennedy 2005). Kennedy's argument is as follows. Brain tissue is energetically extremely expensive, requiring up to 80% of basal metabolic rate (BMR) in children (Leonard & Robertson 2002). During childhood, brain development requires increased access to calories and key nutrients, particularly protein (Kennedy 2005). Since the

maximum productive capacity for breastfeeding among humans is 1200mL/day, and human breastmilk contains ~0.95g of protein per 100mL, even a well-nourished woman can produce only about 80% of the protein required by her 3-year-old child (Kennedy 2005). Given these limits, extended periods of breastfeeding (3+ years) would have constrained the development of our uniquely large brain. Hence, for the evolving human population, weaning between 2 and 3 years would be a biological imperative in order to ensure that the infant had access to sufficient nutrients and protein to maximise brain growth during the critical period (Kennedy 2005).

Conflict/Constraint Models for Age at Weaning

The second main area of biological anthropological inquiry into age at weaning is based upon a notion of energetic balance or constraint. Briefly, in the environment of evolutionary adaptedness (as well as in the present day), individuals had a finite amount of energy at their disposal. Energy which was devoted to one type of process in the body (i.e. maintenance of tissues) could not be devoted to another (i.e. reproduction). Since lactation is the most energetically expensive aspect of reproduction for a female mammal[4] (Gittleman & Thompson 1988), the question of age at weaning was ripe for an approach based on an analysis of energy flows (energetics).

In environments where available energy resources (foods) are patchy or uncertain lactation improves reproductive fitness. Lactation allows prior foraging success to fuel current infant provisioning, by enabling the infant to draw on maternal stores of energy; provisioning is only limited by maternal reserve levels (Dall & Boyd 2004). Therefore, "[l]actation offers a dramatic advantage in terms of the success of a reproductive attempt,

[4] At peak levels in some mammals, lactation can require anywhere between 2.5 and 5 times increase of energy requirements (Gittleman & Thompson 1988). Women require an increase of around 500 calories per day above BMR (roughly 1.25 times) to adequately support lactation (Dufour & Sauther 2002).

as the risk of an energetic shortfall while foraging increases" (Dall & Boyd 2004). However, once the source of nutrition for the infant is the mother's own body stores, the adult female must balance her energy intake with, on one hand, energy directed towards the growth and development of the off-spring, and on the other, that directed towards her own maintenance and well-being.

One of the first routes to the study of lactational energetics came from the question of lactational amenorrhea. Konner and Worthman argued that the drive to reproduce was the principal factor driving weaning behaviour, since ovulation is suppressed by intensive lactation (Konner & Worthman 1980). The connection between suppression of the reproductive function in humans and intensive breastfeeding appears to be the energetic cost of milk production (Ellison 1994; Ellison 1995; Valeggia & Ellison 2003; Vitzthum 1989). Empirical studies suggest that the degree of energetic stress that lactation represents for the woman may be the factor which determines the length of post-partum amenorrhea within the human range of 2 months to 3 years (Ellison 1994; Ellison 1995; Valeggia & Ellison 2003; Vitzthum 1989).

For non-human primates these energy costs of lactation are met in various ways, through increasing foraging time (Gittleman & Thompson 1988), metabolising body stores of fat, decreasing BMR, decreasing energy spent on activity or a combination of all of these (Dufour & Sauther 2002). Among humans, the energy costs are met through energy intake increases, where possible, and physical activity decreases, again where possible (Dufour & Sauther 2002; Valeggia & Ellison 2003). Food sharing between women simultaneously increases energy intake and allows the reduction of physical

activity, suggesting that such practices may be evolutionarily adaptive (Dufour & Sauther 2002).

When increasing food intake or decreasing energy expenditure is not possible, mobilisation of body stores to provide milk for the infant can and does occur in humans (A. Prentice, Prentice, & Whitehead, et al. 1981; A. M. Prentice & Prentice 1988). Where women are under chronic nutritional stress, lactation tends to put them into a negative energy balance, causing weight loss, including muscle tissue catabolism (Vinoy, Rosetta, & Mascie-Taylor 2000). In such a situation, where finite maternal resources are taxed to the extreme, it has been theorised that conflict will arise over the investment of those resources (Trivers 1974).

Depletion of maternal stores of macro- and micro-nutrients can severely compromise the mother's future ability to reproduce, and even her survival. Therefore, it is not in the mother's interest to invest maximum maternal resources in the currently nursing offspring (Trivers 1974). Rather, she will opt to protect her future capacity to produce and nurture offspring. In contrast, the currently nursing offspring will act to maximise the benefit that it receives from lactation. Trivers' argument is largely based on the notion of "selfish genes": an individual is related 100% to itself, while as a parent he or she is only related to each off-spring by 50%.

Some scholars maintain that "opportunity costs rather than costs to residual reproductive value are the major force driving human weaning decisions" (Quinlan & Quinlan 2008). While the physical demands of labour can be a factor constraining the ability to breastfeed (Panter-Brick, 1992), breastfeeding will often continue when work and continued lactation are compatible (Ulijaszek & Leighton 1998). Cross-culturally,

women breastfeed for longer in societies where men are more actively involved in child care (Quinlan, Quinlan, & Flinn 2003; Quinlan & Quinlan 2008).

Along these lines, in contrast to Trivers' idea of parent-offspring conflict, McDade and Worthman suggest the "weanling's dilemma" (1998) to explain the conflict around age at weaning. The weanling's dilemma is the following: while the infant consumes only breastmilk, it is protected from pathogens and toxins in its environment. However, at a certain point (around 6 months of age) breastmilk ceases to meet nutritional requirements for growth and development (McDade & Worthman 1998). In their formulation, in addition to the biological constraints/drives of the woman and child, the conflict over breastfeeding arises from an entire suite of other constraints that promote or prevent breastfeeding including the ideology, social ecology, physical ecology and political economy of a particular culture (McDade & Worthman 1998; McDade 2001; McDade 2002). Competing demands in these various spheres may play an important role in constraining the ability of the woman and infant to breastfeed until 6 months (McDade & Worthman 1998).

Social/Structural and Individual Predictors of Breastfeeding Duration

Investigation of breastfeeding duration has not been the province of the biological anthropologist alone. Scholars of cultural anthropology, sociology, nutrition and biology, medicine, nursing, and public health have conducted research in this area. The many influences that have been investigated can be arranged on a continuum from distal to proximal, external to internal, structural to individual. Individual-level factors can be further broken down into behavioural, biological and experiential factors.

Social/Structural Predictors of Breastfeeding Duration

At the broadest level, many researchers have investigated the impact of structural and demographic factors on rates of breastfeeding initiation and length of breastfeeding (Adair, Popkin, & Guilkey 1993; Adair, Popkin, & Guilkey, et al. 1993; Callen & Pinell 2004; Chapman & Perez-Escamilla 1999; Dodgson, Duckett, Garwick, & Graham 2002; Flacking, Ewald, & Starrin, et al. 2007; Flacking, Nyqvist, & Ewald 2007; Flacking, Nyqvist, et al. 2007; Perez-Escamilla, Lutter, Segall, Rivera, Trevino-Siller, & Sanghvi 1995). Reviews of the literature have found a strong association between maternal education and breastfeeding initiation and duration (Scott & Binns 1998). Women with more education are more likely to initiate breastfeeding, and to continue breastfeeding for longer than women with less education (Li, Kendall, Henderson, Downie, Landsborough, & Oddy 2008). In Sweden, women with the fewest years of education were 2.5 times more likely to wean full-term infants completely before six months post-partum than women with higher education (Flacking, Nyqvist, et al. 2007). In Brazil, women with 4 years or less of education were 2.28 times more likely to have ceased exclusively breastfeeding than women with 13 years of education or more (Venancio, Escuder, Kitoko, et al. 2002). In the United States, women with education beyond high-school were twice as likely to state the intention to breastfeed (H. J. Lee, Rubio, Elo, McCollum, Chung, & Culhane 2005) and better educated women were significantly more likely to breastfeed exclusively (Quandt 1985). This effect did not occur in every context: in the United Arab Emirates and the Philippines, women with more years of education were less likely to fully breastfeed to 6 months (Adair, Popkin, & Guilkey, et al. 1993; Al Tajir, Sulieman, & Badrinath 2006). This inverse effect may in part be explained through

increased access to the work force in these contexts among women who had attained a higher level of education.

Socio-economic status is widely acknowledged as an important factor in determining both initiation and duration of breastfeeding (Callen & Pinell 2004; Flacking, Nyqvist, et al. 2007) though the direction of the correlation can change depending on the country context; in developed countries increased SES tends to be positively associated with breastfeeding measures, while in developing countries the association tends to be negative (Perez-Escamilla, Lutter, Segall, Rivera, Trevino-Siller, & Sanghvi 1995). Structural interventions, such as the U.S. Special Supplemental Nutrition Program for Women, Infants and Children (WIC), have been shown to undermine breastfeeding initiation and duration among low-income mothers through the provision of free formula (Callen & Pinell 2004; Cricco-Lizza 2007). Access to commercial weaning foods in Ecuador also led to a curtailment of breastfeeding, resulting in higher morbidity and mortality (Vitzthum 1989; Vitzthum 1992). However, access to breastfeeding educational materials through WIC has at least the possibility to counteract this effect (Cricco-Lizza 2007; Raisler 2000; Weimer & United States. Dept. of Agriculture. Economic Research Service 1998).

In developing countries, when childcare and work conflicted, breastfeeding duration tended to be shortened (Adair, Popkin, & Guilkey, et al. 1993; Sellen & Smay 2001). This trend was borne out in industrialised contexts as well (Flower, Willoughby, Cadigan, Perrin, Randolph, & Family Life Project Investigative 2008; Kosmala-Anderson & Wallace 2006; Vanesterik & Greiner 1981) suggesting that work is a central structural limit to breastfeeding duration in many women's lives.

Individual Predictors of Breastfeeding Duration

Studies have examined a wide variety of demographic, behavioural, biological, mental health, and experiential predictors of individuals' breastfeeding duration.[5] A substantial body of research has shown that when women bear children from unintended pregnancies they are less likely to initiate and less likely to continue breastfeeding (Cheng, Schwarz, Douglas, & Horon 2009; Gipson, Koenig, & Hindin 2008; Joyce, Kaestner, & Korenman 2000; Korenman, Kaestner, & Joyce 2002; Marston & Cleland 2003) and several large, retrospective survey-based studies have found a negative association between unintended pregnancy and duration of breastfeeding (Cheng, Schwarz, Douglas, et al. 2009; Hromi-Fiedler & Perez-Escamilla 2006; J. S. Taylor & Cabral 2002). However, there has been a paucity of research on this topic in developing countries (Gipson, Koenig, & Hindin, et al. 2008).

Behavioural factors like smoking cigarettes (Amir 2001) and drinking alcohol (Giglia, Binns, Alfonso, Scott, & Oddy 2008) have been associated with decreased duration of breastfeeding. Hormonal mechanisms involving suppression of OT or prolactin (PRL) have been suggested to explain these associations, but the connection has not yet been elucidated (Amir 2001; Heil & Subramanian 1998). Breastfeeding style (frequency and duration of feedings per day) can significantly alter the hormonal profile, which impacts milk production (Diaz, Seronferre, Cardenas, Schiappacasse, Brandeis, & Croxatto 1989; Konner & Worthman 1980; Quandt 1985; Vitzthum 1989). Pacifier use was associated with poor infant performance during breastfeeding (Dewey, Nommsen-

[5] It is certainly possible (and possibly more accurate) to view at least some of these predictors as "structural" rather than, or as well as, individual level factors. I have designated them as individual factors for two reasons: first, the studies themselves did not make links between the factor (e.g. unplanned pregnancy) and its possible structural antecedents; second, these are factors that are in a certain sense "close" to the body and subjectivity of the individual.

Rivers, Heinig, & Cohen 2003), though Kramer and colleagues found that pacifier use was a marker of breastfeeding difficulties rather than necessarily being causally associated (Kramer, Barr, Dagenais, et al. 2001). The practice of co-sleeping, where a woman and her infant sleep in the same bed, has been shown to have a protective effect on breastfeeding duration, as well as to reduce the incidence of sudden infant death syndrome (SIDS—McKenna 1995).

Biological factors have also been shown to influence breastfeeding outcome. Generally, onset of full milk production (lactogenesis II) occurs three or four days post-partum, but can be delayed up to 14 days (J. Riordan 2005). Guatemalan women who had a delayed onset of lactation were significantly more likely to cease exclusive breastfeeding before 6 months post-partum (Hruschka, Sellen, Stein, & Martorell 2003), while American women with delayed onset of lactation breastfed for 3.4 months, compared to 11.7 months among women without delayed onset (Chapman & Perez-Escamilla 1999). This association was mediated by exposure to supplemental non-breastmilk foods in the pre-onset period, indicating that delayed on-set has a biocultural, rather than purely biological effect on duration. Women who experience greater than normal stress during labour and delivery are more likely to experience delayed onset of lactation, potentially through the suppression of OT by maternal stress (Dewey 2001). In a study of Guatemalan women, high maternal cortisol levels at two hours post-partum were significantly associated with delayed onset of lactation (Grajeda & Perez-Escamilla 2002). It seems, therefore, that maternal stress during delivery influences breastfeeding duration via the stress-influenced pathway of delayed onset of lactation (Dewey 2001).

Women's internal individual factors such as mental health status, self-efficacy and coping ability have been tied to breastfeeding outcomes, even when controlling for important confounding factors such as age, parity, and education. Among Canadian (Dennis & McQueen 2007; Dennis & McQueen 2009) and Australian women (Henderson, Evans, Straton, Priest, & Hagan 2003), those who showed signs of post-partum depression on the Edinburgh Postnatal Depression Scale (score > 12) were significantly more likely to discontinue breastfeeding. Norwegian women who showed increased negative affectivity (tendency to frequently experience negative emotions and feel negatively about themselves) were 1.25 times more likely to bottle-feed and those who scored lower on measures of self-efficacy were 2.88 times more likely to bottle-feed (Ystrom, Niegel, Klepp, & Vollrath 2008). American women who breastfed exclusively had a higher self-concept, increased feeling of moral worth and value as a family member than those who exclusively bottle-fed (J. R. Britton & Britton 2008).

The experiences and perceptions of breastfeeding women have been extensively investigated through ethnographic research. This research engages with feminist theoretical interests in mothering, identity creation and power and often uses a phenomenological method of enquiry (Schmied & Lupton 2001). This method "seeks to describe the essence of a phenomenon, as experienced by participants who have the 'lived experience' of the event" (Cresswell 1998). As such it provides a distinctive perspective on the practice of breastfeeding and its meaning in women's lives. The qualitative, descriptive nature of the research grounds the results in the experiences of particular small groups of women, while drawing conclusions about larger social processes. These studies provide an important complement to the quantitative

investigations described above. One limitation of this type of investigation is that with few exceptions (Gottschang 2007), the vast majority of such research has been conducted in Australia, Canada and the U.K.

Experiential research has explored the experiences of women who encountered serious difficulties with breastfeeding (Bottorff 1990; Hauck, Langton, & Coyle, et al. 2002; Kelleher 2006). In the face of these difficulties, the ideas that a mother should be willing to give to her child without question and to stay committed to her decision to breastfeed were of central importance to women's decision-making (Bottorff 1990). Even women who were committed to continue "on the breastfeeding path" identified encumbrances and encouragements for breastfeeding (Hauck, Langton, & Coyle, et al. 2002). Partners' and family members' support or lack thereof was vital to the (dis)continuation of breastfeeding in the face of substantial difficulties (Hauck, Langton, & Coyle, et al. 2002). The sheer physical demands of breastfeeding were a serious challenge to breastfeeding for some women, potentially "more demanding, perhaps even debilitating [physically]…than childbearing" (Kelleher 2006). In the commitment to continue breastfeeding in the face of such challenges, women felt that their own comfort and needs were secondary to the benefits infants received from breastfeeding (Kelleher 2006).

Research from the north of England revealed women's experiences of breastfeeding as a liminal practice, to be done in isolation and only in ways that conformed to cultural norms (Mahon-Daly & Andrews 2002). A perceived lack of consonance between breasts as components of the woman's sexual relationship with a partner and breasts as a way to nurture and feed infants was found to be problematic for

women in a variety of cultures, from China to Brazil to the United States (K. A. Dettwyler 1995a; Gottschang 2007; Marshall, Godfrey, & Renfrew 2007). In Brazil and France the relationship between breastfeeding and sexuality was found to be fraught, with women and men both expressing discomfort at the coexistence of nurturing and sexual roles for the breast (Sandre-Pereira 2003). The author argues that this discomfort may be linked to the weaning discourse that places responsibility for weaning on the infant's choices, a common trope among Brazilian women (Sandre-Pereira 2003). In some instances, women must "manage the performance of breastfeeding…with specific attention to the dominant notion of a sexualized rather than nurturing breast" (Stearns 1999).

Issues of sexuality are just one facet of women's struggles to manage the integration of the new "good mother" identity with their "other pre-existing identities as women, wives and workers" (Marshall et al. 2007: 2157; Shelton & Johnson 2006). The ideal good mother subordinates her own preferences, desires and needs to those of her infant, in a process of "intensive mothering" (Hays 1996:97). The good mother is patient, selfless, in control of her emotions and willing to devote herself unstintingly to her children (Lupton 2000). In Australia, university-educated women who had been professionals prior to the birth of the infant expressed ambivalence towards the different roles they were supposed to attempt at the same time, as they discovered that "the ideal of the 'good mother' is not coterminous with that of the 'independent mother'" (Lupton 2000: 62). Women who became mothers later in life, who had had longer to establish and maintain an autonomous identity, found it especially difficult to integrate the new maternal role into their pre-existing identities (Shelton & Johnson 2006). Sevon argues

that women's ambivalence to maternal responsibility arises in part because dominant cultural narratives construct "good mothering" as a goal that is at once tempting and impossible to attain, leading women to both embrace and resist the requirements placed on them (Sevon 2007). Choi and colleagues found that resistance to the dominant narrative was non-existent among women in their study, arguing that the fear of being judged as a failure was so strong that women would redouble their efforts to live up to the ideal, rather than question or subvert that ideal (Choi, Henshaw, Baker, & Tree 2005).

Currently, breastfeeding is a central component of the dominant "good mother" narrative (E. Murphy 1999). Deviance from this expectation calls for "repair work" on the part of the woman, to protect her status as a good mother (E. Murphy 1999). Thus, women who switch from the breast to the bottle will call upon alternate discourses, for example insufficient milk, to make a claim that her choice actually shows superior rather than inferior skills as a mother (E. Murphy 2000). Breastfeeding is not an automatic ticket to good mother status; rather, that status depends on evidence that the infant is growing and content. Women who continue to breastfeed when the infant is not growing or seems unhappy can also be at risk of being labelled as a bad or irresponsible mother by peers and family members (Marshall, Godfrey, & Renfrew, et al. 2007). In this context, health professionals could be seen as allies for women who are making a stand to breastfeed (Marshall, Godfrey, & Renfrew, et al. 2007). By contrast, in some instances the "expert practice" of the health professionals threatened women's ability to choose to continue breastfeeding; mothers of infants who did not keep pace with the growth curve[6]

[6] The standard reference infant growth charts were developed from a sample of formula fed infants (Dewey 1998). Breastfed infants often fall below the curve because they tend to be longer and have less body fat than formula fed infants of the same age.

were told to switch to formula feeding so that the doctor could monitor exactly what the infant was consuming (Mahon-Daly & Andrews 2002).

The necessity to breastfeed in order to conform with the good mother ideal is also reinforced through the health care system and the behaviours of health care workers. In Sweden, where "the cultural norm is pro-breastfeeding" (Flacking, Ewald, & Starrin, et al. 2007), in order to conform with the local definition of the "good mother", mothers of pre-term infants were faced with an increased feeling of obligation to breastfeed, since they were bound to the hospital and medical staff for the duration of the infant's stay in the neonatal unit (Flacking, Ewald, & Starrin, et al. 2007). Other studies also found interactions with "authoritarian and inflexible care providers" (Hall & Hauck 2007) to be discouraging to women's efforts to breastfeed. Women identified healthcare workers who gave standardised breastfeeding advice as unhelpful, but those who gave individualised assessment and advice as helpful (Hauck, Langton, & Coyle, et al. 2002), while other women found that attempts to help, without proper explanation or acknowledgement of the maternal role, were intimidating and unwelcome (Kelleher 2006; Lupton & Fenwick 2001). Clearly, infant feeding is a contested arena for earning the title "good mother."

Discussion

The literature drawn from biological anthropology provided a comparative baseline for work undertaken regarding breastfeeding duration (also known as age at weaning) in the sub-discipline. This is important for any study involving biological data on breastfeeding for, to paraphrase Sellen, the fact that in "modern" societies women have access to breastmilk substitutes and that infants can survive on such a diet does not

decouple infants from their evolved need to breastfeed (Sellen 2001b). At the same time, it is important to examine the arguments for a “natural” age of weaning carefully.

While it is possible that species allometry may give hints of some species norm for age at weaning, the extremely wide variety of indicators suggested by the literature reviewed in the first section of this chapter, and the differing ages suggested by these indicators, suggests that it may be difficult to pinpoint that “natural” age.

Lee has pointed out that despite biological norms there can be great inter-individual variation in weaning age within as well as between species (P. C. Lee 1997). Some of the influences that change duration of lactation among mammals include poor habitat quality, litter size, sex of offspring, resource limitations/nutrient intake (i.e. food restriction) of the mother, and conception of the subsequent pregnancy soon after birth (Lee 1997: 89). It is plausible to argue that these factors still play a role in human decision making about breastfeeding, just as they do in other mammalian species, even if somewhat “buffered” by human culture.

Kennedy argues that particular developmental variables are of little value for predicting the “natural” age for weaning among humans since the role that these play in weaning is at best indirect (Kennedy 2005). Evidence from ethnographically observed cultures around the world puts the average ages at introduction of non-breastmilk foods at six months and the average age at total breastfeeding cessation at somewhere between two and three years (Kennedy 2005; Sellen 2001a). These parameters are remarkably close to current biomedical recommendations (exclusive breastfeeding for six months, followed by continuation of breastfeeding to two years and beyond). It is important not to jump to the conclusion that “culture” (i.e. the breastfeeding recommendations) are simply

reflecting a biological reality, here, but this wide agreement may suggest that, other things being equal, breastfeeding for somewhere between 2 and 3 years, with complementary foods introduced after six months may constitute a "typical" age at weaning across human populations.

If we do accept this as a "typical" length of breastfeeding among humans, we must still acknowledge that other things are often *not* equal. As McDade and Worthman (1998), Sellen (2001) and others have argued, human age at weaning is influenced by a "complex mix of material and ideological factors" (Sellen, 2001: 2707), not to mention structural inequalities and experiential factors. These factors, particular to the human experience, play an important role in women's decisions about whether to initiate and continue breastfeeding and when to wean.

The literature regarding a wide variety of these factors that was presented in the second section of this chapter revealed ways in which the inequality of circumstances from one person to another has the potential to strongly shape her actions and behaviours. The structural and social factors presented here provided the basis for many of the themes explored with participants during fieldwork in São Paulo. These large scale studies presented issues that could be investigated in more depth using the individual-oriented methods of this research project. For example, why and how did unplanned pregnancy become implicated in limited initiation and duration of breastfeeding? Would mental health indicators line up with other forms of stressful experience in women's day-to-day lives, or were they an entirely separate dimension of life?

Finally, the experientially-oriented analyses reviewed here reveal the value of narrative and experience for studies of breastfeeding duration. While this final group of

studies cannot claim to be generalisable, given the small, convenience samples used, they contribute to a deeper understanding of breastfeeding cessation in the lives of individual women.

Chapter Summary

This chapter presented literature from a wide variety of disciplines, from biological, sociological, medical and public health perspectives. Chapter IV and Chapter V respectively will outline the theory and methods used in this study, which attempts to combine structural with experiential approaches drawing on ethnographic and biological data to understand breastfeeding duration.

CHAPTER IV

THE BODY: A BIO-EXPERIENTIAL APPROACH

During the preparatory stages of my doctoral research when I was considering the design of the project, I made two visits to the Santa Marcelina Foundation (SMF) network where I hoped to conduct my research on breastfeeding, the first for two weeks in August 2004 and the second for one week in August 2005. In the course of these visits I had the opportunity to meet and talk to many doctors and nurses at the SMF. In discussing the issue of breastfeeding duration with them, two things became clear. First, there was no lack of institutional interest in increasing rates and duration of breastfeeding among clients of the network; and second, that the health workers I spoke with were firmly convinced that the cause of low breastfeeding rates was a lack of education, intelligence and willingness to listen, coupled with a tendency towards laziness on the part of new mothers. From my interactions with the clients, from the breastfeeding experiences of friends and colleagues, and from the literature presented in Chapter III, I was convinced that this explanation was staggeringly limited, as well as being devastatingly unhelpful to women grappling with the challenges of breastfeeding and the changes of motherhood, for the first time.

Given this contradiction, I wanted to seek a deeper understanding of the reasons that women who had wanted to breastfeed often stopped well before they had intended to. As a biocultural anthropologist, I sought a theory and a method that would allow me to consider many of the social and structural factors investigated in Chapter III, but put the observations into the context of the embodied experiences of my participants. Merleau-

Ponty's *Phenomenology of Perception*, first encountered in a Political Ecology course, offered me a basis for the kind of theory and practice of the embodied subject that I hoped to develop during my doctoral research.

Merleau-Ponty and *Phenomenology of Perception*

Merleau-Ponty set out to elaborate a phenomenology of perception in response to two dominant paradigms, empiricism and intellectualism. For Merleau-Ponty, both empiricism and intellectualism took the scientific view of the world for granted, while failing to see that all understanding of the world, including the scientific mode, is rooted in an embodied, pre-objective experience in/of the world (Merleau-Ponty1981; Matthews 2006). In radio discussions of his work, Merleau-Ponty made it clear that he was *not* denying the usefulness of science as a mode to explore and understand the world, but rather that in *Phenomenology of Perception* he sought to challenge "the dogmatism of science that thinks itself capable of absolute and complete knowledge of the world" (Merleau-Ponty quoted in Matthews 2006) and to return to the embodied knowledge of the subject as the basis of all further theorising about the world.

With reference to the intellectualist tradition, Merleau-Ponty critiqued the notion that the world existed only in the minds of the subject, that it was conjured into being by the thinking subject. The philosophy of Descartes had had a pervasive influence on Western thought, on the understanding of the nature of subjectivity and the connection or interaction between body and mind. To quote Hass, it is:

> "on the basis of Descartes's radical doubt that a host of influential thinkers have come to understand perception as a fundamentally *cognitive* experience, as a species of thought (specifically, a *judgment*), as the 'internal' representation of an 'external' world" (2000: 121).

This “radical scepticism” (Hass 2000), held that the only thing that is knowable for any subject beyond all doubt is that the thinking subject exists. In Descartes’ view the subject is an essence of mind, detached and separable from the biological body to which it is connected (Matthews 2002). The subject was conceived of as standing *outside* the world of experience and imposing meaning on that world (Matthews 2006). For the Cartesian dualist, “our being is not strictly *in* the world at all; the subject of experience…is a conscious mind which is independent of the world of matter, even of the body” (Matthews 2002). With his body as simply an object like other objects in the world, he can then approach the world in an entirely detached or objective way, a sort of “view from nowhere” (Matthews 2006). In challenging Descartes’ famous dictum “I think, therefore I am” Merleau-Ponty outlines the following argument for an intentional consciousness, defined through action in the world:

> “It is not because I think I am that I am certain of my existence: on the contrary the certainty I enjoy concerning my thoughts stems from their genuine existence. My love, hatred, and will are not certain as mere thoughts about loving, hating and willing: on the contrary the whole certainty of these thoughts is owed to that of the acts of love, hatred or will of which I am quite sure because I perform them” (Merleau-Ponty, 1981: 382)

Merleau-Ponty understood human subjectivity to be that of “a ‘body-subject’, an embodied subjectivity for whom tacit, sensory and sentient knowledge is always prior to explicit, conscious knowledge” (Kruks 1998: 68). In using the term “body-subject” Merleau-Ponty collapses the opposition between body and mind that posits them as separate aspects of human existence, and insists on the understanding of human subjectivity as always-already embodied: the “body” and the “subject” are indivisible.

Merleau-Ponty's phenomenological position incorporated some central tenets of the philosophy of Husserl, the founder of transcendental phenomenology, while rejecting or moving beyond others. Husserl perceived the function of phenomenology to be to clarify the concepts of consciousness and perception, which humans use to understand the world around them through various means, including the natural sciences (Matthews 2006). The method of phenomenology was to return to ordinary human experience as the source of science and all other theoretical activities (Matthews 2006). Husserl understood consciousness as "intentional"; that is, always directed towards or referring to some object. In simpler terms, "Consciousness is always the consciousness *of* something" (Matthews 2006: 6). In Husserl's understanding, the subject is engaged with the world as "being in the world" (Fischer 2007; Matthews 2006) such that the "the subjective is not a separate inner world, but is necessarily related to the world we are conscious of" (Matthews 2006:13). The implication of this statement is that once consciousness is understood as intentional, it cannot be thought of as separate from its objects in the world.

In elaborating his philosophy, Merleau-Ponty borrowed the term "being-in-the-world" from the phenomenological tradition of Husserl and Heidegger but rejected the notion of *epoché*, also known as the "phenomenological reduction" (Dreyfus 2000). Husserl used the term *epoché* to describe the method by which the subject could consciously bracket off "mental meaning" from the external world. In essence, Husserl believed all consciousness to be intentional (that is, directed towards a specific object), and, as a corollary, that the world of objects and external forms was constituted solely through the subject's intentional consciousness and activities (Sanders 2008). In other

words, Husserl believed that one can suspend one's existence in the world and attain a detached, objective understanding of that world, by the process of "bracketing" off the world. This process implies an important distinction "between the structure that makes possible the mind's access to objective reality, and that objective reality itself" (Dreyfus 2000:33), seeming to echo the Cartesian model in a way that Merleau-Ponty rejected. Husserl maintained that "an analysis of our subjective access to reality did not require taking a stand as to whether there was an objective reality to which the mind thus gained access" (Dreyfus 2000:33). In contrast, according to Merleau-Ponty to use the term "being-in-the-world" was to imply that the world existed independently of the subject's thoughts about it (Matthews 2006).

Merleau-Ponty rejected the supposed separation of the mind from the world, the subject from the object, and intentional content from intentional object (Dreyfus 2000). By placing a strong emphasis on the embodied nature of human subjectivity he diverged substantially from the earlier use of the term being-in-the-world (Matthew 2006). For Merleau-Ponty being "in-the-world" was inseparable from being a living organism so that *Phenomenology of Perception* presents, in one sense, a materialist approach. At the same time, in contrast to the empiricists, Merleau-Ponty rejected the view of the body as a "physico-chemical object" (Matthews 2006: 88), the nature of whose perceptions could be explained purely with reference to physiological processes of the body. Tracing the complex mechanisms which coordinated the sensory information of sight, sound, touch, and so on, could not reveal the true nature of human perception, being altogether atomistic. Merleau-Ponty felt that perception was to be understood through a Gestalt approach: "The world is an open and indefinite unity in which I have my place"(1981:

354). The *nature* of human perception involves an on-going dialogue with the world, in which perception is not reducible to objective processes occurring in the body and in which the objects that a subject perceives are not perceived as separate, individual items removed from all context, but rather against the background of a perceptual field, in interaction with other objects in that field and with the body-subject itself.

In *Phenomenology of Perceptions* consciousness or subjectivity is engaged with the world. The perceiving subject is not in the world in the same way that pure objects are, since he is able to act on the world as well as being acted upon by it (Matthews, 2006). As Grosz explains, for Merleau-Ponty, "[the body] is the condition and context through which I am able to have a relation to objects" (Grosz 1994: 86). Because of the embodied nature of subjectivity "[c]onsciousness is being-towards-the-thing through the intermediary of the body" (Merleau-Ponty 1981: 138-139), while "[m]y body is…at least in relation to the perceived world, the general instrument of my 'comprehension'" (Merleau-Ponty, 1981: 235). As humans, we are "through and through compounded of relationships with the world" (Merleau-Ponty 1981: xiii). The notion of the body-subject is important to the development of a bio-experiential approach, which I will outline in the final section of this chapter.

Feminist Uses and Critiques of Merleau-Ponty

Since my research focuses on women's experience with breastfeeding, it is important to address feminist responses to Merleau-Ponty's theories of perception and consciousness. Some feminists have charged that the phenomenology of Merleau-Ponty is that of the male body alone, and that "never once in his writings does he make any suggestion that his formulations may have been derived from the valorization and

analysis of the experiences of only one kind of subject" (Grosz 1994: 110). Iris Young echoes these concerns. Young has made productive use of the phenomenology of perception (Young 1990a; Young 1990b; Young 1990c), but challenges Merleau-Ponty's conception of the bodily understanding as developing from intentional action and movement ("not a matter of 'I think that', but of 'I can'" Merleau-Ponty 1981:137) . Young questions the accuracy of this conception for *female* embodiment, asserting that "[f]eminine bodily existence is an *inhibited intentionality*, which simultaneously reaches towards a projected end with an 'I can' and withholds its full bodily commitment to that end in a self-imposed 'I cannot'"(Young 1990c:148).

In Irigaray's reading, the phenomenology of Merleau-Ponty has a problematic tendency towards universalizing and totalizing the experience of an unknowable feminine Other (Irigaray 1993). However, other feminist scholars oppose this reading. Murphy argues that "there is evidence that Merleau-Ponty understood discourse [with another] to be an experience of rupture, non-coincidence, and difference" (A. Murphy 2006: 258) rather than of absorption of difference/otherness into the self. Indeed, Merleau-Ponty states that "[i]n dialogue with another, my own existence changes, is disturbed by difference; the body of another presents me with a question, and calls for a transformation of my being" (Merleau-Ponty 1981:183-84). This does not suggest that in interaction the subject will be able to take over or subsume the Other. Kruks asserts that "[i]n spite of his own sexism, the import of Merleau-Ponty's account of embodied existence is not to obscure or deny differences. Rather, it is to point to the tensions of difference and commonality and to suggest that embodiment offers a site of *potential* communication and affirmative intersubjectivity" (Kruks 2000: 42). For feminists

searching for "webs of connection" between women with very different lives, Merleau-Ponty's theory of the Other (alterity) may actually provide a common ground:

> "The grief, anger, and jubilation of life embodied are highly individuated emotions, informed by a particular corporeal style—a style that is raced, sexed, aged, and marked by the specific manner in which one's body greets the world. The production of meaning is a function of a finite cultural moment and of a highly stylized body that greets this moment" (A. Murphy 2006: 259).

Kruks concludes that "Merleau-Ponty may well be a rich resource for feminists who wish to move beyond the distinctions of sex and gender without, in poststructuralist fashion, reducing all experience to discursivity" (Kruks 2000: 70).

Social Theories of the Body

The body has been the focus of social theory for decades, though that attention has increased in the last 20 years (Csordas 1994). The following section reviews some of the broad trends in social theory of the body that have had an important influence upon work within anthropology.

The Body as a Natural Symbol

One of the earliest theories of the body arose from a symbolic understanding of the body's role in human culture. In *Natural Symbols* (Douglas 1996), one of the best known examples of this approach, Mary Douglas uses the body as "a natural symbol with which to think about nature, society and culture" (Scheper-Hughes & Lock 1987: 7). Douglas' central argument is that human societies use the physical body as a template for understanding social phenomena larger than themselves. While describing the impact of the social body on the treatment of the physical body, Douglas also reveals a highly objectified understanding of the physical body: "the care that is given to it, in grooming, feeding and therapy, the theories about what it needs in the way of sleep and

exercise...draw upon the same culturally processed idea of the body" (Douglas 1996: 69). Fundamentally, Douglas' physical/social "distinction reiterates that [distinction] between mind and body, culture and biology" (Csordas 1994: 5). John O'Neill makes a similar argument about the human tendency towards anthropomorphism (O'Neill 2004). O'Neill (2004) introduces five bodies as themes for analysis: the physical, the social, the body politic, the consumer, and the medical body. Although clearly knowledgeable about the phenomenology of Merleau-Ponty (O'Neill 1970), his elaborations of the five bodies "study the body while still taking embodiment for granted" (Csordas 1994: 6). The symbolic approach to study of the body examines the ways in which the (objectified) bodies of individuals are related to the surrounding world through *metaphor*, rather than through experience.

The Structurally Constrained Body

A structuralist approach to the body views it as shaped, defined and developed by the structures of society which surround it. Pierre Bourdieu, a student of both phenomenology and structuralism, was one of the most important structuralist theorists of the body. Bourdieu's stated aim was to move beyond both the subjective impulse of the phenomenologists and the objective orientation of social scientists such as Lévi-Strauss (Bourdieu 2003; Throop & Murphy 2002). In order to do so, Bourdieu employed and extended Mauss' concept of *habitus*—a subjective but not individual system of internalised structures that influences dispositions of taste and shapes the ways that the individual acts in and reacts to the world (Throop & Murphy 2002). Bourdieu argued that since individuals develop their predilections and inclinations from their surroundings and formative experiences, groups—or more commonly classes—have a united or shared

habitus that inclined them towards certain tastes, preferences, opinions and styles (Bourdieu 2003). According to Bourdieu, the individual carries with herself her past and present position in the social structure, "as a system of internalised cognitive and motivating structures produced by the structures of her particular social environment, in the form of these dispositions, tastes and styles" (Bourdieu 2003: 86). These tastes and dispositions then structure the individual's modes of behaviour. As members of a class have children, these dispositions, tastes and preferences are reproduced by/in those children (Throop and Murphy 2002). Bourdieu therefore argued that the *habitus* is both generative, in that it would continue to be passed on within a class, and structuring, in that the tastes, dispositions and modes of being of the lower classes influence their capacity to access higher status. Bourdieu was particularly critical of the phenomenology of Sartre for failing to recognise that subjectivity is constrained by these "durable dispositions" that arise from structural conditions (Throop and Murphy 2002: 190).

Bourdieu questioned the phenomenologists' notion of "intentional consciousness" with reference to the *habitus.* If, among the individuals within a group or class, the practices, tastes and dispositions of the *habitus* become commonsense or unquestioned, then that "commonsense obviates the intention and intentional transfer into the Other dear to the phenomenologists, by dispensing, for the ordinary occasions of life, with close analysis of the nuances of another's practice" (Bourdieu 2003: 86). However, Throop and Murphy and others have argued that:

> "Bourdieu's vision…provides us with an overly deterministic rendering of human experience and behavior. While Bourdieu's practice theory takes a step away from the objectivist model of social structure, it only nominally deals with subjective experience, which is, according to his view, always mediated by inculcated structures that already reflect the objective structures being perceived" (2002: 198).

It is inaccurate, they argue, to mistake the process of interaction between human subjectivity and the external world as "simple mapping of externalized structures upon a *tabula rasa* mind" (Throop & Murphy 2002: 201). Merleau-Ponty views the world and the consciousness of the embodied subject as mutually constituting (1981), each influencing the other, rather than one dominating the other.

The Post-Structuralist Body

One of the most influential post-structural theorists of the body is undoubtedly Michel Foucault. For Foucault, the body is the site of the exercise of power in modern society (Weedon 2000). The body politic uses techniques of discipline and surveillance to shape the bodies of individuals through discursive practices tied to expert knowledge (Scheper-Hughes & Lock 1987), which are subsequently internalised by the individuals and mobilised in self- and other-discipline.

Although Foucault claims that he takes a "materialist" approach by substituting the body for "subjectivity," his use of the term "the body" has been critiqued as being essentially objectified/objectifying (T. Turner 1994). Foucault's work has a tendency "to ignore the primary character of the body as material activity in favor of an emphasis on the body as a conceptual object of discourse" (Turner, 1994: 28). With regard to the phenomenological understanding of the human body-subject, Turner writes:

> "what Foucault's notion of the body as an essential inert or passive conceptual category excludes is the body in its socially fundamental aspect as material activity, including the entire range of concrete bodily processes and faculties that are directed and effected, with varying degrees of success, within the schemes of acting, perceiving, cognizing and feeling that make up social representations of the body, and which comprise the material content of both moment-to-moment interactions of the embodied actor with the object world and longer-term processes of socialization" (Turner 1994: 44).

As I will argue below, it may be most useful to examine these "bodily processes and functions" in the context of structural forces played out in the body, viewed through a phenomenological, rather than a discursive lens.

The Body and Embodiment in Medical Anthropology

The turn towards analysis of the body and bodies has been particularly important to medical anthropology of the last two decades. A specifically phenomenological approach to the body has been invoked by a number of scholars within the sub-discipline.

The Three Bodies

In "The Mindful Body: A Prolegomenon to Future Work in Medical Anthropology" Nancy Scheper-Hughes and Margaret Lock present a comprehensive overview of the "three bodies" of the phenomenological, symbolic/structuralist and post-structuralist traditions already outlined above and point to the differences in epistemology required to work within each of these paradigms of the body. In their formulation, the first body is the personal body of lived experience. The personal body is endowed with consciousness of mind and body, an internal body image and a sense of "body self-awareness, of mind/body integration, and of being-in-the-world as separate and apart from other human beings" (Scheper-Hughes & Lock 1987: 14). The social body is used to represent relations in the natural, social and spatial world, in essence to humanise "natural" and social phenomena (Scheper-Hughes & Lock 1987). Finally, the body politic is the realm of power acting on the body, through which society reproduces and socialises the kind of bodies that it requires to function. The *surface* of the body is a representative medium on which cultural identity can be expressed and inscribed.

Scheper-Hughes and Lock argue that emotion is the missing link "capable of *bridging* mind and body, individual, society, and body politic" (1987: 29; emphasis added), stating that it is "in human events literally seething with emotion…that mind and body, self and other *become one*. Analyses of these events offer a key to understanding the mindful body, *as well as the self*, social body and body politic" (1987: 29; emphasis added). In these latter statements, the authors appear to express a dualistic understanding of the mind and body, since they argue that the mind, self and body are not *ordinarily* one, but in fact require the "bridge" of emotion in order to come together. This is unexpected, in light of their opening paragraph which states that dualism is a cornerstone of a "biological fallacy" of the body (Scheper-Hughes & Lock 1987: 6).

In *Death Without Weeping* (1992), her acclaimed work on mother love and infant death in Brazil, Scheper-Hughes states that hers will be phenomenologically grounded anthropology, an "antropologia-pé-no-chão" (anthropology with its feet on the ground; Scheper-Hughes, 1992: 4). Scheper-Hughes defines the phenomenological body as "the immediately grasped and intuitively 'true' experience of the body-self" (1992: 136) and later states that "[h]unger and thirst are mindful as well as embodied states" (1992: 231). Here it seems that Scheper-Hughes here does not recognise the lack of distinction between body and subjectivity that is posited in phenomenology. A truly phenomenological perspective "requires that the body as a methodological figure must itself be non-dualistic i.e. not distinct from or in interaction with an opposed principle of mind" (Csordas 1990:8). The body-subject is consciousness embodied: the perception of hunger or thirst is not meant by phenomenologists to be read as some form of "pure"

sensation. Merleau-Ponty argued that such an idea held no meaning when discussing human perceptions of the world.

Aesthetics and Use of the body

Desjarlais uses an embodiment approach to his study of the Yolmo people of Nepal. He argues that "Western ways of reading the body have dominated our accounts of other peoples and other sensibilities, such that a return to the sentient body now seems needed" (Desjarlais 1992: 250). In his reading of embodiment, a person not only has, but *is* a body, and he argues that "the social formations that prevail in Helambu mold the very essence of sensory experience" of that body (Desjarlais 1992: 38). Desjarlais is principally concerned with bodily aesthetics and techniques of the body, and the ways that personhood is conferred through knowledge of how to move the body appropriately in day-to-day and ritualistic interactions. Desjarlais questions the notion of "bodies as texts, emotions as discourses, and healings as symbolic" (Desjarlais 1992: 249) in a context where "women men and children spend much of their time working in fields, collecting firewood, sowing millet, walking, dancing, eating, drinking, hurting, and healing" (Desjarlais 1992: 249).

While I agree with Desjarlais regarding the importance of an anthropology of health rooted in the body-subject, I question his specification that this type of approach is somehow *more* appropriate for his Yolmo informants than for populations in the Western (or Westernised) world. In phenomenological terms, this notion makes little sense: although those of us raised in the Western tradition may be steeped in Cartesian duality as an intellectual approach to the world, this does not in *practice* separate us from the experience of our bodies. *Our* everyday tasks are also the intentional actions of body-

subjects.[7] Indeed Morgan and Conklin have argued that "[w]hile it has been common for anthropologists to acknowledge that ideologies of personhood are "embodied" in many non-Western societies…personhood is equally evident in North American ethnophysiology" (Conklin & Morgan 1996: 686). Desjarlais' characterisation of non-Western cultures as somehow more "experience-near" than Western cultures recapitulates the tropem, common since the earliest days of anthropology, of the anthropological Other as inherently closer to or more in tune with nature.

Disease, Dysfunction, Disability

Pain studies are one of the main expressions of phenomenology in anthropology, perhaps because of the way that the embodied nature of human subjectivity is revealed in moments of disease, distress or dysfunction, what Csordas terms as "a sort of *dys*-appearance, a bodily alienation or absence of a distinct kind" (Csordas 1994:6). Since pain is a reality that is "quintessentially lived and experienced in the body" (Jackson 1994: 201) medical anthropologists who focus on pain use the study of the "dys-appearance" of the body as a rich source of information about the ways that the body generally fades from conscious awareness (Csordas 1994).

Csordas' study of the chronic pain of a young Navajo man named Dan focuses on the ways in which bodily pain is implicated in meaning-making and cultural participation for this young man, while Good uses chronic pain to ask "is pain an essential part of the self, or is it 'merely' a part of the body? Can the pain be separated as object from the self as subject, thus differentiating the subject from the world which acts upon it, or must he

[7] This is not to argue that the *content* of embodied experience is unaffected by local specificities and individual experience; indeed, that is the central premise of a bio-experiential approach. Rather, I argue that the experiencing of the world through direct primary experience with the body-subject is shared among humans.

‘passively endure’ the pain?” (Good 1992). A phenomenological approach has been used in the hope of understanding the frustrations of those who are experiencing a fundamentally altered experience of being-in-the-world as the result of chronic disease or disability (Kaufman 1988).

Jackson uses the experiences of patients at a pain treatment center to engage with the dualities of body/mind and subjective/objective experience in dealing with chronic pain. She argues that although patients at times cling to the Cartesian duality (which is, after all, an important cultural construct and the keystone of most medical treatment), “[c]hronic pain challenges the notion of the body as object and the self as subject. While the subject can be the conscious mind ‘having’ an objective body and an objective pain, it is also true that the subject can combine with pain, becoming the ‘pain-full me’” (Jackson 1994: 207). For Jackson, the patients’ talk about pain reveals these dualisms in the patients’ conceptions of themselves in a way that is productive for the understanding of the body-subject.

A Bio-Experiential Approach

In developing the bio-experiential approach presented in this dissertation, I use Merleau-Ponty’s phenomenology of perception (Merleau-Ponty 1981) as the theoretical basis. Merleau-Ponty’s move away from the objectivist view of the body allows for the development of a powerfully *anthropological* take on biology, in which human experience is experience of both the body and the subject—more precisely, of the “body-subject.” The central concept for this development was that of being-in-the-world, the understanding that human subjectivity is *embodied* subjectivity and irreducibly connected to our biological being (Merleau-Ponty 1981).

Apprehending the world through our senses can be argued to be a human universal. Scheper-Hughes and Lock feel that

> "It would…be difficult to imagine a people completely devoid of some intuitive perception of the independent self. We think it reasonable to assume that all humans are endowed with a self-consciousness of mind and body…and of being-in-the-world as separate and apart from other human beings" (1987: 14).

Among the Wari' of the Amazon, for example, the dominant understanding of existence is collective, but "[h]owever heavily elaborated are notions of the social body, Wari' still recognize that people act and experience relationships from a subjective perspective" (Conklin & Morgan 1996).[8]

When we start from the perspective that human being is being-in-the-world it shapes the way that we decide to investigate questions of biology and health. As reviewed above, phenomenological work in medical anthropology has been about the experience of illness, pain, otherness, dissociation, and/or degeneration of the body-subject. Those who have worked on embodiment have tended to keep the functioning physical body to one side: "[t]hat *level* of bodily working seems to remain forever outside culture, fixed into 'biology'" (Birke 2000: 199). Some scholars have called for attention to "bodies in their concrete specificities" (Grosz 1994) yet with the body thought of "as changing and changeable, as transformable" (Birke 2000:199). Despite current trends in medical anthropology, an experiential focus does not *necessitate* the dismissal of the biological body. Indeed, when taking a phenomenological approach it is appropriate to consider the impact of experiences of stress on the complete body-subject who experiences the world through his or her sensing body.

[8] Both Scheper-Hughes & Lock and Morgan & Conklin are clear that having a sense of individual subjectivity is *not* the same as having social personhood.

The phenomenological approach has seemed most useful because of the notion that the body is in a never-ending dialogue with the world. As Bourdieu says "[o]ur experiences are sedimented into our bodies…this includes our habits, ways of moving through the world, ways of using our bodies" (Bourdieu 2003); the physiological functioning of our bodies is also altered by our experiences (e.g. individuals chronically exposed to stress may have dampened HPA responses to stressors). To borrow O'Neill's phrase "bodies are good to think with" (O'Neill 2004) particularly when "we think of indeterminacy or transformation" (Birke 2000:203). In the last two decades biological anthropologists have dramatically increased their investigations into such modulations of the body, using a host of biological markers of bodily process ("biomarkers"). These tools developed by biological anthropologists have the capacity to destabilise notions of the body as inert, unchanging and pristine, to allow us to see the indeterminacy and continually-transforming nature of the human body.

From a phenomenological perspective, biomarkers can be thought of as bodily traces of experience. Biomarkers are always markers *of* some experience or activity in the body and they are generally used to examine responses differing from baseline functioning of the body. When we look at biomarkers they are an additional measurable marker of the processes going on in the body, and those processes are happening in response to the world experienced by the body-subject. To maintain the focus on the complete body-subject, the bio-experiential approach involves putting together biological markers and ethnographic data. In addition to investigating biological traces, a bio-experiential approach must gather information about the way the body-subject consciously experienced the events in his or her life.

If we wish to take a bio-experiential approach to the study of the effects of a woman's stressful life experience on breastfeeding duration, we must use a method that incorporates the ethnographic, to record women's accounts about experience/events as well as the biomarkers of the physiological response. A combined method enables a better understanding of what is, in fact, one unified experience.

Breastfeeding women, as all other humans, perceive stressors in their environment and react consciously through their actions and choices, as well as unconsciously through their physiological responses. The use of a bio-experiential approach reinstates the sensing, perceiving body-in-the-world as the centre of analysis, and affirms the central place of a woman's experience in the process of breast feeding. It simultaneously acknowledges the connection of that experience and the biological mechanisms that sustain lactation.

Using a bio-experiential approach that locates the individual experience of breastfeeding and all its attendant stressors in a sensible, perceptive and responsive biological body presents one way of bringing biological and cultural modes of examination to bear on breastfeeding. The physical body cannot be seen as static and unchanging, but rather must be viewed in interaction with the experiences of the individual within social structures, and under political forces. Indeed, in its sheer physicality, breastfeeding is a process that lends itself to analysis of the interconnection between body and experience.

A bio-experiential approach asserts the importance of the embodied position of the woman herself in the process of breast feeding, while simultaneously allowing the anthropologist to place the physical body (and all its processes) into relationship with the

stressors that an individual experiences. I hypothesise that interactions between the physical body, day-to-day stressors and breastfeeding cessation can be examined through a focus on the breastfeeding hormone oxytocin, as one biomarker of the impact of stressful life experiences on the body-subject.

In order for a woman to breastfeed successfully, she must produce and maintain adequate levels of oxytocin, the hormone that enables the transference of milk from the breast to the infant (Buhimschi 2004; Sala & Althabe 1968). It has been hypothesised that the release of oxytocin during breastfeeding is suppressed by stress hormones (Lau, 2001). As negative perceptions and experiences are channelled through the body, they are translated into stress hormones (Gunnar & Quevedo 2007). These hormones circulate through the body and cause functional changes, such as a decrease in oxytocin production. Without sufficient oxytocin, the infant cannot empty the breast properly (Dewey 2001), and eventually milk production stops (Lau 2001). A woman's day-to-day stressful experiences, familial, social, economic or political, impinge on the functioning of her body and interfere with her ability to breastfeed successfully. This in turn may cause her to feel incompetent and powerless (J. Riordan 2005), and make her reluctant to continue trying to breastfeed.

Thus, we can see that in breastfeeding a synthesis between biological and cultural variables exists as a concrete reality, as the conditions surrounding an individual are manifest in the condition of the biological body. The utility of a bio-experiential perspective is that it allows us to examine how cultural, familial, political and economic conditions that constrain lactating women might also influence the breastfeeding

experience, potentially resulting in early breastfeeding cessation, even among women who intended to breastfeed.

By providing a bridge between research concerned with the biological mechanisms of breast feeding, and that which focuses on the embodied experience of particular women, a bio-experiential approach offers the possibility of greater synthesis between sub-disciplines of anthropology, and the potential to improve the analytical power of breastfeeding research.

Chapter Summary

A bio-experiential approach to breastfeeding research was outlined in this chapter, building on the phenomenology of perception of Merleau-Ponty. The following chapter, Chapter V, will outline the methodological approach taken in line with this theoretical approach.

CHAPTER V

METHODS

In my fieldwork, I combined qualitative and quantitative methods to obtain as complete a picture as possible of breastfeeding among low income women in São Paulo, Brazil. São Paulo is a global megacity, the fourth most populous in the world, and the most populous in South America. The metropolitan area of São Paulo covers over 248,000 square kilometres (Instituto Brasileiro de Geografia e Estatistica 2002). São Paulo is the industrial centre of Brazil, and most of the large multi-national corporations in Brazil have their headquarters in São Paulo. The city is divided geographically into five main Zones: the Central, Southern, Western, Northern and Eastern Zones (Deák 2001). The Central Zone, where the city was first established in 1554, is in decline, with the majority of multinationals now based in the Southern Zone, and only the large banks still in the Centre. The wealthiest neighbourhoods of the city are found in the Southern Zone. Cost of living in these areas of São Paulo was the highest in South America and the 34th highest in the world in 2006—97% of the New York City standard (Mercer Human Resources Group 2009). The wealth gradient from southern São Paulo to the eastern periphery is roughly matched by a gradient in skin-colour. European descended light-skinned Brazilians, as well as employees of foreign companies are concentrated in the wealthy areas in the south of the city, while individuals of mixed heritage or Afro-Brazilian descent are more likely to live in the outlying regions of the city (Deák 2001).[9]

[9] As in most Brazilian cities there are a few densely packed *favela* areas located in the southern zone in close proximity to some wealthier areas; these serve as sources of hired help for the wealthy.

The Eastern Zone is one of the fastest growing areas of the city, popular among middle and low income residents. Those parts closest to the core of the city are becoming gentrified rapidly and the presence of North American style malls tracks the extent of such development. Government services are also becoming more accessible in parts of the Eastern Zone. However, as the city expands eastwards, new areas are constantly becoming occupied. Migrants to São Paulo generally settle on the fringes of the city, often in areas with little to no infrastructure. People construct their own wood, brick or breezeblock houses. The federal government has established programs to legalise impromptu settlements known as invasions, thus giving the inhabitants access to water, electricity and sewers, but population increase tends to outpace improvements in infrastructure (Torres, Alves, & de Oliveira). Settlements that were established in the late 1980s have yet to see paved roads, proper sewage and garbage disposal services (personal observation).

The research conducted for this dissertation took place in the easternmost periphery of the Eastern Zone. This part of the city lies beyond the end of the Metrô line at Corinthians-Itaquera, between 8 and 12 km from the last station on the subway line. Small, privately owned van/buses (*lotaçoes)* and larger municipal buses serve as the principal mode of transport for the population of these areas, though there are a few widely-spaced stops on the urban commuter train line in this area. Most residents rely on the *lotaçoes* as they are less expensive to ride than the train or Metrô. The six neighbourhoods in which the research was conducted were concentrated in two sub-prefectures of the municipality of São Paulo, Itaim Paulista and Guaianases.

While income disparity is clearly visible across the city of São Paulo (Deak, 2001), within the periphery it is hard to disentangle working class and *favela* (slum) areas, as these tend to blend into one another. Day-to-day stress in these neighbourhoods is significant, with many people earning only a marginal living. The structure of employment in Brazil has changed markedly since the late 1980s, with increasing informal sector work and self-employment (Amadeo & Pero 2000). Involvement in informal labour is associated with poor health indicators in Brazil (Giatti et al, 2008). The Infant Mortality Rates (per 1000 live births) for the sub-prefectures of Itaim Paulista and Guianases were 14.2 and 18.8 per 1000, respectively, whereas the wealthy prefectures to the south had IMRs around 7 or 8 per 1000 (City of Sao Paulo 2002). Homicide is the number one cause of death for males in São Paulo—15% of male deaths in 2001 were from homicide (City of Sao Paulo 2002), but these sub-prefectures have homicide rates even higher than the average. Organised crime and police violence are also common in this part of the city (Peres, Cardia, Mesquita Neto, Santos, & Adorno 2008). Many of the violent attacks on Military Police and the transportation system by the "First Command of the Capital" gang in May and July 2006 took place within the research area. In some cases, these attacks resulted in clinics being closed or clinic staff being told not to leave the clinic to do home visits. One of the few infrastructural advantages present in these prefectures is a coherent network of public family health clinics run by the Santa Marcelina Philanthropic Foundation.

Health Services in the Eastern Zone

The Brazilian constitution of 1988 established the right to universal access to health care for all citizens (Elias & Cohn 2003). The vast majority of residents of the

Eastern Zone rely on government-provided health care, with a small minority having access through their employer to some form of private health care services. The state government of São Paulo has created public-private partnerships with various private medical and philanthropic organisations to provide free care to those who need it (Toma & Monteiro 2001).

Established in 1996, the Santa Marcelina Foundation (SMF) is one such private partner. The SMF provides free care to inhabitants of the Eastern Zone through a network of 58 *unidades básicas de saúde* (UBS-Basic Health Units) and 3 tertiary level hospitals. As of April 2006 183,983 families were registered with the network, for a total of 708,627 individuals (Santa Marcelina Family Health Program 2005). As of April 2006, all of the clinics in the Santa Marcelina network were *programa de saúde de familia* (PSF-Family Health Program) clinics. Clinics operating on this basis attempt to engage with the community, to treat health problems at the level of the family and community, rather than only between patient and doctor. Individuals are enrolled and tracked as part of a "family" household unit.

Clinic staff are organised into teams and assigned to a particular area. Each team is composed of five or six community health workers (ACS-*agentes communitário de saúde*), two nursing auxiliaries, one doctor and one nurse. The ACS are the key to the functioning of this system and are required to reside in the area for which her team is responsible. The ACS is responsible for a "micro-area" of a few streets within the area, purportedly covering 150 families. In practice, due to extremely high population density, ACS will often end up responsible for between 150 and 210 families (personal observation). Initially, the ACS were almost entirely recruited from older female

community leaders, who acted as liaisons between the clinic staff and the local people, but younger ACS who see the position as the first step toward upward mobility are now the norm. Approximately 600 births occur in this network each month (Santa Marcelina, 2000) which made the SMF an ideal institution to cooperate with to complete research with pregnant and breastfeeding women. Field research took place between January 2006 and January 2007 through six PSF clinics in the SMF.

Recruitment

The criteria for inclusion in the study were as follows. All women were required to be of reproductive age, between 15 and 45 years old, and to be intending to breastfeed for at least 12 weeks. Only women who had never given birth (and therefore never breastfed) were recruited to participate, since evidence suggests that the experience of breastfeeding and decision-making about breastfeeding (Davanzo, Starbird, & Leibowitz 1990; Nagy, Orvos, Pal, Kovacs, & Loveland 2001) can vary with parity. Women who had previous pregnancies that ended in miscarriage or abortion were included in the sample. Women of all ethnic backgrounds and financial situations in the six neighbourhoods were included in the sample. Since the study areas have very high concentration of migrants, it was not unexpected that 15% of participants were born elsewhere than São Paulo, and 83% had one parent and at least 59% had both parents who were born elsewhere (some women did not know the birthplace of their father).

Given issues of power differentials due to race, nationality and class, I was concerned about possible coercive effects if I directly approached participants for recruitment in the health clinics. Initially, recruitment flyers were posted in visible locations in all the clinics, but these failed to elicit a response. Subsequently, the ACS at

each clinic were enlisted to help with recruitment. I described the basics of the study to the ACS working in the six clinics and they in turn mentioned it to those clients within their micro-areas who fit the recruitment criteria.

If a client expressed interest in participation, the ACS then scheduled a time for me to meet with her. At that time I described the research in detail to the client, including an explanation of the purpose of the study, and the biological and ethnographic data to be collected at each interview. Clients were informed that their participation was completely voluntary and that during any interview they had the right to refuse to answer any question that made them uncomfortable and/or refuse to provide biological samples, without affecting their participation in the study as a whole. The women were also informed that they could cease to participate in the study at any time, without repercussions or compromising their current medical care. Women who were still interested in participating were asked to give written confirmation of their consent to participate. Very few women who met with me to discuss the study opted not to participate; however, many women who the ACS scheduled to meet with me never showed up for the appointment. This likely reflects a difference of opinion between the ACS and the woman about whether she was "interested" in participating.

Participants were recruited at various points of pregnancy. Most were in their late-second or third trimester of pregnancy. Although statistics from the network suggested that 80% of women initiated pre-natal visits in the first month (Santa Marcelina Family Health Program 2005), many of the younger women who had become pregnant unintentionally stated in later interviews that they did not discover/ acknowledge/confirm that they were pregnant until they were in the second trimester.

While all participants were asked for their informed consent at the beginning of their participation, consent for biological data collection was obtained on an on-going basis. At each interview participants were asked whether they were still willing to provide biological samples and anthropometrics. If a participant chose not to provide any of the above data, the interview continued as normal, but leaving out that aspect of the data. Refusal to provide data was never grounds for termination of either a particular interview or participation in the study as a whole. Only the participant could decide to terminate her participation. All data collected during the study has been kept confidential. All biological samples were marked only with a randomly generated identifying number. Records matching individuals to identifiers and pseudonyms are stored securely, separate from all other research data. All data are stored in a password protected computer or a locked filing cabinet.

Compensation

Each woman who participated in the research was offered a cash remuneration of R$80 (~$40USD) for completion of the study. Half of the remuneration, or R$40 was given during the first post-partum interview. Participants who completed all 7 interviews received the second half of the remuneration during the final interview. At the time that the research began, the monthly minimum wage in Brazil was $83USD.

Ethics Approval Process

Human subjects approval was obtained from the University of Massachusetts Amherst Institutional Review Board, as well as the Ethics Review Board for the Santa Marcelina Philanthropic Foundation. In accordance with Brazilian national regulations,

the research protocol was also approved by the National Committee on Research Ethics (CoNEP).

Ethnographic Component: Instruments/Procedures/Data Analysis

For the ethnographic portion of the data collection the goal was to conduct seven one-hour in-depth interviews with each participant. The first interview with each participant took place during the final trimester of pregnancy, in a private area in the nearest Family Health Clinic to her home. The pre-partum interview collected basic demographic information (age, education level, previous knowledge about breastfeeding, relationship status, living situation, intended duration of breastfeeding, socio-economic status, reproductive history etc), in addition to asking open-ended questions about the participant's expectations, intentions and perceptions regarding breastfeeding. Beginning at 2 weeks post-partum, interviews took place every 2 weeks until the baby reached 12 weeks of age, with the aim of conducting 6 post-partum interviews with each woman. This methodology was employed to monitor the changing stressors and perceptions of breastfeeding women through the first 12 weeks.

In order to minimise the burden of participating in the study, and to minimise loss to follow-up, all of the post-partum interviews were conducted in the participant's home, rather than in the health post. An ACS accompanied me to the participant's house on the day of the first post-partum interview, but did not stay during the interview. Participants were contacted prior to each interview to confirm that they were still willing to participate, and to ensure that interview times were convenient.

During the first post-partum interview, information about place and type of delivery, infant's birth weight and length was collected. Probing questions explored the

participant's perception of breastfeeding, her relationship to her body in the act of breastfeeding, the feelings of others (family/male partner etc.) about her breastfeeding, the perception of her social position and ways in which it affected her ability/willingness to breastfeed, her economic constraints and social support network. The themes explored during the interviews were designed to gather information about the experiences of racism, sexism, and other structural inequalities in women's lives in general and as they play into the breastfeeding experience. Permission was granted by all participants to record the interviews using a digital voice recorder (RCA RP5016 Voice Recorder)

Biological Data: Instruments/Procedures/Analysis

The procedures, instruments and analysis techniques used to collect the biological data for this study are presented in the following section.

Biological Stress Data

Epstein-Barr Virus Antibody (EBV-ab) level has been shown to increase with increasing levels of psychosocial stress (Glaser, Pearson, Jones, et al. 1991; Glaser, Friedman, Smyth, et al. 1999; Marketon & Glaser 2008; Yang & Glaser 2002), and so was chosen as a biological proxy for life stress. Blood spot samples were collected for EBV-ab analysis. In the context of anthropological field work, dried blood spot samples have several advantages over whole blood samples. Firstly, the collection of the sample does not require a trained phlebotomist and is far less invasive for the participant. Secondly, dried blood samples do not degrade as easily as whole blood and are much easier to transport. EBV antibodies from dried blood spot samples have been demonstrated to be stable for up to 8 weeks at ambient temperature (~22 degrees Celsius) and, when frozen, show no signs of degradation when tested after 2 years (McDade,

Stallings, Angold, et al. 2000). The antibodies are also resistant for up to 6 freeze/thaw cycles, so that the chance of a sample being damaged or destroyed by temperature fluctuations (e.g. during transport) is minimal.

Before collection of the sample, the participant's finger was cleaned with an alcohol swab, and then pierced with a single-use self-retracting lancet (Vaccutainer). Blood samples were collected on protein saver card, a type of specialised filter paper designed for blood collection (#903, Schleicher and Schuell, Keene NH). The paper ensures that the blood components spread out on the paper evenly from the point where the blood first contacted the paper; therefore, the concentration of EBV antibodies will be even throughout the blood spot. Four drops of blood were collected from each participant during each collection, each onto a separate collection circle on the protein saver card. The sample cards were placed in a cool shaded area and were allowed to air dry overnight. They were then placed in a Ziploc bag to protect them from moisture, and stored in the freezer. At the end of the research period, blood spot cards were shipped to the U.S. on dry ice and transported to Dr. T McDade at the Laboratory for Human Biology Research (LHBR), at Northwestern University, Evanston IL by plane.

A total of 348 dried-blood spot samples were obtained during the course of research. Circumstances prevented the collection of blood-spot samples on some occasions. Additionally, two women declined to provide blood spot samples (one for religious reasons and one because she disliked having her finger pricked). One other participant's blood flow was such that insufficient samples were obtained at collection.

In May 2008, I traveled to the LHBR at Northwestern University to train in the Enzyme Linked Immunosorbent Assay (ELISA) protocol for measuring antibodies to

EBV in dried blood-spots, as developed by McDade (McDade, Stallings, Angold, et al. 2000). I conducted the analysis of all blood spots for EBV-ab. The ELISA was conducted using kits produced by DiaSorin Inc. (Ref #:P001606A- Kit for the measurement of IgG Antibodies to EBV viral Capsid Antigen). These kits contained sample plates pre-coated with viral capsid antigen for use in a competitive binding "sandwich" assay technique. In the lab, samples were prepared from the dried blood spots by punching out one 5-mm disk from the perimeter of each spot, placing each disk in a test tube containing 250µL of assay buffer solution and soaking the disks overnight. Blood spots that were too small to provide an adequate sample were discarded.

Aliquots (100µL) of each sample were then transferred by pipet to two wells in the pre-coated plates; duplication of sampling was done for quality control purposes. Aliquots were taken using a reverse pipetting technique for greater accuracy. Plates containing samples were incubated for 45 min at 38 degrees Celsius, to allow EBV antibodies present in the aliquoted samples to bind to the antigenic coating on the plate. Following the incubation period, plates were washed in assay buffer five times, using an automated plate washer. A tracer liquid solution containing horseradish peroxidase (HRP)-marked antigen was then added to the aliquots in each well and allowed to incubate. Plates were washed another five times to remove excess antigen. This resulted in the antibodies from the blood samples that had bound to the plate being "sandwiched" between two layers of antigen (hence the term "sandwich" assay).

Finally, a colour-producing agent designed to react with the HRP-marked antigen was added to each well, allowed to incubate and then a "stop" solution was added which terminated the colour-producing reaction. The intensity of the colour produced in each

well following incubation and “stopping” indicated the amount of antibody/antigen complex present (Figure 5.1). The wells with little antibody/antigen complex present showed a lighter colour, those with more antibody/antigen complex showed a darker colour. The wavelength of the colour in each well was measured using the BioTek EL808 plate reader, which was then fed into computer software (KC Junior). This software used the colour intensity of the wells containing the calibrators to produce a curve from which the precise amount of antibody/antigen complex could be calculated from the colour wavelength produced by each well.

Three quality controls were used for each plate. These known-value concentrations of antibody enabled the researcher to determine whether the values calculated for the samples were reliable. In addition, the values for each of the duplicate aliquots were averaged to provide a more reliable estimate of the amount of antibody in the overall sample. Theoretically, two aliquots of the same sample should give values very similar to one another, since they are being taken from the same sample at the same time. The Coefficient of Variation (CV) of the values produced by each of the two duplicates was calculated to quantify the similarity of the two aliquots. The CV is calculated by taking the average of the values from each aliquot, and dividing by the standard deviation of the two values. For the EBV-ab assay protocol, CVs over 10% indicated inaccuracy in assay technique (e.g. pipetting error, reagent splash etc.), and unreliability of the value obtained. Out of 348 samples only 12 (3%) duplicate pairs had CVs over 10%. Those samples were rerun in order to obtain reliable results, except in cases where insufficient blood spot sample remained to rerun the assy.

C-reactive protein (CRP) assays were also conducted on each of the blood spots, as a control to determine whether the participant had been fighting an infection at the time that the blood spot was collected. EBV-ab is an indicator of immune response in an individual, and has been tested to show that it functions as a proxy of that individual's stress level. However, if the participant is fighting off an infection at the time of the blood collection, the EBV-ab value reflects the immune response to illness, and is no longer valid as a measure of stress (McDade, Stallings, Angold, et al. 2000). Based on cut-off values obtained by McDade's and colleagues 2004 comparison of CRP values in plasma versus blood spots (McDade, Burhop, & Dohnal 2004), blood spot samples with values above 9.2 were considered to indicate that the participant had been experiencing active infection. Accordingly, the corresponding EBV-ab values were excluded from the statistical analyses. Only 3 EBV-ab values had to be excluded due to active infection (CRP value > 9.2). The final number of valid EBV-ab values was 312. The results of the analyses of EBV-ab levels and CRP is presented in Chapter VI.

Hormonal Data

At each of the six post-partum interview points (2, 4, 6, 8, 10 and 12 weeks post-partum) a breastmilk sample was collected from each participant for determination of oxytocin (OT) levels (Takeda, Kuwabara, & Mizuno 1986). In response to auditory, tactile and situational cues oxytocin levels rise to a peak stimulated level immediately prior to and during breast feeding bouts (McNeilly, Robinson, Houston, et al. 1983). In this study, breastmilk was superior to other bodily fluids for measuring oxytocin level because it better reflects stimulated oxytocin level. It is a woman's stimulated, rather than basal, oxytocin level that enables milk let-down. OT is measurable in urine (Amico,

Ulbrecht, & Robinson 1987; Polito III, Goldstein, Sanchez, Cool, & Morris 2006) but logistically the chance of missing the peak stimulated level of OT is greater with urine, since the participant would have to suspend her other activities to go and collect the sample soon after the nursing bout. Salivary samples have been examined as a means of determining OT level, but give unreliable results (Horvat-Gordon, Granger, Schwartz, Nelson, & Kivlighan 2005). Using dried blood spots for oxytocin analysis has become impracticable in terms of laboratory procedure, due to procedural changes to the assay made in March 2006 (Assay Designs: http://www.assaydesigns.com). For the above reasons, and given the stability of oxytocin in breastmilk, the simplest means to capture peak stimulated OT levels was to have participants collect a sample of breastmilk during or immediately following a breastfeeding bout. Unlike the collection of a urine sample, collection of breastmilk was fairly easy to combine with breastfeeding. Some women reported that while they were breastfeeding the infant on one breast they could collect the milk that was leaking from the other.

The research protocol called for one breastmilk sample to be collected by each participant at each of the six post-partum interviews in order to track her oxytocin (OT) level over time. This would have yielded 378 breastmilk samples. Several issues arose in the collection of samples. First, some women ceased to breastfeed during the course of the study. Since the protocol required that women collect breastmilk while nursing in order to capture the stimulated level of OT, participants who ceased to breastfeed did not provide breastmilk samples. Second, some interviews were missed, either because the participant was not home or because circumstances prevented me from getting to a

participant to conduct the interview.[10] Some of these interviews were rescheduled, but many were not, leading to missing data points.

At the end of each interview participants were provided with a 100mL plastic test tube labelled with the date of the following interview and asked to express a breastmilk sample on that day, during a day-time (8am-6pm) breastfeeding bout. It was important for collection times to be between 8am and 6pm to avoid registering the nocturnal increase in oxytocin level, which occurs on a circadian rhythm (Forsling 2000). Participants were asked to fill the test tube about half way to ensure a sufficient sample, as the fat, protein and carbohydrate fractions of the milk had to be removed before the OT assay could be run. No special preparation of the breast was required prior to sample collection. To avoid degradation of OT in the milk samples, participants were asked to refrigerate samples after collection until the time of the interview. One participant did not have access to a refrigerator to store the sample, so she collected the sample during the course of the interview, rather than beforehand. The samples were then transported in an ice water bath in an insulated container and stored frozen. Takeda and colleagues (Takeda, Kuwabara, & Mizuno, et al. 1986) have demonstrated that oxytocin is stable in human breastmilk when incubated for 2 hours at 37 degrees C. Following completion of the research, breastmilk samples were shipped on dry ice by courier from São Paulo to the Center for Human and Primate Reproductive Ecology (CHaPRE), at Yale University, New Haven, CT. A total of 300 breastmilk samples were obtained from participants over the course of the research period.

[10] These circumstances included flooding of routes needed to get to clinics, as well as clinic closures due to World Cup football games in June and July 2006 and due to death threats issued to clinic staff during anti-Police violence in May and August 2006.

Oxytocin ELISAs were conducted by the director of the CHaPRE lab and by an undergraduate laboratory technician from the lab, using kits produced by Assay Designs Inc (Ref #: 900-153 Oxytocin enzyme immunoassay kit). This assay used a competitive-binding sandwich ELISA protocol similar to that described above for EBV-ab from blood spots except that breastmilk samples first had to be clarified of fat and protein fractions. OT values are expressed in pg/mL units.[11]

The OT values obtained from some samples had to be discarded. As described above, in performing a ELISA assay, each sample is split into two aliquots that are placed next to each other on the sample plate and their values are compared to one another in order to make sure that the level of OT obtained from the aliquots reflects the level of OT present in the sample. The two values are compared using the coefficient of variation (CV). For a complex assay protocol involving breastmilk, a CV of 30% is acceptable (R. Bribiescas, pers. com). Of the breastmilk samples, 129 out of 300 (43%) had a CV above 30% and therefore were excluded from analysis. Once the data from the 129 unreliable samples were removed, a total of 171 samples with reliable OT values (those with a CV below 30%) remained in the OT data set (57% of the original number of samples). The results obtained from analyses of these 171 samples are presented in Chapter VI.

Anthropometric Data

Maternal height was recorded at the first post-partum interview. The participant's weight was measured at each post-partum interview, using a digital scale accurate to 100 grams, in order to track changes in weight and BMI. Body fat percentage and hydration percentage were measured by the same scale (Tanita, UM080W), through

[11] Picograms/millilitre

electrical conductance. Infant weight and length were recorded using a paediatric scale accurate to 5 grams (SECA model 334) and a measuring tape at each interview.

Psychometric Data: Instruments/Procedures/Data Analysis

The Edinburgh Post-Natal Depression scale (Cox, Holden, & Sagovsky, et al. 1987), validated for use in Brazil by Da Silva and colleagues (Da-Silva, Moraes-Santos, Carvalho, Martins, & Teixeira 1998), was administered during the first and last post-partum interviews. The scale is designed to assess the likelihood that a woman is suffering from post-partum depression. Respondents are asked to think over the previous one-week period in answering the questions. The 10-question scale has a high value of 30 points, and a score of 13 or higher indicates a likelihood that the woman is suffering from post-partum depression. The widely-used Cohen self-reported stress scale was also administered to participants. This scale was validated for use in Brazil by Luft and colleagues (Luft, Sanches, Mazo, & Andrade 2007). The scale evaluates "how unpredictable, uncontrollable, and overloaded respondents find their lives" (Cohen, Kamarck, & Mermelstein, et al. 1983). Respondents are asked to think back over the previous month to answer the questions. All scales were administered orally.

Besides the scales mentioned above, an 8-question composite life-stress assessment was developed based on the main concerns expressed by a pilot group of women from the same neighbourhoods who were also dealing with breastfeeding for the first time and echoed by the first five participants, during the first post-partum interview. This scale was then used with participants during subsequent interviews. The scale consisted of a set of rankings on a scale with a low of one and a high of five for eight different aspects of life: happiness at home, relationship with partner/father of child,

relationship with family, self-esteem, capacity to cope with domestic duties, personal well-being, financial situation and amount of sleep. Even for those women who classified themselves as single, relationship with the father of the child was a relevant stressor since even if the romantic relationship had ended the father had the potential to increase or lessen stress in the participant's life. Brazilians generally maintain very close ties with family members, giving Relationship with Family more salience than it might have in some other contexts. Each aspect was scored on a Likert scale from one to five. A response of five for a particular aspect of life indicated a positive experience of that aspect, while a response of one indicated a negative experience. The mean of each participant's responses over the 12 weeks was calculated, to provide an Average Composite score for that participant. Possible scores on the Composite scale of 8 questions ranged from five to 40 points.

Participants were also asked to rate their experience of stress since the previous interview on a simple 1-10 scale, with 1 representing very little stress and 10 representing a great deal of stress (10-pt scale hereafter).

Bio-Behavioural Data: Instruments/Procedures/Data Analysis

As part of interviews, women were asked a variety of questions in order to determine their breastfeeding behaviour at the time of the interview. Women were asked: whether they were still breastfeeding; if so, how many times per day and for how long; how long breastfeeding bouts lasted; whether they were also breastfeeding at night; and whether the infant was ingesting anything other than breastmilk. The purpose of these questions was to determine whether the participant was breastfeeding exclusively, partially, on a token basis, or had weaned the infant. When a participant reported weaning

the infant she was asked to specify the date. The short (2 week) period between interviews meant that women could generally remember the final day on which they had breastfed.

Observational Data

Observational data from the medical system and the wider community were an important source of information about the role and status of breastfeeding beyond the demographic of the research participants. I attended pregnancy and breastfeeding group meetings held in many of the clinics in the Santa Marcelina network. These meetings were variously run by doctors, nurses and community health workers and provided information about the dynamics between these health professionals and community members/clients. SMF also held a conference devoted to breastfeeding at the Santa Marcelina Faculty in January 2007.

In addition to these formal sessions, I spent a great deal of time talking with staff at the health clinics (doctors, nurses, and community health agents), in the course of months in the field. Regular visits to the neighbourhoods where my participants lived, and living in a similar neighbourhood in the same region of the city, enabled me to observe the marketing of breastmilk substitutes and baby-related items in supermarkets and pharmacies.

Further information was obtained from pamphlets and other written material that pregnant and breastfeeding women would have had access to, which was provided by the PSF and national council on breastfeeding at pregnancy and breastfeeding groups. Figures 5.2 and 5.3 are two of the displays that were put up in clinics during the annual "International Breastfeeding Week" in the clinics.

Statistical Software, Procedures and Analysis

The Statistical Package for the Social Sciences (SPSS version 16.0 for Windows) was used for the majority of the statistical analyses conducted. Since normality is an important assumption of many of the statistical tests presented in Chapter VI, the normality of continuous variables was assessed using skewness and kurtosis statistics[12] as well as P-P plots. The skewed nature of the distributions of OT values at all time periods can be seen in Figures 5.4-5.9. In order to obtain a more normal distribution for analytical purposes, the data were transformed using the base-10 logarithm. Comparing the untransformed distribution of OT at 8 weeks post-partum (Figure 5.10) to the log-transformed distribution of OT values at 8 weeks post-partum (Figure 5.11) illustrates the normalisation of the distribution.

Cross-tabulation

Cross-tabulation was employed to examine group differences for categorical variables. The χ^2 test and Fisher's exact test were used to determine whether there were significant differences between outcome groups. Chi-square was used when cells in the cross-tabulation had expected values greater than 5. Fisher's exact test was employed when cross-tabulation showed expected cell values lower than 5 for more than 20% of the cells. A χ^2 probability of .05 or less was considered significant.

Analysis of Variance

Analysis of Variance (ANOVA) was used to test for differences between the three outcome groups (exclusive/predominant, partial and token/weaned) for continuous variables (e.g. Age, Monthly Income). Post-hoc tests were included in the ANOVA to

[12] Skewness measures the symmetry of a distribution around its mean. Kurtosis measures the "peakedness" or wideness of a distribution.

test for differences between sub-groups. The homogeneity of variances of the three groups was tested first, in order to determine which post-hoc test for between group variance would be appropriate. Fisher's Least Significant Difference test was used when the Levene statistic for the homogeneity of variances showed that the variances of the groups were similar ($p>.05$). When the variances were significantly different from one another ($p<.05$) Dunnett's T3 test was used. Dunnett's T3 assumes unequal variances between groups.

Hierarchical Linear Models

Since SPSS does not have the capacity to create multi-level models, the software called HLM (version 6.36a) was used for hierarchical linear modelling (HLM). HLM is used when effects on the variation seen in a particular continuous outcome measure, such as OT level, are likely to be due to effects operating at two or more different levels. In the case of the repeated measures of OT through the 12 weeks post-partum, all OT values for each participant were first nested by participant (Level 1).[13] Then, participants were nested based on some characteristic–for example, Planned vs. Unplanned pregnancy (Level 2). When the model is run, the HLM test parses out the portion of the variance in OT levels that arises from Level 1 differences (in this example, due to individual participants) and the portion of the variance that is due to Level 2 differences (in this example, differences due to Planned or Unplanned Pregnancy status). If no significant variability was found within participants, the analysis ended there, since there was no variance to apportion between individual (Level 1) and group (Level 2) effects.

[13] It is important to nest by individual when data consists of repeated measures taken from a single individual since high correlations of within-individual scores at each time point are likely. This correlation is controlled for by nesting by individual.

Multivariate Analyses

The outcome variable of interest for Hypothesis 4 was categorical (exclusive/predominant, partial and token/weaned), so logistic regression was chosen to identify factors associated with the outcomes. Logistic regression allows for the construction of models to predict categorical dependent variables. Both categorical and continuous variables can be entered into logistic models as predictors of the dependent variable (in this case breastfeeding outcome). Since breastfeeding outcome at 12 weeks had three possible outcomes, first multinomial logistic regression (MLR) was used to investigate the impact of the various factors that showed significance in bivariate analyses. MLR creates a predictive model for categorical variables with more than two possible outcomes. In order to choose between various models, the goodness of fit of the model is monitored. Pseudo R^2 are used to determine how well a statistical model fits the variability seen in the data. The three pseudo R^2 tests used in MLR are Cox-Snell, Nagelkerke, and McFadden. In addition, a classification chart that indicates the probability that individuals will be accurately classified based on the predictors is compiled for each model. Based on these criteria, the best MLR model is identified. If the R^2 value or overall classification accuracy decreased after the addition of a particular predictor, that predictor was eliminated before the subsequent variable was added to the model.

Due to the sample size, and the number of predictors that were found to be significantly predictive of outcome in the MLR, the outcome variable was dichotomised. To move from three categories to two, the exclusive and partial groups were merged, while the weaned category remained separate. This choice was made on the basis of

bivariate and MLR results that showed very few significant differences between the exclusive and partial groups. The resulting variable had two outcomes: Breastfed and Weaned. Once the outcome measure had been dichotomised, it was possible to use Binary Logistic Regression (BLR), which for this sample size offered greater power. Like MLR, BLR allows for the construction of models to predict categorical dependent variables, but only for outcomes that are dichotomous.

Cox regression analysis was the final form of logistic regression used for multivariate analyses. Cox regression allows for the construction of a model of factors that predict the attrition of individuals from a particular behaviour (i.e. from breastfeeding to weaning). Cox regression provides useful information because the factors that are significantly predictive of a behavioural *outcome* may not be significantly predictive of the *duration* of that behaviour.

Chapter Summary

This chapter laid out the methodology used in this bio-experiential study of breastfeeding in the Eastern Zone. Chapter VI will present results of the quantitative analyses, followed by discussion of these results in Chapter VII.

CHAPTER VI

RESULTS OF STATISTICAL AND BIOLOGICAL ANALYSES

This chapter presents quantitative analysis of biological, psychometric and categorical data. Ethnographic data adds depth to the statistical analysis. The structure of the chapter is as follows. First, overall characteristics of the participants are presented, then certain differences between the three breastfeeding outcome groups (Exclusive, Partial and Weaned) are presented. Each of the main hypotheses that were presented in Chapter I are tested statistically. All Tables and Figures are collected at the end of the text.

Participants were recruited in 6 family health care units. Ten clinics were visited initially, but logistical problems prevented research in four of these (e.g. the roads into and through one clinic area were impassable during the rainy season; gang presence meant that a community health worker would have had to accompany me at all times). The number of participants recruited from each unit ranged from 4 (6.2%) to 19 (29.2%) (Table 6.1). All participants were primiparas. One participant (Sara, 34) had three children who she had adopted as infants, but she had never lactated or attempted to breastfeed. Some participants had experienced miscarriage, abortion or stillbirth.

Participant Characteristics

A wide variety of demographic, structural and social data about the participants' lives was collected from women during the first and subsequent interviews. These data are presented below, and are used in the bivariate and multivariate analyses used to test the four central hypotheses.

Age

The mean age of women in the sample was 22.2 years (± 5.45), with a range of 15 to 38 years. In terms of the "ideal" age for motherhood in Brazilian society (Goldani 1999), 50.8% of women fell into the category of ideal age, while 49.2% fell outside the ideal age range (younger than 18, older than 30 years). More so than age, the importance of family structure and stability for determining the appropriate age to have a first child was expressed across all outcome groups:

> "When the woman has a *consciencia*, a stable financial situation, not just when…how can I say it…when she has a boyfriend on the corner and she thinks that he likes/loves [*gosta de*] her" (Selina, 21)[14]

> "When you have a familial structure. You need that a lot" (Anelis, 19)

> "I, for example, wanted to finish my university, have some stability, a very stable life….with my own house" (Kelly, 23)

> "When you have a house, a good job, stability in your life" (Dagmar, 18)

Birthplace

All participants were born either in São Paulo (84.1%) or the Northeast (15.9%). Birthplace information was not available for 8 of the participants' fathers and 4 of their mothers. Of fathers with known birthplaces 82.5% were immigrants to São Paulo; of mothers with known birthplaces 68.9% were immigrants to São Paulo. The majority of fathers (56.1%) and of mothers (54.1%) were born in the impoverished northeastern states of Brazil.[15] Only 14.8% of participants had two parents who were born in São Paulo, while 26.2% had one parent born elsewhere and 59% had two parents born elsewhere.

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[14] All names given for participants are pseudonyms.
[15] Alagoas, Bahia, Ceará, Maranhão, Paraíba,Pernambuco, Piauí, Rio Grande do Norte and Sergipe

Education

Since six younger participants (9.2% of the total sample) were enrolled in government funded high school at the time of the study, numbers given here will reflect the educational status of those who reported being finished with government funded education. Of those participants, 52.5% had completed all three years of high-school, 22% had completed one or two years of high-school, 8.5% had completed elementary school and 8.5% had completed only some years of elementary school. Four (6.8%) were enrolled in post-secondary studies during the research period and one participant (1.7%) had successfully completed post-secondary education as a teacher.

Employment

Twenty (30.8%) of the participants were working at the time of the birth. Of these, 17 (85%) had formal employment, through which they were entitled to maternity leave benefits. Federally mandated maternity leave in Brazil provides 100% salary for a four-month period and protection against dismissal for one month after the return to work. These benefits apply only to employees who are officially registered by the company as employees (paying social security taxes for the employee). Of the three women who did not receive official maternity benefits, two were self-employed and one had an agreement with her employer that provided her with some benefits even though she was not officially registered.

Work was mentioned often by women in the Exclusive group as incompatible with breastfeeding or at the least as a substantial obstacle to be overcome. When asked what factors might interfere with breastfeeding one woman responded

> "My work né? My maternity leave is four months, then there are two months of breastfeeding allowance…I think it's kind of difficult [to

> combine working and breastfeeding]. Most of the time you'll be working when your child needs you. I work nine hours a day, twenty minutes from home " (Maria Elena, 22)

Another participant stated that "If you have to work and leave the baby. That might stop you if you have to go all the time" (Corinna, 20). It was not uncommon for women who had been breastfeeding exclusively throughout the research period (first 12 weeks) to state that the infant would have to be introduced to non-breastmilk foods before the return to work (generally at 16 weeks). In the final interview one woman said "Before I go back to work I'll give him a little bit [of other foods] to get him accustomed to it…I'll give him a tablespoon per day to get him used to the taste" (Selina, 21). Dagmar, 18, reported that her infant was being supplemented regularly only because the crèche (daycare) would not feed expressed breastmilk, "The director said that I could bring it, but that she couldn't be responsible for it. Breastmilk can't be boiled, it has to just be heated, and the crèche doesn't have conditions to allow for that."

Religion

Brazil has traditionally had strong ties to the Catholic church, though in recent years the Protestant Evangelical movement has increased in membership tremendously. Of the participants 35.4% were Catholic, 26.2% Evangelical Protestants, and 27.7% felt no connection to any religion, though some specified that they believed in God. Around 3% belonged to the Spiritist tradition of Kardecism.

Marital Status

When asked their marital status, 37% stated that they were single, 23% that they were "Together" (*amigada*/*juntada*/*junto*) and 40% that they were married (n=65). From an outside perspective, the three categories appear to overlap to a certain degree, since

some participants responded that they were Single because they were not legally married, even if they were cohabiting, while others reported that they were Married because they were cohabiting, even though they were not legally married. One young woman summed up the idea of being Together "I'm *amigada*…not married, not single. *Amigada*" (Dolores, 18). Another, slightly older, participant gave her status as "Single. I live with the father of the baby, but I'm single" (Deusa, 27). The responses given were those deemed most appropriate by the participants themselves, and likely reflected their view of the nature of the relationship better than strict legal categorisation.

Pregnancy and Relationship Status

Two thirds of participants in the study stated that the pregnancy was not planned (67.7%). Though both single and partnered women reported unplanned pregnancy, the percentage of women with unplanned pregnancies increased significantly (χ^2=24.680, $p<.00001$) from Married (35%) to "Together" (73%) to Single (100%) groups (cross-tabulation shown in Table 6.2). Many of the participants experienced unstable romantic/sexual relationships: 12.3% of participants' relationships with the father of the baby were dissolved before the baby was born; 15.4% of participants had a relationship with a partner dissolve during the post-partum research period.[16] For some women the pregnancy acted to solidify relationship bonds: 26.2% of participants either moved in with or married the father of the baby. These alliances were not always envisioned positively by the women: "I got married because of the pregnancy and to not disappoint my father, not because I truly loved my husband. I wasn't in love with him, I was just pregnant by him" (Selina, 21).

[16] There is some overlap between these two statistics, as some women who split from the father of the baby during pregnancy formed a subsequent relationship and then split with that partner during the research period.

No participants moved in with or married a partner other than the father of the baby. Two participants reported that they had plans to marry a partner other than the father of the baby (relationship formed during the pregnancy) but this had not occurred by the end of the study period. Among fathers, 26.2% had at least one child from a previous relationship.

Living Arrangements

Women's household environments largely fell into four arrangements: 33.8% lived in a separate home with a partner; 23.1% lived with a partner in her mother's *quintal*; 29.2% lived in her mother's *quintal* without a partner; 10.8% lived with a partner in the partner's family's *quintal*. Only 3.1% of women lived neither with family nor a partner. Of the two women in this position, one had immigrated to São Paulo from the Northeast without her parents, while the other was at odds with her parents and did not wish to live with either of them. The minimum number of siblings among participants was 0 and the maximum was 14. The most common number of siblings was two. During the research period, 33.8% lived in a house with at least 1 sibling.

Continuing to live in the house with the participant's family was not considered a positive circumstance in the life of a woman becoming a mother for the first time. This was evident in comments about the ideal circumstances in which to have a baby, such as: "When she has her house, her own life, a job" (Gilderlene, 16) and "Married, with your husband. When you have your own life" (Claudinha, 16).

Housing Characteristics

Household size ranged from one to six persons. The most common number of persons per household was two. House size ranged from one to eight rooms (not counting

the bathroom if one was present). The most common number of rooms per house was three. A statistic to measure crowding was calculated, by dividing the number of rooms in the house by the size of the household, giving an answer in rooms/person. The most common number of rooms per person was 1, with a mean number of rooms/person of 1.35.

Delivery Characteristics

Nearly half of the participants, 47.7%, delivered during the winter (June 22-Sept 21), 33.8% during the fall (March 22-June 21) and 18.5% during the spring (Sept 22-Dec 21). The low number of participants delivering during the Spring is due to the field research period ending in the last week of January; women who delivered later in the Spring would have had their participation truncated before the full 12 weeks of follow up. Therefore, women with due dates later in the Spring were not recruited for the study. Women were asked pre-partum to name the hospital in which they planned to deliver and after the birth were asked where the delivery had occurred. Forty percent of participants had delivered in the hospital at which they had planned to deliver and 37% at a different hospital than planned. For 23% of participants one or other response was missing.

Caesarean deliveries are extremely common in Brazil. In this sample 36.9% of participants had a Caesarean delivery, 1.5% had a forceps delivery and 60% had a vaginal delivery without mechanical assistance.

Infant Anthropometrics at Birth

Infant length at birth ranged from 43cm to 55cm ($\bar{x}$= 48.75 ± 2.25). Infant birth weight ranged from 2160g to 4325g. The mean birth weight in grams was 3244 ± 491g. Three infants (5%) had low weight at birth (< 2500g). Five infants (8%) had high weight

at birth (>4000g). The ponderal index is a measure of infant size designed to take into account both length and weight. Ponderal index is calculated as 100×weight in grams/(length in centimetres)^3. Ponderal index ranged from 2.05 to 3.04. Mean infant size was 2.79 ± 0.339. Ponderal index showed a significant quadratic relationship with maternal body mass index (BMI) at two weeks post-partum (p=.05, r^2=.175; Figure 6.1). When participants with BMI over 30 (obese) were excluded, ponderal index showed a significant positive linear relationship with maternal BMI at two weeks post-partum (p=.005, r^2=.256; Figure 6.2).

Sex Ratio at Birth

The sex ratio of the infants born during the study was 1.00:1.25 boys to girls (28 vs. 35). This sex ratio is unusual given that the global average sex ratio at birth is 1.05:1.00 boys to girls (Davis, Gottlieb, & Stampnitzky 1998).

Longitudinal Anthropometric Data

Two of the participants were lost to follow up after the pre-partum interview,[17] so post-partum data were collected from a total of 63 participants. Participants' heights ranged from 151cm to 179cm, with a mean height of 161.2cm (±5.78).

Oxytocin Data

As stated in the previous chapter, 43% of the breastmilk samples produced unreliable values. Using the reduced data set of 171 samples, interviews 2 and 5 had the highest number of participants (n=63) with an associated breastmilk sample (34 and 33 participants with samples, respectively), while interviews 4 and 6 had the fewest participants with a sample (25 participants with samples). Table 6.3 provides the

[17] Neither participant withdrew from the study officially, but attempts to follow up with them were unsuccessful.

descriptive statistics for the OT values among samples from each interview time point. OT values for the various time points were non-normally distributed (Figures 5.4-5.9). All values were log-transformed to achieve normality (not shown).

As mentioned in Chapter V, Hierarchical Linear Modelling was used to determine whether there was significant variability in the trends through time for each individual participant in the sample (Level 1) and between groups (Level 2). The two variables that were examined using HLM, were EBV-ab titre and OT level. There was no significant variability in levels over time, so the analysis terminated at Level 1.

Since the HLM analysis revealed that there was no significant variability through time, it was determined that it would be appropriate to use the mean of each individual's OT values to represent her OT level. Using the mean value also added power to the analysis since 94% of participants had an associated mean OT value (shown in Table 6.3). After each participant's mean OT value was calculated, it was determined that the distribution was non-normally distributed (Figure 6.3). The values were log-transformed to normalise the distribution (Figure 6.4).

Epstein-Barr Virus Antibody Titre Data

Table 6.4 provides the descriptive statistics for the EBV-ab value distributions at each interview point. Unlike the OT data, the EBV-ab data was essentially normally distributed and so did not require transformation. Like the OT data, there was no significant variation in EBV-ab values over time, so the mean EBV-ab titre was calculated for each participant and used to represent her EBV-ab titre (shown in Table 6.4). The mean EBV-ab distribution was not normally distributed and so was log-transformed to obtain a normal distribution (shown in Table 6.4)

Weight and Body Mass Index

Participant's body mass index (BMI), body fat percentage[18] and weight in kilos were collected and/or computed at each time point. Figures 6.5 through 6.7 show the change in the mean values for each of these variables through the six interview time points. The change over time trends for weight and BMI show an initial downward trend, followed by an upturn at between 8 and 12 weeks post-partum, whereas maternal body fat appears to increase at 4 weeks post-partum, followed by a decreasing trend from 6 to 12 weeks post-partum. This difference may be a sample issue, due to the smaller number of participants for whom body fat percentage was captured at 2 weeks post-partum. Additionally, it is plausible that the women who had high values for body fat at 4 weeks post-partum might at 2 weeks post-partum have had body fat percentages above the 45% measurement cut off for the scale. This bias would result in the mean for body fat at 2 weeks appearing to be lower than body fat at 4 weeks. If we exclude the 2 week post-partum measures, body fat shows a sharp decline after birth until 6 weeks post-partum (Interview 3), followed by essential stasis from 6 to 12 weeks post-partum.

Psychometric Data

The Edinburgh Post-Partum Depression (PPD) scale was used to assess participants' likelihood to be suffering from post-partum depression. The scale was administered at 2 weeks post-partum and again at 12 weeks post-partum. Sixty-two participants (98%) completed the PPD scale at time 1; 53 women (84%) completed the scale at time 2. The average PPD score at 2 weeks post-partum was 9.05 (±5.45), with 2 and 8 being the most common scores (Figure 6.8). The average score at 12 weeks post-

[18] The upper limit of detection for body fat percentage was 45%. This truncated the body fat values, since no value was available for participants with body fat above this cut-off point.

partum was 9.19 (±6.4), with multiple modal categories. Generally, scores at 12 weeks were more widely dispersed around the mean (Figure 6.9). Change over time in PPD score was calculated by subtracting PPD score at time 2 from PPD score at time 12. For the 52 women who completed the scale at both time periods, there was very little change in PPD score. For 22 of these women (42.3%), the PPD score stayed the same or increased by 1 point. The mean change over the entire sample was -0.5 points (Figure 6.10).

The Rosenberg self-esteem scale was conducted with 28 participants (44%). Of the participants who completed the scale 3 (11%) had scores reflective of low self-esteem, while 25 (89%) had scores in the normal range.

Stress Scales

Perceived day-to-day stress was measured using a simple 10-point scale, using a composite measure of stress based on eight components of daily life, and finally using the Cohen stress scale. Both the 10-point stress scale and the composite stress score scale were administered to participants repeatedly between 2 and 12 weeks post-partum. Data are available for all but two participants (94%). For the Cohen scale, data are available for 36 (55%) of the participants. The descriptive statistics for all three stress scales are presented in Table 6.5 The Cohen stress scores were normally distributed around a mean of 15.9 (±6.58). The distribution is shown in Figure 6.11.

For the 10-point stress scale participants were asked to rate the level of stress in their life from one to ten. The mean of each participant's responses over the 12 weeks was calculated, to provide an Average Stress Score for that participant. Average scores

on the 10-point stress scale were normally distributed around a mean of 4.92 (± 2.19) (Figure 6.12).

As discussed in Chapter V, the Composite stress scale was a score composed based on Likert scale responses to eight aspects of daily life. Possible scores on the Composite scale ranged from five to 40 points, with lower scores indicating less satisfaction/more stress. Participants' scores ranged from 19.33 to 38.67. The distribution of scores had a mean of 32.39 (±4.15; Figure 6.13). These three stress scores were found to be strongly correlated, as will be discussed below.

Defining Breastfeeding Outcome Groups at 12 weeks

Women were divided into outcome groups based on their reported breastfeeding practice at 12 weeks post-partum. Outcome at 12 weeks is unavailable for the two participants who were lost to follow up after the birth, as well as for two additional participants who completed only the first 3 interviews. Therefore, breastfeeding outcome at 12 weeks is available for 61 participants. Breastfeeding outcomes were initially grouped into five categories: exclusive, predominant, partial, token and weaned. Women who reported that the infant was not receiving and had not received any non-breastmilk food or liquids were classified as exclusively breastfeeding (49.2%). Women were classified as predominantly breastfeeding if the infant had at some point had been given non-breastmilk food or liquids but was currently being breastfed exclusively (9.8%). Women who were still breastfeeding but were regularly giving non-breastmilk foods or liquids were classified as partially breastfeeding (18.0%). Women who were giving almost exclusively non-breastmilk foods and liquids but who would occasionally nurse the infant were classified as engaging in token breastfeeding (3.3%). When women

reported that their infants were receiving no breastmilk they were placed in the Weaned category (19.7%).

Due to the sample size (n=61), the five groups were collapsed into three outcome groups. The exclusive and predominant groups were merged, since the women's breastfeeding practice at 12 weeks was identical; only the infant's prior diet differed. ANOVA was run with the token breastfeeding group merged with the partial group first and then with the weaned group. ANOVA was able to detect differences between groups when the token group was merged with the weaned group, but differences were masked when the token group was merged with the partial group. The token and weaned groups are in practice more similar than the token and partial groups are, since women who reported token breastfeeding nursed only sporadically rather than as a part of a regular daily schedule. The Token and weaned groups were merged into a single group (Weaned). The three outcome groups were Exclusive, Partial and Weaned (Table 6.6).

Monthly Income Differences by Breastfeeding Outcome

When Monthly Income was analysed by Breastfeeding outcome group, using ANOVA, no difference was found between groups overall (p=.209). Post-hoc testing revealed that participants in the Exclusive group had higher Monthly Income than the Weaned group, but not significantly so (+R$439, p=.079).

The overall ANOVA was close to significance overall for Monthly Income per capita (p=.060). Post-hoc testing here revealed that participants in the Exclusive group had significantly higher Monthly Income per capita than participants in the Weaned group (+R$251, p=.020).

Pre-partum Breastfeeding Intention Differences by Breastfeeding Outcome

Breastfeeding intentions at the pre-partum interview were grouped into four categories, based on women's responses to the question "How long do you plan to breastfeed?" (Table 6.7; N=65). Many women mentioned a particular length of time or range of time that they would breastfeed. Women who mentioned particular lengths of time were divided into the first two categories based on whether they stated a duration longer or shorter than the biomedical recommendation (six months).

Other women gave answers that suggested that they felt their breastfeeding practice would be determined by contingencies beyond their control. The group labelled "baby driven" gave answers related to the infant. Essentially, these women said that they would breastfeed for as long as the infant wanted to. In Brazil the agency of the infant is often included in discussions of breastfeeding practice. Another group of women gave answers that suggested that their practice would depend on the presence, absence or failure of breastmilk supply. These women gave responses using the subjunctive phrase "emquanto tiver leite" (as long as there is milk), suggesting uncertainty about the likelihood that there would be milk or that the milk would last.

Using Fisher's exact test it was determined that, for those women whose breastfeeding outcome at 12 weeks was known (n=61), intended breastfeeding duration was significantly associated with breastfeeding outcome at 12 weeks (p=.019). Women who stated that they would breastfeed for as long or longer than recommended, and those who said that the infant preference would influence their breastfeeding practice, were more likely to still be breastfeeding exclusively at 12 weeks (65% and 75% respectively). Of women who stated that they would breastfeed for less than the recommended period,

62.5% had switched to partial breastfeeding by 12 weeks. Of those who stated that their breastfeeding duration would be influenced by whether they still had breastmilk, 60% had weaned by 12 weeks. The complete cross-tabulation is shown in Table 6.8.

Due to the sample size, power was low for cross-tabulation using four categories, so Breastfeeding Intention was recoded as a binary variable. Categories were grouped by the expectations women had regarding their breastfeeding. Women who stated that they would breastfeed for as long or longer than recommended were grouped with women who said that infant agency would determine length of breastfeeding (Positive expectation). Women who said they would breastfeed for less than the recommended length of time were grouped with those who said that their breastfeeding practice would be dependent on their breastmilk production (Negative expectation). Two-thirds of the women in the Positive expectation group (67%) were still breastfeeding exclusively at 12 weeks post-partum. In contrast, slightly more than two-thirds of the women in the Negative expectation group had supplemented or weaned by 12 weeks (69%). The difference between groups was significant (p=.032; cross-tabulation shown in Table 6.9).

Hypothesis Testing

Moving from descriptive to analytical statistics, the following section will investigate the main hypotheses of the research, as outlined in Chapter 1.

Hypothesis 1

Hypothesis 1 was that women's day-to-day stress may impact breastfeeding duration in part through changes in levels of the breastfeeding hormone oxytocin; therefore, women with higher levels of stress will show lower levels of OT. T-tests and ANOVA were used to determine whether OT level varied between groups for categorical variables indicative

of more stressful life conditions. Variables examined using t-tests were: Planned pregnancy (yes/no), Split from Partner during research (yes/no), Split from Father of infant during pregnancy (yes/no), Ideal Age (yes/no), PPD score at 2 weeks (0-12, 13+) and PPD score at 12 weeks (0-12, 13+). Variables examined using ANOVA were: Living situation and Marital status.

Significantly higher OT levels were found among women who had split from a partner during the research period (t= -2.132; p=.037), but no increase was seen for women who had split from the father of the infant during pregnancy (t=-1.427). No difference in mean OT level was found between women who scored above the cut-off for PPD at 2 weeks post-partum and those who did not (t= -.494). Women who scored above the cut-off for PPD at 12 weeks post-partum had significantly higher OT levels than those who did not (t = -2.494; p=.016). Women who had an unplanned pregnancy did not show significantly higher OT levels than women who had planned the pregnancy (t= 1.700). No significant difference was found between groups for Marital status. For Living Situation no difference was found overall between groups, but post-hoc tests revealed that women who lived with a partner as well as her family had significantly lower OT levels than women who lived only with her family (p=.031), while women who lived with a partner and his family had marginally lower OT levels that women who lived only with her own family (p=.087). None of the other inter-group comparisons were significant. Figure 6.14 shows the ranges and means of OT by living situation group. In order to examine the impact of household circumstance factors on OT level, curve estimation was used to determine whether household size, house size or crowding

showed any relationship to mean OT level. None of these variables showed any association with OT level (not shown).

Next, regression analysis was used to determine whether participants' scores for the 10-pt stress scale and Composite stress scale scores at a particular time point were related to their OT levels at the same time point, at the previous time point, and at the following time point. Curve estimation was used to determine whether linear, quadratic or cubic relationships existed between the independent variables, and the dependent variable, OT. Significant positive linear relationships were shown to exist between OT at particular time point and 10-pt stress scale score at the same time point, for three of the interview points: 6 weeks post-partum ($p=.03$; $R^2=.236$), 8 weeks post-partum ($p=.05$; $R^2=.399$) and 12 weeks post-partum ($p=.027$; $R^2=.304$). A marginal negative relationship was found between Composite score at 12 weeks and OT level at 12 weeks ($p=.095$; $R^2=.205$). However, as mentioned previously, due to the unreliable OT values, OT values were not available for all time points, which lowered the power of the regression analyses when broken down into individual time points.

For this reason, curve estimation was used to determine whether mean OT values showed linear, quadratic or cubic relationship to mean 10-pt stress scale scores and mean Composite scores, as well as to score on the Cohen stress scale. The 10-point stress scale shows significant linear and quadratic relationships to OT level. The quadratic relationship is strongest ($p=.005$, $R^2=.173$; Figure 6.15), suggesting that women with the lowest and highest levels of reported stress have higher OT levels than those with intermediate stress levels. The Composite stress scale (for which higher values indicate less stress) showed a negative linear trend with OT level that approaches significance

($p=.055$, $R^2=.064$; Figure 6.16. When scores on the sub-set of the Composite scale that focused on interpersonal relationships were examined separately, they showed a significant positive relationship with OT levels ($p=.025$; $R^2=.085$). Cohen scale values showed a highly significant positive linear relationship with OT level ($p=.005$, $R^2=.217$; Figure 6.17). While the number of participants who completed the Cohen scale was smaller than the other two scales (n=36), the associations strongly support the same conclusion. In the case of all three scales higher levels of stress are associated with higher, not lower, OT levels.

Interestingly, data from ethnographic interviews suggested that some women did report having experienced failure of let-down (presumably due to suppression of pulsatile OT) in response to specific stressful experiences. One participant had an "ugly fight" with her partner and fainted, followed by difficult breastfeeding, saying that her daughter "cries a lot to breastfeed, because she sucks and sucks and very little comes out" (Gilderlene, 16). Another participant intervened in a physical confrontation between her mother and father, who was drunk, and experienced a period in which her milk would not let down.

Hypothesis 2

Hypothesis 2 stated that women who show higher levels of biological stress, as measured through EBV antibody levels, will have lower OT levels. Curve estimation was used to determine whether any associations existed between a participant's EBV-ab level at a given time point and her OT level at the same time point, the previous time point and the following time point. No associations were found between EBV-ab value and OT value at any time point (results not shown). Mean EBV-ab levels were then examined to

determine if they showed an association with the mean OT levels. No significant relationship was found between mean EBV-ab levels, and mean OT levels (Table 6.10).

Correlation was run to determine whether reported and biological stress measures were correlated. EBV-ab showed no correlation with any of the stress scales, but all stress scales were highly correlated with one another (Table 6.11).

Hypothesis 3

Hypothesis 3 held that women with lower OT levels will be more likely to have ceased breastfeeding by 12 weeks post-partum. ANOVA was run to determine whether there were differences in mean OT level between the three breastfeeding outcome groups (Exclusive, Partial and Weaned status at 12 weeks post-partum). Mean OT levels were found to be significantly different between the three groups (p=.015; Table 6.12, Figure 6.18). Post-hoc tests indicated that OT levels of the weaned group were significantly *higher* than in the exclusive group (p=.004) and *higher* than the partial group, though here the effect did not reach significance (p=.068). No significant differences were found between the exclusive and partial groups. When the three outcomes were collapsed into a binary (Breastfed/Weaned), the Weaned group showed significantly higher levels of OT than the Breastfed group (p=.008; Table 6.13, Figure 6.19).

Hypothesis 4

Hypothesis 4 stated that women with more stressful life circumstances will be more likely to have weaned by 12 weeks. Bivariate and multivariate analyses follow below.

Bivariate analyses

Bivariate analyses were used to analyse the impact of a wide variety of factors on Breastfeeding outcome at 12 weeks (Exclusive/Partial/Weaned). These factors included

the following types of variables: Participant Characteristics (age, post-partum depression score at 2 weeks and at 12 weeks, pre-partum breastfeeding intention, religion, type of delivery, location of delivery); Anthropometrics (participant's BMI at 2 weeks post-partum, infant birth length and weight, infant length at 2 through 12 weeks, infant weight at 2 through 12 weeks), participant's mean OT value (log), participant's mean EBV-ab value (log); Structural factors (educational level, employment status, maternity leave access); Living Situation factors (household size, number of rooms, crowding, living with siblings, with parent, or in parent's compound, alone or with in-laws); participant's Family Background (father born in São Paulo, mother born in São Paulo, participant born in São Paulo); Relationship factors (planned pregnancy, marital status, living with partner, father of infant has other kids, move in/marry partner due to pregnancy, split with father of infant during pregnancy, split with partner during research period). The association of categorical variables with Breastfeeding Outcome at 12 weeks was examined using Chi square and Fisher's Exact tests. The association of continuous variables with Breastfeeding Outcome was examined using ANOVA.

Group differences were found as to Breastfeeding Outcome, when comparing women within and outside of the "ideal" age range for first time motherhood (19-30 years, based on Goldani 1999; supported by study participants, as shown below). Of women outside the ideal range, 55% had supplmented or weaned by 12 weeks compared to 27% of women within the ideal age range (χ^2=6.503, p=.039; cross-tabulation shown in Table 6.14). Some women in the sample stated that there was no "right" age for a woman to have her first child, and that it would depend on the characteristics of the woman and on the desires of the couple:

> "Whenever is good to have your first baby" (Maria José, 19)
>
> "When [the woman] feels prepared. There's no age" (Letícia, 24)
>
> "You have to accept the pregnancy when God sends it" (Cleiba, 16)
>
> "When she feels ready" (Carolina, 19)

By contrast, others believed that age did play a key role in determining when a woman's first pregnancy should occur:

> "It should be a woman who is already an adult, who knows what she wants" (Elsa, 33)
>
> "I think being older. It's a bit better when you're 25, and working" (Eva, 16)
>
> "Girls who are only 17, no….they need to be more prepared, more mature" (Débora, 24)
>
> "From the age of 19 on, because less than that…Younger that that they don't have anything in their head" (Eliana, 20)
>
> "After 20 years, you're old enough to be well stabilised and to have it planned, so that it's not unwanted" (Irene, 35)

One woman put limits on either end of the "appropriate" age: "Twenty-five or twenty-six years [old]. Up to twenty-nine or thirty years [old]. In that period" (Eloisa, 24). Delivery type, living with siblings, living with mother and living in the mother's compound were not significantly associated with breastfeeding status at 12 weeks.

Planned pregnancy showed a difference between outcome groups. Women who planned the pregnancy were more likely to breastfeed exclusively. Women who did not plan the pregnancy were more likely to breastfeed partially or to wean (p=.034; cross-tabulation shown in Table 6.15). The difference in cumulative risks of supplementing and of weaning, between women with planned and unplanned pregnancies, are illustrated in Figure 6.20 and Figure 6.21, respectively.

Marital status and living with a partner showed a trend towards significance. Women who were married rather than single or "together" were more likely to breastfeed exclusively (p=.057; cross-tabulation shown in Table 6.16). Women who lived with a partner were more likely to breastfeed exclusively (p=.059; cross-tabulation shown in Table 6.17). These last two results did not reach significance.

The psychometric measures (Rosenberg self-esteem scale and PPD scale) were also assessed by breastfeeding outcome group. There was no association between low self-esteem and breastfeeding outcome at 12 weeks (Fisher's p=.5299). For PPD, women were placed into at risk (score of 12 or above) and not at risk (score 0-11) categories. At 2 weeks post-partum 22% of Exclusive outcome women had PPD scores that indicated a risk for post-partum depression, compared with 30% of the Partial group and 39% of the Weaned outcome group (Fisher's p=.549; cross-tabulation shown in Table 6.18). By 12 weeks post-partum the percentage at risk in the Exclusive group had increased to 27%, compared to a decrease for the Partial group to 20% and an increase for the Weaned group to 78% (Fisher's p=.011; cross-tabulation shown in Table 6.19). Being at risk for PPD at 12 weeks post-partum was strongly associated with being in the Weaned outcome group.

Group differences on all other continuous variables were examined using ANOVA, using post-hoc tests to distinguish sub-group differences. Infant weight at 2 weeks (overall p=.022, exclusive-weaned p=.012) and mean OT value 2-12 weeks (log) (p=.015, exclusive-weaned p=.004) were found to be significantly different among the three breastfeeding outcome groups, with an even larger difference between the exclusive

and weaned groups. Box plots showing the distribution of these variables by breastfeeding outcome group are given in Figures 6.22 and 6.23.

Participant's BMI at 2 weeks post-partum (overall p=.125, exclusive-weaned p=.030), infant birth weight (overall p=.126, exclusive-weaned p=.043), infant weight at 4 weeks post-partum (overall p=.076, exclusive-weaned p=.028), and infant length at 4 weeks post-partum (overall p=.061, exclusive-weaned p=.024) and infant length at 6 weeks post-partum (overall p=.105, exclusive-weaned p=.035) did not show a significant difference overall among the three breastfeeding outcome groups, but post-hoc tests revealed significant differences between the exclusive and weaned groups. Box plots showing the distribution of these variables by breastfeeding outcome group are given in Figures 6.24 through 6.28.

As described in Chapter V, experiential stress was measured through the use of three reported stress scales (simple 10-point, Composite and Cohen). Higher scores on the 10-point scale and Cohen scale indicated higher stress. A lower score on the Composite scale indicated a less positive rating of the eight components of the scale, and therefore higher stress. For all three scales, women who at 12 weeks post-partum were in the Exclusive breastfeeding outcome group reported significantly lower levels of stress than women who had weaned by 12 weeks post-partum; that is, they had lower scores on the 10-point (p=.034) and Cohen scales (overall p=.068, exlcusive-weaned p=.022) and higher scores on the Composite scale (p=.049). For all reported stress measures the Partial group had scores intermediate between the Exclusive and Weaned groups. Boxplots by breastfeeding outcome group for the three reported stress scales are shown in Figures 6.29-6.31.

The eight components of the Composite score are detailed in Chapter V. A mean score was calculated for each aspect from the responses given at each of the interviews. The mean scores from various components of the Composite scale were analysed by group using ANOVA, and were also used in the multivariate analyses presented in the following section.

In the ANOVA, the components that showed a significant difference overall between breastfeeding groups were Happiness at Home (p=.0021) and Relationship with Partner (p=.037). Post-hoc tests show that there was a highly significant difference between the exclusive and weaned groups in Happiness at Home (p=.006); for the Relationship with Partner component there was a highly significant difference between the exclusive and weaned outcome groups (p=.011) and a difference (though not significant) between the partial and weaned groups (p=.09). There was also a non-significant difference between the exclusive and weaned groups for the Self-Esteem component (p=.058). For all eight components the exclusive breastfeeding group had the highest (most positive) scores and the weaned group had the lowest (Figure 6.32). The partial group generally had intermediate scores. Figures 6.33 through 6.35 show the boxplots for each of the three components where the difference was significant or close to significance.

Multinomial Logistic Regression

The categorical and continuous predictor variables that had been found to be significant in bivariate analyses were entered into the MLR model. The model for breastfeeding outcome which had the highest Pseudo R^2 values while correctly classifying the highest percentage of individuals included the following predictors: Age,

Planned Pregnancy, mean OT level, Interpersonal Factors satisfaction score, Breastfeeding Expectation, and Birth Weight. The fit of the overall model was highly significant ($p<.0001$) and all three of the Pseudo R^2 values were high suggesting that the ability of the model to explain the variability in the data is very high. The model classifies 77.6% of the data correctly, overall.

As shown in Table 6.20, the only factor predictive of membership in the Partial group rather than the Exclusive group, after controlling for the other factors, was pre-partum Breastfeeding Expectation. Women in the Partial breastfeeding group were significantly less likely to have a positive expectation about breastfeeding before birth (OR=0.106; 95% CI= 0.017-0.647). If this predictor was removed from the model, the accuracy of classification for individuals belonging to the Partial group fell from 30% to 0%. By contrast, the other predictors all showed significant variation between the Exclusive and Weaned groups (Table 6.20). Women who were more likely to end up in the Weaned group than the Exclusive group were older (OR 1.450), had higher mean OT levels (OR 1.035), had lower birth weight infants (OR 0.996), and had unplanned pregnancies (OR 280.602—see Table 6.20 for all odds ratios and 95% confidence intervals). This is consistent with the findings from the bivariate analyses where much of the variation was shown to be between the Exclusive and Weaned groups. These factors remained predictive of breastfeeding outcome while controlling for the others.

Binary Logistic Regression

Due to the lack of difference between the Exclusive and Partial groups, these two groups were merged in order to maximise the power of the Logistic Regression. This created a new Breastfeeding Outcome variable with two possible outcomes: Breastfed

(77%) and Weaned (23%). Given the dichotomous nature of the variable, Binary Logistic Regression (BLR) could then be conducted to determine which predictors contributed to Breastfed vs. Weaned outcome at 12 weeks post-partum.

The best model, based on pseudo R^2 values and classification accuracy, is shown in Table 6.21. The factors entered into the model were age, planned pregnancy, mean OT level, mean satisfaction score for Interpersonal Factors, mean satisfaction score for Financial Situation,[19] and Birth Weight. Mean satisfaction with Interpersonal Factors (p=.730) and mean satisfaction with Financial Situation (p=.095) were found not to be significant when controlling for other factors. However, mean satisfaction score for Financial Situation was retained in the model because it improved classification accuracy As shown in Table 6.21 women in the weaned group were older (OR 1.606), had higher OT levels (OR 1.056) and their infants were born at lower Birth Weight (OR 0.996). They were also more likely to have had an unplanned pregnancy (OR 330.698). The final model assigned 93.1% of participants to their correct outcome group.

Cox Regression

Cox regression was used to determine which factors were predictive of breastfeeding duration (i.e. “survivorship”). A forward Likelihood Ratio procedure was used to test the ability of factors to predict Breastfeeding survivorship (Table 6.22). Factors that were found to be predictive of Weaning were older age (OR 1.450), unplanned pregnancy (OR 29.588), higher mean OT level (OR 1.020), lower mean satisfaction with Interpersonal Factors (OR 0.392) and higher mean satisfaction with the

[19] Mean score on Interpersonal factors and mean score on Financial Situation are drawn from the component questions of the Composite scale. Higher values indicate higher satisfaction with that aspect of life. Mean satisfaction score for Financial Situation is only weakly associated with Monthly Income per capita (R^2 = .085).

Financial Situation (OR 4.771). Figure 6.36 shows the difference in breastfeeding survivorship curves between women who had planned and unplanned pregnancy (i.e. infants who "survived" unweaned to 12 weeks post-partum). This figure shows that a much lower percentage of women who had planned their pregnancy had completely weaned their infant by 12 weeks post-partum. While this difference is stark, it is much less stark than the difference shown in Figure 6.21, where the effect of pregnancy status *alone* was considered. The difference between Figure 6.21 and Figure 6.36 shows the effect of controlling for the other factors (age, OT level and interpersonal scores) in the Cox regression analysis. However, the effect of unplanned pregnancy is still dramatic (nearly a 10% difference between planned and unplanned groups).

A second Cox regression model was constructed to test the effect of the predictors on Exclusive Breastfeeding survivorship; in other words, the length of time before women introduced supplementation (Table 6.23). Supplementation was predicted by older age (OR 1.079), unplanned pregnancy (OR 4.206) and lower mean score on the Interpersonal Factors (OR 0.765). Figure 6.37 shows the difference in exclusive breastfeeding survivorship curves between women who did and did not plan to become pregnant. This reveals a dramatic difference in supplementation rates between women who had planned and unplanned pregnancy, even controlling for other variables.

Known Monthly Income Sub-sample

Monthly income was available only for a sub-set of participants (n=50), but because income is a potentially important predictor of breastfeeding outcome and duration, BLR and Cox regressions were run separately for the sub-set of 50 to determine

the effect of monthly income. Due to the size of the sub-sample, these analyses have lower power.

The initial BLR model included those factors that had been found to be significant in the BLR with the complete sample, plus the added covariate Monthly Income. A forward stepwise procedure was employed. In the final step the factors that were determined to be predictive of breastfed vs. weaned status at 12 weeks were Age, Planned Pregnancy and mean OT level (Table 6.24). Monthly Income was not found to be predictive of breastfed vs. weaned status at 12 weeks. BLR was then run using Monthly Income per capita rather than overall Monthly Income. Using forward stepwise procedure it was determined that Monthly Income per capita, Age and mean OT level were predictive of breastfed versus weaned outcome at 12 weeks (Table 6.25). In this model the effect of Planned Pregnancy disappeared once controlling for Monthly Income per capita.

Monthly Income per capita was added to the Cox Regression models predicting Time to Weaning and Time to Supplementation for the sub-sample of known income (n=50). Using a forward stepwise procedure, it was determined that Monthly Income per capita and Age were predictive of Time to Weaning, while mean OT level, Planned Pregnancy and mean score on Financial Situation aspect were not (Table 6.26). By contrast, Planned Pregnancy remained significantly predictive of Time to Supplementation, even controlling for Monthly Income per capita (Table 6.27), along with Age. Monthly Income per capita, mean OT level and mean Financial Situation score were not predictive of Time to Supplementation. Figure 6.38 shows the survivorship curve for Exclusive Breastfeeding, when controlling for Monthly Income per capita.

Comparing Figure 6.37 (survival curve *not* controlling for Monthly Income per capita) and Figure 6.38, we can see that the difference in cumulative exclusive breastfeeding survival between planned and unplanned groups is even greater when controlling for Monthly Income per capita. That is, holding monthly income steady the effect of an unplanned on women's breastfeeding outcome at 12 weeks is even greater.

Chapter Summary

This chapter presented the results of the statistical and biological analyses. Results for the sample as a whole were presented first, followed by differences by breastfeeding outcome group. Results of the testing of the four main hypotheses were presented in turn. Further discussion of the statistical results presented here follows, in Chapter VII.

CHAPTER VII

DISCUSSION OF STATISTICAL AND BIOLOGICAL ANALYSES

As outlined in Chapter I, the objective of this research was to draw on biological and ethnographic data to examine a central question: what biological, structural and personal stressors in women's lives lead them to supplement and wean their infants before 12 weeks post-partum if they intended to breastfeed for longer? This chapter will summarise briefly and discuss the statistical results presented in the previous chapter. Important variables associated with weaned status at 12 weeks post-partum will be identified. These results will be placed in the context of previously published research in the field.

Demographic and anthropometric data, and biological and self-reported stress measures were examined to identify the effect of stressful life circumstances on breastfeeding outcome at 12 weeks levels. The effect of these factors on an important breastfeeding hormone, oxytocin (OT), was also examined. The central results of these analyses are outlined below.

Participant Characteristics

As detailed in the previous chapter, women from the Eastern Zone of São Paulo who were breastfeeding for the first time shared a suite of characteristics. They were largely young, with more than half being under the age of 20. They were the first generation to be born in the city, with the majority of their mothers and fathers having origins in impoverished regions in the northeastern states of Brazil. The level of education was not high, with nearly forty percent having less than a high school diploma.

The participation in the employment market was also low. Less than one third of participants were employed at the time of recruitment.

Romantic relationships among these women tended to be fairly unstable, with as many as one quarter of participants dissolving the relationship with the father of the baby during the pregnancy or the first 12 weeks post-partum. While another quarter of the participants solidified a relationship with the father of the baby by moving in with or marrying him, some participants reported ambivalence about this change.

Just over half of these young women were still living in the same household with their mother, either in the same house or the same compound. In about one quarter of cases, the participant's partner had moved into the household as well. Living in the mother's house was not seen in a positive light, although it did provide the opportunity for greater allocare for the infant. Having their own house was an important theme that came up among participants.

Delivery experiences were quite stressful for these women, even disregarding the length and intensity of labour. Nearly 40% of women were not able to or did not deliver at the hospital that they had planned. Forty percent of patients experienced medical interventions during their deliveries (Caesarean or forceps). While in some contexts women do prefer to have a Caesarean delivery, none of the participants in this study stated a preference for Caesarean; all said that they would prefer to have a vaginal delivery.

Post-partum depression was more common among this sample of women than has been reported previously in Brazilian contexts (Da-Silva, Moraes-Santos, Carvalho, et al. 1998) with 28% at 2 weeks post-partum and 34% at 12 weeks post-partum having scores

that indicate a risk of PPD. Globally, the rate of post-partum depression is between 10 and 15% of women (Da-Silva, Moraes-Santos, Carvalho, Martins, & Teixeira 1998), which suggests that the women in this sample are at a greater risk of developing PPD, and that the tendency only increases with time post-partum. In general, the stress levels for these women were high. More than 60% of participants scored above the mean Cohen scale score (13.7/40). Participants with scores above the mean were shown to be more likely to have weaned the infant by 12 weeks post-partum.

Just under half of the participants were still breastfeeding exclusively at 12 weeks post-partum, but nearly 25% had already weaned by then. This level of exclusive breastfeeding falls in line with Venancio and colleagues' (2002) finding that less than 30% of infants in Sao Paulo are breastfed to 16 weeks post-partum. This is especially so since it would be reasonable to expect an additional decrease in exclusive breastfeeding among working women at or before 16 weeks, as the federally-mandated maternity leave period expires at 16 weeks post-partum. As shown in the ethnographic material, many working women who were on maternity leave believed that before they returned to work at 4 months it would be essential to introduce infants to non-breastmilk foods. They felt that the adjustment period would then be easier on the participant, the infant and the caregiver. The fact that nearly 20% of women were still partially breastfeeding while also regularly using supplemental foods suggests that women do perceive benefits to breastfeeding. However, women in this group largely reported that breastmilk could not completely sustain the infant on its own.

Discussion of Hypothesis Testing Results

Hypothesis 1, that stress would be associated with lower levels of OT was rejected. In fact, it was found that women who reported higher levels of stress and who were characterised by more stressful social circumstances had significantly higher levels of OT. Stress scores on the Cohen and 10-pt stress scale showed significant positive relationships with OT at particular time points, and mean stress scores had positive linear relation to mean OT levels. This result was in striking opposition to the initial hypothesis and was quite unexpected, given the literature on the relationship of stress and OT in the context of breastfeeding. As presented in Chapter II, previous work with breastfeeding women has shown that pulsatile release of OT is suppressed in women under acute stressors such as mental arithmetic and pain stimuli (M. Newton & Newton 1948; Ueda, Yokoyama, Irahara, et al. 1994). It has also been shown that pulsatile release of OT suppresses stress response in breastfeeding women (M. Altemus, Deuster, Galliven, et al. 1995). In both these cases, there is a negative relationship between stress and OT. However, outside of the context of breastfeeding, OT has been shown to be positively correlated with stress level. Taylor et al (S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006) and Turner et al (R. A. Turner, Altemus, Enos, et al. 1999) have shown that women who experience gaps in their interpersonal relationships or who report a less warm, caring, supportive relationship with a partner demonstrate higher levels of basal OT.

One possible explanation for the positive association found here between OT and stress is that despite the fact that all breastmilk samples were collected during breastfeeding bouts (in order to capture stimulated OT levels) the samples may have

captured the women's basal rather than stimulated OT level. Among the participants in this study mean OT level is positively correlated with stressful social circumstances, as measured through self-reported stress levels. This is similar to the findings of Taylor and colleagues (2006) and Turner and colleagues (1999).

Studies linking stress and OT found that OT levels rise in response specifically to gaps in or dissatisfaction with *interpersonal relationships*, rather than in response to generally high stress. Of the eight aspects making up the Composite stress score in this study, those that reflected interpersonal stress (Relationship with Partner, Happiness at Home, Relationship with Family) were correlated with OT level. The five other aspects (Well-Being, Self-Esteem, Personal Capacity, Financial Situation, Sleep) were not associated with OT level. This is especially significant since participants across all three groups expressed the most dissatisfaction with the Financial Situation and Hours of Sleep out of all 8 components (shown in Figure 6.36). Since the other aspects of the Composite score were clearly stressful aspects of the participants' lives, and yet did not show a correlation with OT level, it appears that OT levels are related to interpersonal stressors, rather than generalised stress levels. On that basis, the idea that the OT values may reflect the women's basal OT levels is strengthened.

Another possibility to be considered is that chronic stress does not suppress OT release in the way that acute stress has been shown to (Ely & Petersen 1941; M. Newton & Newton 1948; Taleisnik & Deis 1964; Ueda, Yokoyama, Irahara, et al. 1994), in which case there would be no negative relationship to find, regardless of the conditions of collection of the breastmilk. In order to rule out the possibility that a suppressive effect of stress on stimulated levels of OT exists, it would be necessary to conduct research in a

laboratory setting, in which absolute control could be maintained over the collection of the milk.

Hypothesis 2, that EBV levels would be inversely related to OT levels was rejected. Based on multiple studies linking psychological stress to the reactivation of EBV infection, EBV antibody titre was identified as a biological measure of stress. Given that stress was hypothesised to suppress OT, it was reasonable to hypothesise that EBV-ab and OT levels would be inversely correlated. As described above, OT levels were actually positively correlated with stress scores, suggesting that OT might be found to be positively correlated with EBV-ab levels as well. However, in the analysis EBV-ab showed neither the expected negative correlation nor a positive correlation with OT level. Further analysis indicated that EBV-ab values did not correlate with any of the reported stress scores, and did not differ with respect to categories of stressful life circumstance variables (Planned/Unplanned Pregnancy etc). HLM analysis found no variability through time for EBV-ab values.

These findings suggest that EBV-ab may not have been activated in response to the stressors present in participants' lives, though the lack of reactivation remains to be explained. EBV-ab analysis suggests that virtually all participants had been previously exposed to the virus and therefore could be expected to show reactivation responses to stress. In a study of cadets at West Point academy, Glaser et al (1999) found that not all types of stress resulted in reactivation of EBV infection; the psychological and physical stress of basic training did not result in an increase in EBV-ab level, while the academic/ psychological stress of the final exam period did.

It is plausible that the chronic stress associated with social circumstances and the day-to-day stress experienced by these participants may not have activated the hypothalamic-pituitary-adrenal axis to a sufficient extent to result in reactivation of the EBV infection. Alternatively, it is possible that the pulsatile release of OT due to breastfeeding, while not measurable through breastmilk samples, was sufficient to suppress cortisol in this group of participants; as mentioned previously, an inverse relationship has been shown between pulsatile OT levels and cortisol (Amico, Johnston, & Vagnucci, et al. 1994). Cortisol is a key to the stress–induced modulation of the immune system, the end point of which is reactivation of EBV infection. While the explanation is still elusive, we can conclude that EBV-ab titre did not serve as an effective biological indicator of stress in this population.

Hypothesis 3, that women who showed lower mean OT levels would fall into the Weaned category at 12 weeks post-partum, was rejected. The opposite result was found: mean OT levels were highest among women who had weaned by 12 weeks, intermediate in partially breastfeeding women, and lowest in women in the exclusive group. Since one of the key functions of OT is to induce milk release during nursing, it is unexpected that women who had weaned would have the highest levels of the hormone. However, if, as I have suggested, the OT levels measured were in fact basal OT levels—such that higher levels of OT were associated with higher levels of interpersonal stress—the association between weaning at 12 weeks and higher OT level can be explained due to the higher levels of stress in the woman's life (see Hypothesis 4 for a more detailed explanation). Non-pulsatile release of OT has been shown not to influence breastfeeding or result in letdown (Nissen, Uvnas-Moberg, Svensson, Stock, Widstrom, & Winberg 1996;

Yokoyama, Ueda, Irahara, et al. 1994). Therefore, the high basal levels of OT would not facilitate letdown or help to maintain lactation in a woman. Given that a strong positive relationship between stress and OT has been shown (above), the association of high OT level with earlier termination is reasonable.

Hypothesis 4, that women with higher reported stress and with more stressful life circumstances will have weaned by 12 weeks post-partum is supported. Women who were exclusively breastfeeding at 12 weeks post-partum had lower reported stress on the Cohen and 10-pt scales, and higher satisfaction on all eight aspects of the Composite scale, including significantly higher scores on Relationship with Partner and Happiness in the Home. These women were also less likely to have social circumstances that might increase stress, such as unplanned pregnancy, early or late age at first pregnancy, single motherhood or living separately from a partner.

Multinomial Logistic Regression

The MLR identified that when compared to Partial breastfeeding outcome, Exclusive breastfeeding outcome was predicted by positive rather than negative expectations of breastfeeding pre-partum. Women who stated that they would breastfeed until or beyond 6 months were more likely to be breastfeeding exclusively at 12 weeks post-partum, as were women who stated that they would breastfeed for as long as the infant wanted to. Women who expressed doubt about their capacity to produce and maintain a milk supply sufficient to support an infant were more likely to have switched to Partial breastfeeding by 12 weeks, as were women who stated that they planned to breastfeed for less than 6 months.[20]

[20] No participant stated an intention to breastfeed for less than 3 months, but several gave durations that fell between 3 and 6 months.

What is clear from this result is that women who are less confident in their ability to breastfeed, or less committed to the bio-medical recommendation of breastfeeding exclusively for 6 months find themselves supplementing their infants even before 12 weeks, and earlier than their stated intention. The lack of confidence is particularly interesting, as the women show the same kind of mistrust of their own bodily capacities as is described by Scheper-Hughes in her landmark study of infant mortality in the Northeast of Brazil. One of her informants stated that "some goats give milk and others are dry…it is the same with us" (Scheper-Hughes 1992: 325). The idea that women's bodies might not be reliable for the production of milk was clearly present in these communities in São Paulo, more than 15 years later.

Those women who were less committed to the bio-medical recommendation about breastfeeding in many cases expressed a view of optimal infant feeding that differed from the "official" version. This difference in perspective will be discussed more fully in Chapter VIII.

More differences were identified by MLR between the Weaned and Exclusive groups, including older age, higher mean OT levels and lower birth weight infants. Unplanned pregnancy was also a significant predictor of Weaned status at 12 weeks. It is possible that the effect of older age here amounts to a generational effect, in that breastfeeding norms in Brazil have begun to change only fairly recently. The oldest women in the sample were nearly a full generation older than the mean age of the participants. Additionally, the mothers of these older participants would also be older, and therefore more likely to encourage bottle feeding. Finally, there was an association

between older age and participant being born in the Northeast of Brazil, where breastfeeding rates are particularly low.

As was shown in Hypothesis 2, higher mean OT levels were associated with increased interpersonal stress in the participant's life. Therefore, taking mean OT level as a measure of stress, from this analysis it appears that women with higher interpersonal and life stress were more likely to wean at 12 weeks post-partum. As has been shown in previous research, support from a partner and/or family members can have an important impact on ability to breastfeed (Quinlan & Quinlan 2008). Lower reported satisfaction on the Interpersonal Factors, highly correlated with mean OT, suggest that the less supportive social environments experienced by participants in the Weaned group significantly impacted their ability/desire to breastfeed to 12 weeks post-partum.

The predictive effect of lower birth weight of the infants on breastfeeding outcome is somewhat surprising as it was women who were mothers to larger infants who expressed doubts about continuing to breastfeed, not women with smaller infants. However, the result does suggest that women's perceptions of infant size may have contributed to their infant feeding decisions.

As described in Chapter III, the effect of unplanned pregnancy on breastfeeding outcome at 12 weeks has been identified in previous studies. Women who have unintended pregnancies are less likely to initiate breastfeeding and tend to terminate breastfeeding earlier (Cheng, Schwarz, Douglas, et al. 2009; J. S. Taylor & Cabral 2002). In this population, ambivalence about the role of mother and resistance to the experience of breastfeeding appear to be intertwined with the experience of unplanned pregnancy.

Binary Logistic Regression

Binary Logistic Regression models were constructed to determine which factors predicted that a woman would be breastfeeding exclusively or partially versus having weaned her infant at or before 12 weeks post-partum. As in the MLR, older age, higher mean OT level, and lower Birth Weight were predictive of Weaning.

When BLR was run for the smaller sub-sample of individuals with known Monthly Income per capita (n=50), the effect of Planned Pregnancy and of Financial Situation score were no longer significant. Mean OT level and Age were both retained in the sub-set BLR model, along with Monthly Income per capita. This suggests that with regard to breastfeeding outcome, the impact of Planned Pregnancy is largely explained by the effect of Monthly Income per capita. Women with unplanned pregnancies had lower monthly incomes than women with planned pregnancies, with a difference of R$158 per person in the household.

Cox Regression

Cox Regression allowed the identification of factors predictive of Time to Weaning and Time to Supplementation. The model that best explained Time to Weaning included older age, higher mean OT, and unplanned pregnancy, lower score for interpersonal Factors and higher score for Financial situation. This suggests that the same factors predictive of breastfeeding outcome also influenced the Time to Weaning, shaping the survival curve, or pattern by which women ceased to breastfeed.

However, once Monthly Income per capita was introduced to the Cox Regression model, all other factors except Age became non-significant. In other words, the variation in Time to Weaning that was initially explained by Planned Pregnancy status, mean OT,

Interpersonal Factors and Financial Situation score disappeared once Monthly Income per capita was controlled for. This suggests that with respect to Time to Weaning, the variation due to Planned Pregnancy can be explained by the lower Monthly Income of the participants in the unplanned category.

The Cox Regression model that best explained Time to Supplementation for the total sample included older age, unplanned pregnancy and lower mean score on the Interpersonal Factors. Mean OT and Financial Situation score did not predict Time to Supplementation. The difference between this model and the model to explain Time to Weaning suggests that Interpersonal Factors were more important in explaining the introduction of supplements than in the decision to wean.

Interestingly, when Monthly Income per capita was added to the Cox Regression model, Planned Pregnancy remained significantly predictive of Time to Supplementation for the sub-set (n=50), as did Age. Interpersonal Factors score was no longer significant when controlling for Monthly Income per capita, and Monthly Income per capita was itself not significantly predictive of Time to Supplementation.

What these analyses show us is that different factors influenced eventual breastfeeding outcome, the Time to Weaning, and the Time to Supplementation among these participants. While Monthly Income per capita was associated with complete weaning, unplanned pregnancy was predictive of Supplementation even when controlling for Monthly Income per capita.

While complete weaning is explained by more disadvantaged circumstances (financially) and by age, time to supplementation was clearly connected to planned

pregnancy status. This suggests a common underlying factor among the women who did not intend to become pregnant that makes them more inclined to supplement the baby.

Chapter Summary

This chapter has laid out conclusions drawn from the biological and statistical analyses of the quantitative data, and the results of the four Hypotheses tested. In the following chapter, Chapter VIII, the connection between unplanned pregnancy and supplementation will be explored using the concepts of maternal ambivalence and the "good mother", and other important ethnographic themes will be discussed. In the final chapter, Chapter IX, the biological results from this chapter and the ethnographic results from Chapter VIII will be discussed jointly, with reference to the overarching question of breastfeeding duration in the Eastern Zone of São Paulo, Brazil.

CHAPTER VIII

ETHNOGRAPHIC ANALYSES

This chapter will present some of the key ethnographic data drawn from interviews with participants. The first section of the chapter will examine the role of breastfeeding as a marker of the "good mother" ideal, and how this ideal is used by women, community members and health care workers. The second section will describe the ambivalence about breastfeeding, and about the "good mother" ideal, that was felt by a sub-set of "reluctant mothers."

Breastfeeding as a Practice of the "Good Mother"

In order to understand the meaning of breastfeeding in the narrative of the "good mother," we need to hear from participants about why they planned to breastfeed. This allows us to determine which aspects of breastfeeding were the most salient among this group of women. When women were asked "Why do you want to breastfeed your baby?" the responses could be grouped roughly into four categories. More than half of the participants gave a reason related to the general health and well-being of the infant. These women said things like "They say that it helps the baby avoid sickness" (Carolina, 19) and "Milk is healthy" (Corinna, 20).

Slightly more than one quarter mentioned some specific benefit to the infant's health. Women who gave this type of response generally gave very brief answers and mentioned specific components of breastmilk such as "protein", "vitamins", "antibodies" and "minerals." Some of these women seemed to be trying to give the "right" answer to the question. The women who gave these answers appeared to be very aware of the bio-

medical rationale for breastfeeding, though some expressed it in more specific, and others in more general terms. Five percent said that they would breastfeed because they had been told by a doctor to do so.

Less than five percent of participants gave an answer in which the importance of breastfeeding lay in the relationship between the woman and her child. Participants who ended up breastfeeding exclusively to 12 weeks post-partum were much more likely to give such a response. One participant who had planned her pregnancy explained:

> "Mother's milk is everything, né?...I think it's everything good. The love that you feel, the strength [*força*] you will give your child. And you're more connected to the baby as well. The most important thing is the connection with your child. The love, the touch. Feeling the baby. It's very important." (Sonia, 28)

Delnice, 26, who had not planned her pregnancy, but who was committed to breastfeeding exclusively, felt that "it's a privilege to be breastfeeding your child…it's the best contact of anything. He's there feeling your heat, the heat of the mother." Other women felt that breastmilk was a God-given substance that a mother was honoured to be able to provide for her child.

> "She has the opportunity to breastfeed her child, with something from within her. It's a gift of God, to be able to take care of someone. It's something unique from yourself. You're different from women who aren't breastfeeding" (Débora, 24)

> "It's an incredible thing. It's a thing from God who makes everything perfect. For humans it's an incredible thing." (Francinha, 18)

These data have three implications. First, public health education about breastfeeding is quite effective and its penetration extensive, in that the vast majority of women gave a health related reason for breastfeeding, and more than a quarter tied the importance of breastfeeding to a specific health related component of the milk itself.

Second, we can see that more woman/child centred reasons for breastfeeding take a very distant second place behind infant–health related reasons. Finally, the benefits of breastfeeding were almost universally couched in terms of the infant, rarely in terms of the woman and child, and never in terms of only the woman; even when asked directly about the benefits of breastfeeding *for the mother*, most women stated that the benefit was that she would see her child healthy and robust. Very few of the women felt that there were any benefits to breastfeeding for the woman herself.

Clearly, women feel overwhelmingly that breastfeeding is something that women do to benefit their infants. The extent to which women see breastfeeding as an experience that is difficult to bear but *must be borne* for the sake of the infant will become clear in the following sections.

The "Good Mother" in Breastfeeding Discourse

The Foucauldian notion that discourses can be used as a form of discipline to control and shape subjects' uses of their bodies (Foucault 1990) was particularly interesting for the analysis of breastfeeding discourse and practice in São Paulo. Women's talk about breastfeeding recapitulated ideas of the "good mother" for other mothers and for themselves, while community members and health workers discourses emphasised different readings of the good mother.

Women Discipline Other Mothers

During the pre-partum interviews participants were asked what reasons women give for weaning infants or introducing non-breastmilk foods. They were also asked what factors in life might prevent a woman from breastfeeding successfully. Since the responses to these two questions differed substantially, it became clear that the former

question was mostly perceived as asking about invalid reasons for cessation, and the latter question about valid reasons, though there was some overlap between categories. It is interesting to note the differences in response between women who ended up in the different outcome groups (Exclusive, Partial, Weaned), despite the fact that these interviews took place before the birth of the infant.

Pre-partum, across all groups the appearance of the breasts was noted as a reason that (other) women refused to breastfeed, and not as something that would actually interfere with breastfeeding. However, women who were ultimately breastfeeding at 12 weeks post-partum added their own judgement of the statement:

> "Principally [they say] that the breasts will fall. But there's no way they will fall. They get stronger!" (Francinha, 18)
>
> "It's more because of vanity. The girl will feel embarrassed because the breasts have fallen. It's vanity, just vanity." (Eloisa, 24)
>
> "It's just vanity. It's your job to give the breast." (Dolores, 18)

By contrast women who were in the Partial and Weaned groups at 12 weeks also stated that fallen breasts were often given as a cause of concern, but did not add their condemnation of the statement.

Women in the Exclusive group gave very particular sets of responses about valid and invalid reasons. Reasons mentioned by participants in this group included lack of or unsustaining breastmilk, fallen breasts (aesthetic), breast or nipple pain, work, lack of time, fear of over-attachment of the baby, and breastfeeding being too much trouble. Again, women in this group added their own judgement of these "excuses": "She wants to do what's easiest for her. Get the bottle and put it in his mouth" (Selina, 21) and "Others don't even breastfeed for one month. It's simply laziness…give the bottle and

sleep another 2 hours!" (Viviane, 35). Although many women in the Exclusive group identified breast or nipple pain as a reason that women would give for ceasing to breastfeed, only one woman mentioned this as a factor that could interfere with breastfeeding and then only "if the breast is bleeding all the time—then it's not okay [to breastfeed]" (Josilene, 24).

Multiple women in the Exclusive and Partial groups felt that there were no good reasons not to breastfeed:

> "Every woman wants to breastfeed her child. The ones who don't [want to] are the ones who can't." (Dolores, 18).
>
> "I think nothing…there's nothing that can interfere, no." (Pietra, 16).
>
> "Ah, I don't know. I don't think anything can. What's important is your child." (Rosinha, 18)

No participant in the Weaned group expressed the opinion that nothing could interfere with breastfeeding. The idea that a woman's breastmilk might be inadequate to sustain the infant, either in quantity or quality was common among women in the Weaned group: "Ah, I don't know…things that can interfere? If you don't have milk. Only that." (Jacira, 18) and "Only if it dries up. If not, I'll give it until 6 months." (Amaracleia, 18).

Overall, what came through clearly was that reasons for not breastfeeding that were considered valid were those that were beyond women's control: lack of milk, excessive stress/*nervos* (since these could cause lack of milk), having to work or attend school, the infant refusing to breastfeed, and poor quality diet. In contrast, factors such as breast pain, lack of time, personal appearance, and just not wanting to were not considered valid reasons not to breastfeed. At her final post-partum interview one young woman who was partially breastfeeding, as well as feeding her daughter powdered cow's

milk, shed light on the way that some reasons for not breastfeeding are judged to be invalid:

> "I think [saying that the milk was not sustaining] was an excuse because of the pain that I was feeling. I said 'Vai!…I'm going to stop because this milk isn't sustaining [her]!' In reality it was more because of the pain than because of Matilde. Because for me, one [breastfeed] after the other, there's no problem. But it was more because of the pain that I was feeling [slight laugh].
> [AR: *And it wouldn't have been possible for you to say "I'm in pain, I'm not going to breastfeed any more"?*]
> Right…because generally when you say you don't want to that's when it begins [in hectoring voice] 'No! You have to give [breast] milk to the baby, the baby needs it!' but if you say that it's because the milk isn't sustaining the baby they say 'Ah, no, then you do have to give a bottle'" (Claudinha, 15)

While Claudinha did not specify *who* would pester her about breastfeeding, it was clear that giving the "wrong" excuse (i.e. an excuse focused on the discomfort of the mother, rather than the well-being of the infant) would have exposed her to criticism and judgement as an inferior mother.[21]

Women Discipline Themselves

Many women from all groups reported that feelings of guilt were entwined with their infant feeding decisions. For women in the Exclusive group mention of guilt usually came up the context of "near-misses", times when the participant had nearly given in and made up a bottle of formula, but had decided at the last moment not to:

> "I told my husband 'Ai, I'm going to give her a bottle!' We were fighting, he wasn't understanding anything, and I wanted to give her a bottle, just to sleep a little bit, but afterwards I would just be feeling guilty [*me culpando*]. I'm not going to give a bottle. Only the breast." (Sonia, 28)

[21] Ironically, Claudinha's statement that her true motive for supplementing was the pain of breastfeeding also did not tell the entire story, as at other times she spoke of her intense dislike of the feeling and practice of breastfeeding. This will be discussed more fully, below.

Another participant, Maria Elena, 22, from the Exclusive group reported giving her baby a rice-based cereal in a bottle, which the baby vomited up: "Afterwards I was in pain [*fiquei com uma dor*], I felt guilty. I couldn't see her there, not having the breast." She decided that she would have to keep breastfeeding exclusively, since she would otherwise feel too guilty.

It was not surprising that women felt such a level of guilt, since many of them talked about breastfeeding as something that a woman *had* to do. Across all groups women expressed similar sentiments:

> "You have to give [the breast] until 3 or 4 months, and then you can stop…It's normal! You have to breastfeed." (Joana, 23)
>
> "They say that it's annoying and awful…but you have to give it." (Maria Elena, 22)
>
> "If God gives you [milk], you have to give it." (Marina, 24)

Only one woman explicitly questioned the notion that breastfeeding was important. Amaracleia, 18, said "I don't think it's so important. It's just more stress. To me, it doesn't sustain [the baby]." However, this young woman still stated that it was necessary (if not important) to breastfeed and that she planned to do so. Over the course of interviews it became clear that Amaracleia felt it was necessary to breastfeed because of the contacts she had with health personnel, but that the people in her life did not necessarily share this understanding of breastfeeding as a central aspect of "appropriate" infant care.

Community Constructions of Breastfeeding and the "Good Mother"

All participants were asked "How do people in your neighbourhood/community talk about breastfeeding?" The responses did, to some extent, reflect the position of the

participants (i.e. women in the Exclusive group reported positive community assessments slightly more often, while women in the weaned group were more likely to report negative community assessments). However, collectively the participants' responses offer a good barometer of community beliefs about breastfeeding.

The community endorsement of breastfeeding was more limited than the bio-medical endorsement. One theme that emerged was that those who most strongly advocated for breastfeeding over bottle-feeding were the elderly women in the community.

> "My grandmother, she breastfed 10 children and 4 grandchildren. She says that breastmilk gives strength [*força*]" (Silmara, 21)
>
> "They are mostly older, né? the elderly, né? who say you have to breastfeed" (Joana, 23)
>
> "Younger women say that the breasts are going to fall. [AR: *And the older women*?] Older women say that you have to give the breast" (Josilene, 24)
>
> "The older women say that it's very good. Others say that it's a lot of work" (Marina, 24)

It is interesting to note that these women are the great-grandmothers of the infants whose feeding is at stake. Taking 20 years as a generation, these great-grandmothers would have been raising their own children in the mid-1960s, the majority in the Northeastern region of Brazil. At this period, according to Scheper-Hughes, women fed their infants predominantly with breastmilk, occasionally supplemented with fresh goat's milk, but very rarely with powdered milk or other infant supplements (Scheper-Hughes 1992).

From younger friends and acquaintances, the participants reported more negative assessments of breastfeeding.

> "I have a sister-in-law who says it's awful because it hurts so much. She doesn't breastfeed anymore." (Carolina, 19)

"Most people say not to. Like my friend, she didn't breastfeed." (Amaracleia, 18)

"The majority of people don't give [the breast]. It's too much work." (Kelly, 23)

Some people even advocated expressly for giving bottles as a requirement for good infant health: "Many say that you have to give Nan or Ninho" (Paula, 18) and "Many people say to give a bottle, despite all the information. My niece did…they say that it's important to give a bottle, that breastmilk is not important." (Anita, 19). Women who ended up in the Exclusive group tended to dismiss these stories, and to judge their peers for holding these opinions, while women from the Weaned group simply reported them, without further comment.

Participants reported learning about the idiosyncratic, and potentially difficult, nature of the breastfeeding experience from the stories they heard in the community:

> "For every person it's different. It could be awful for one, and marvellous for another." (Leticia, 24)
>
> "Some people say that it hurts, others that it doesn't." (Claudinha, 15)
>
> "It depends on each mother. Some say that it's great, others that it's awful." (Selina, 21)
>
> "[A friend] said that I should definitely give the breast, that it's good. Another said it isn't good at all, and I should use a pacifier! [laughs] I said no!" (Eva, 16)
>
> "Some think that exclusive [breastfeeding] is right, some that you have to give a bottle. Some aren't aware [*não tem consciençia*] that breastmilk is important." (Débora, 24)
>
> "Some people want to but others don't bother. They say 'I'm not going to [breastfeed]. The day won't allow it'. Others say 'I want to, want to, want to', but then they try and then they have to go off to work. And it's not that easy." (Viviane, 30)

The kind of self-sacrificing notion of breastfeeding common to the "good mother" ideal came up much less often when participants were asked about community discourses on breastfeeding than biomedical ones, but they did come up.

> "Some say that it's awful because the milk gets *empedrado* [engorged], that it hurts the breast, that the nipple gets cracked [*AR: Do they say anything positive about breastfeeding?*] No…but they do say that it's better than giving a bottle." (Larissa, 21)
>
> "They say it's annoying, it's awful, but you have to give it" (Maria Elena, 22)
>
> "Only when I ask they say it's important, that I have to bear it. That's what they say when I ask" (Antônia, 21)

It is possible that participants may in part have reported the community notions that were in keeping either with their own preferred practice or, conversely, those opinions that allowed them to construct their own practice as superior. However, drawing the comments from across the groups appears to provide a good sample of opinions from the wider community. These opinions were significantly more varied than those attributed to health personnel, and were more likely to allow for difference and idiosyncrasy in women's experiences—and practices—of breastfeeding. This suggests that women would likely be able to find some segment of the population to support their infant feeding decisions. The effect of bio-medical discourse was noted above in terms of the reasons women gave for wanting to breastfeeding. The effects of contact with health professionals on women's perceptions of breastfeeding and their role as mothers will be elaborated in the following section.

Health Care Personnel Construct the "Good Mother"

Women who breastfed exclusively at 12 weeks post-partum generally had had much more contact with personnel from the clinic during the pregnancy. Women had

interacted with a variety of health professionals regarding breastfeeding. “Pregnancy Groups” were conducted in many of the clinics, and reinforced the idea of health personnel as the bearers of expert knowledge about child care (Foucault 1995). Women spoke about acquiring this expert knowledge about breastfeeding and other topics: “Yes, there was lots of information for us to learn, things that you have to learn as a first time mother” (Maria Elena, 22). Sara replied that “They showed us a lot and the nurse gave a lot of information. She talked a lot, told us how to take care of the baby. It’s good, since we’re first time mothers [laughs]” (Sara, 34). Sara was already the adoptive mother of three children, all of whom she had raised from infancy, but neither she nor the health care workers felt that she had sufficient expertise as a mother.

Similarly, Sonia, 28, who had considerable experience taking care of her nieces and nephews deferred to the expert knowledge of the health professionals, both regarding breastfeeding and other infant care tasks. In two different interviews Sonia explained how she had “learned” to give a bath properly during the pregnancy groups. Like a soldier learning the proper way to drill arms (Foucault 1995), giving a bath was broken down and taught to the women as a skill requiring precise instruction from an “expert”:

> “For me I thought it was just normal. You wash the body, you wash the head, normal. But [the nurse] showed us how to do it right. It’s the same process, but you don’t take off the clothes, you wash the head, you wash the hair, then dry it off well. Then you take the clothes off and wash the rest of the little body. Imagine being my age and not knowing how to give a baby a bath! No, I took care of my sister’s and brother’s kids, but even then, I don’t think they taught me how to give a bath like that! It was really great”

This detailed list of instruction laying out the “right” and the “wrong” way to give the baby a bath constructs the women as requiring the expert knowledge of the health care workers, in order to function as “good mothers.” Sonia’s response, “[i]magine being my

age and not knowing how to give a baby a bath!", despite having cared for many small nephews and nieces, reveals the power that this construction has for women's visions of themselves.

There was a marked difference in reports of contact with health personnel between participants from the Exclusive group and participants from the Partial and Weaned groups. Women in the Partial and Weaned groups reported that during the pregnancy they had received minimal or no information from clinic staff regarding breastfeeding, and in many cases had not attended Pregnancy Groups:

> "They didn't explain much about breastfeeding. Nobody said anything about it" (Elsa, 33)
>
> "I didn't go to the groups so I don't know [how they were]" (Lucrecia, 19)
>
> "The Group was scheduled, but no one came" (Amaracleia, 18)
>
> "No, never. I didn't have time. I only work" (Marcela, 26)

In many cases it is unclear whether these women consciously avoided pre-partum encounters with health personnel or whether the bureaucracy of the clinics allowed them to slip through the cracks. For this reason it is not possible to state that lack of contact with the health system resulted in less likelihood to breastfeed to 12 weeks, or whether some of the same life factors that led them to supplement or wean before 12 weeks also led them to avoid contact with health personnel.

Similarly, it could be argued that increased pre-partum contact with health professionals had a positive impact on breastfeeding rates, in that women who had more contact with clinic staff mostly ended up in the Exclusive breastfeeding group. At the same time, it is possible that these women were more predisposed to exclusive

breastfeeding, and also to attending the Pregnancy Groups. Even if the increased contact with the clinic was the sole factor responsible for the women's successful exclusive breastfeeding to 12 weeks, it is important to note the dynamic that the pre-partum Pregnancy Groups established/reinforced between women and health professionals. In the course of learning about the benefits of breastfeeding, women were also being taught that expert knowledge about how to care for infants is the province of health personnel, and that women must listen carefully and modify their behaviours according to what professionals say, in order to avoid censure. Having health professionals, especially doctors, in this position of power vis-à-vis women who are dealing with new infants creates imbalances that will be discussed in the following section.

Health Care Personnel Discipline the "Good Mother"

The health sector in Brazil still boasts a rigidly hierarchical structure, with the doctor at the top, then nurses, nurse auxiliaries, community health workers and para-medical personnel, and, finally, the patient or "client." Since women are schooled through pre-partum contact that the word of the doctor should be law, maternal deviance from medical recommendations is the cause for chastisement of the woman in question. A participant reported the following encounter that she observed in the maternity ward between a hospital employee and another new mother:

> "There was a woman there in the room with me, and [by hospital policy] she had to give the breast…but she was giving her baby Nan and the baby was losing weight. The woman [from the milk bank] yelled at her (*levou uma bronca nela*) and said 'Mother! You have to have patience!' and I don't know what else!…The woman said, 'No, I don't have patience. No, I'm going to give [formula]'. [The woman from the milk bank] was really mad!" (Silmara, 21)

Another participant who had weaned her son at 4 weeks had a similar interaction with a doctor in emergency care. A week or two after she had weaned her son, he became sick and had to be taken to the emergency room. “He was sick, wheezing like that…I was so worried…the doctor at the hospital emergency just said [in accusing tone] ‘Mother! What are you thinking? You’re not breastfeeding??? You’re going to kill your child! If the child dies it will be your fault!’” (Mônica, 21). Few women openly challenged the health worker’s assumption that her or she was entitled to scold the woman like a child (Lupton & Fenwick 2001). This domination by healthcare workers, albeit in less draconian form, is an experience common to women in many countries (Flacking, Ewald, & Starrin, et al. 2007; Hall & Hauck 2007; Mahon-Daly & Andrews 2002).

By contrast, some women questioned the medical advice that infants should be fed only breastmilk until six months of age. Virtually all of these women opted to avoid confrontation with health workers by giving them incomplete information about their infant feeding choices. By 2 weeks post-partum Eugenia, 21, had started supplementing her son with cream of rice in addition to breastfeeding but said she planned to tell her doctor that she was still breastfeeding exclusively. She would do this in order to avoid a being “scolded” by the doctor. She and other women who switched to Partial breastfeeding called on an alternate standard of “good mothering” reliant on the infant feeding expertise of family and community members, a strategy employed by women in other contexts as well (E. Murphy 1999).

Unplanned Pregnancy, Maternal Ambivalence and Breastfeeding

Of all the practices of motherhood, breastfeeding most closely binds the identity of “mother” to the woman’s physical body, as the woman symbolically and physically

nurtures her child. Within the Santa Marcelina network discourse constructs breastfeeding as integral to good mothering. The blurred body boundaries, reduced privacy, and altered physical and personal identity are part of what the "good mother" should be willing to take on, in her effort to properly care for her child.

Maternal Ambivalence and "Reluctant Mothers"

Among the participants there was a sub-group of "reluctant mothers," by which I mean that they did not actively desire or pursue motherhood, nor were they happy or pleased when pregnancy occurred. Rather, through various combinations of structural, cultural and personal reasons, they took on the role of mother in opposition to, rather than in fulfillment of their own desires. The ambivalence of these women towards motherhood was particularly salient, and expressed through feelings of alienation from both the child and the woman's new role. The sheer physicality and closeness of nourishing an infant at the breast made breastfeeding a focal point for maternal feelings of ambivalence despite the role of "good mother" that was strongly urged on them by public health workers and family members.

Within the sub-group some women felt such strong resistance to their pregnancy that they were willing to deal with the social and physical ramifications of illegal abortion. They were, however, prevented by the intervention of people in their lives. Lucrecia, 19, wanted to terminate her pregnancy, but stated "my boyfriend and my parents didn't let me." Similarly when describing her decision, Amaracleia, 18, said "I wanted to get rid of it because the father was going to leave me with a mouth to feed. I didn't get rid of it….because my mother wouldn't let me. I didn't want to get pregnant, but it happened. What're you going to do?"

For some women, their ambivalence towards accepting motherhood played out in a reluctance to "find out" about their pregnancy. Each month that Claudinha, 15, missed her period she told herself "it'll come next month, it'll come next month." She didn't want to believe that she was pregnant and "kept saying 'if I am I'll get rid of it, if I am I'll get rid of it.'" By the time she confirmed her pregnancy, she was 6 months pregnant. Jacira, 17, said "it wasn't even me who knew. It was the baby's father….I was already 4 months when we went to the clinic." Eva, 16, was 4 months pregnant when she confirmed that she was pregnant: "I thought I was about 1 month along. I was 3 nearly 4 months! I almost fainted! It really was a shock!"

These three women described entering a depression once they had confirmed their pregnancy, but at the same time, all three stated that they were opposed to abortion. As in many Catholic-influenced countries, in addition to being illegal, abortion is strongly frowned upon and many women feel that abortion can impair the ability to have children in the future. Eva expressed this view: "It's better to have [the baby] because God gives it to you today. Tomorrow…if you get rid of it and tomorrow you want one, you won't be able to get pregnant."

A third group of women felt that by virtue of their sexual choices they would be shirking responsibility in not accepting the child. Neuma, 19, was not enthusiastic about her pregnancy, but said "It's not the child's fault. You did it, so why should the child pay?" From the onset of pregnancy, these women were unenthusiastic about becoming mothers but they were constrained from acting, often through a complex web of legal restrictions, social norms their own personal morality.

Unreality/Disbelief

Following the birth of the baby, the ambivalence of these "reluctant" mothers' regarding motherhood persisted. The women expressed difficulty in coming to terms with their new motherly role, both in relation to their babies and as it affected their own identity. These women expressed a feeling of unreality or disbelief in the situation:

> "it was a bit strange because it's like, I'm breastfeeding her thinking 'Gosh! It's *my* daughter? Really?'… I hadn't woken up from that dream" (Eva, 16)
>
> "it's difficult to believe that she's mine" (Claudinha, 15)
>
> "You feel like 'Geez, I'm a mother! I have a daughter. I'm going to get a present on Mother's Day'" (Marina, 24)

Eva contrasted her own new understanding of the relationship between a mother and a child to that of her friends at school:

> "the girls at school [pause] being a mother isn't, like, as if you were playing with a doll! Almost! [laughing] But a doll that's alive. A doll that moves, that cries. You have to be there at her disposition, to pick her up, take care of her. It's really, like, [pause] so-so."

In Eva's comparison of her baby to a doll there remains a lingering sense of unreality, which speaks eloquently to the difficulty these women felt in engaging with their children.

The alienation that women felt extended to the shifting and changing of their own identities in their new role as mother. Claudinha described her life now as "only taking care of her…only for her" while Maria José, 19, said that "the work that a child gives, only being a mother can you know all the work that it gives." Claudinha here references the "good mother" ideal, that she should put her daughter first always, and is clearly uncomfortable with the change. For Maria Jose the change in identity felt total:

"*Everything* that I did, you know? *Everything* that I was before, today I'm not anymore" (emphasis added). When talking about her negative feelings about her body and appearance, she again drew a connection to her newfound status "ish! Now I think I'm the worst of the worst…before…oh I don't know. Now I'm nothing more than a mother. Life is really different." For Eva, since becoming a mother she feels "like, imprisoned, alone, you know? Like, as if there was an emptiness inside me." While trying to live up to the role that they have taken on, the women had trouble relating to the baby as theirs and integrating their new role into their perception of themselves.

Breastfeeding as an Embodied Practice

The women's ambivalence already evident in the quotes above became particularly prominent when they discussed breastfeeding, a practice that is consistently tied to images of the good mother within the Santa Marcelina clinics and popular discourses in Brazil. These women were trying to follow the advice of doctors, nurses and friends, and to conform themselves to their new role by breastfeeding, but found it difficult to accept the multiple constraints that the practice placed on them.

Firstly, the breastfeeding body becomes differently marked and differently regarded during breastfeeding, a process which can unsettle a woman's previous perceptions of herself (Chodorow 2003; Sandre-Pereira 2003). In the case of these participants, most were very young women and were undergoing a rapid transition from adolescent to mother, which was emphasised for them by a change in the way they and others viewed their breasts. When asked about how her life had changed since her daughter's birth, Maria Jose's very first comment was "Now my breasts aren't just for me, né?" Her breastfeeding meant that she had to share her body with her baby. As

mentioned above, Maria Jose felt that she had become "nothing more than a mother." When asked how she thought about her breasts since the pregnancy Claudinha, 15, said

> "Now…well, I don't want to say that it's public! [laughs] It's not. But…it's not an intimate thing for anyone. If there's someone in the house, you have to just take it [the breast] out, and that's it! Any place. I was embarrassed until she was about a month old. My mum was mad because I was hiding from her. She said everything that I have she has, so why hide?"

Here, Claudinha's mother was trying to be supportive, to help Claudinha become comfortable breastfeeding, but her words asserted something else as well; as a woman breastfeeding a baby, Claudinha did not have the usual prerogative to decide who would see her breasts and when. Claudinha's account suggests that she felt her body boundaries and her privacy were infringed upon as a function of her role as a breastfeeding mother. The potential for family members to impinge on women's breastfeeding and bodily practice is a common theme among experiential studies of breastfeeding (Mahon-Daly & Andrews 2002; Marshall, Godfrey, & Renfrew, et al. 2007).

Many of the women expressed discomfort, both physical and emotional, with the act of breastfeeding, but, as expressed by Marina (below) felt that breastfeeding was something that had to be endured for the sake of the baby:

> "it hurts a lot. Your breasts are really sensitive. The baby spends the whole night on the breast. You have to bear it…you have to breastfeed, né?" (Marina, 24)

> "It was okay. It wasn't that easy or that difficult. Then my breast got engorged and I couldn't stand it. When that passed, it was good…like, it was okay" (Eva, 16)

> "at the beginning it was really difficult. I didn't really have any expectations, because for me it was all a novelty, but at the beginning it was really difficult. At the beginning it hurt, I was swollen, I had to stay up all night" (Maria Jose, 19)

Kelleher has argued that among breastfeeding women emotional and psychological states were linked to their physiological condition (Kelleher 2006). Among women in São Paulo women's discomfort with motherhood due to the unplanned nature of their pregnancies shaped the way that physical discomforts were perceived and dealt with.

The physical discomforts of breastfeeding were difficult to deal with, but perhaps less so than the more amorphous discomfort referenced by Neuma and Claudinha. Neuma, 19, disliked breastfeeding her baby, though she had difficulty expressing exactly why "Oh I don't know, I think it's strange. I don't like it at all. She stays there sucking the breast [pause] Sometimes it hurts." Claudinha also had trouble expressing her dislike: "I don't know why but I didn't like it at all. It's a thing that makes you feel strange. Her there… It's strange. I don't know how to explain myself, you know? I don't feel very good."

These latter quotes speak to psychological discomfort tied to the presence of the baby at the breast and the physicality of the breastfeeding encounter. Women in industrialised countries report this discomfort with the act of breastfeeding as an invasion of bodily limits (Marshall, Godfrey, & Renfrew, et al. 2007; Schmied & Lupton 2001) or an unwanted sense of physicality (C. Britton 1998), although no experiential study has reported on the connection to unplanned pregnancy.

Interacting with the physical and psychological challenges above, was the never-ending demand that the breastfeeding infant placed on the women. The women all voiced similar complaints:

> "she'd breastfeed a lot, a lot and still be hungry" (Marina, 24)

> "she never lets me stop. She sucked to the point that nothing came out at all" (Irene, 30)

> "he stayed breastfeeding the whole night!" (Cleonice, 18)
>
> "I feed feed feed, she sucks sucks sucks and she still wants more!...she only stops crying to open her mouth [to feed]" (Amaracleia, 18)

Like women in other contexts (Lupton 2000), these women perceived their infants as continually demanding attention and energy, physically and emotionally draining the mother, far beyond the point that they ought to have been satisfied.

When faced with this set of challenges, the women in this sub-group made the decision to cease or limit their breastfeeding, in the face of censure from health care workers and family, and earlier than they had planned to. Some of the participants who exemplified this conflict and decision-making process were Lucrecia and Amaracleia, who switched to formula feeding before 1 month, and Marina and Maria Jose, who switched by 2 months. In contrast, despite experiencing intense discomfort from breastfeeding Neuma and Claudinha indicated that they felt obligated to continue breastfeeding until 6 months, the minimum age recommended by health workers, but still did introduce supplementary foods ahead of schedule. The women profiled here became mothers unwillingly, embedded in a set of social structures, relations and narratives that placed them at a disadvantage when trying to conform to the ideal of the good mother. When faced with shifting identities, physical and psychological discomfort and intolerable demands, narrative analysis indicates that they had a more difficult time conforming themselves to the "good mother" ideal.

Chapter Summary

This chapter has reviewed some of the key ethnographic data drawn from interviews with participants. The construction of the "good mother" ideal, and the

resistance to that ideal by a group of participants who had become pregnant unintentionally were discussed in detail. In the following chapter, Chapter IX, the implications of this data will be discussed, in connection with the biological results from Chapter VII, and in conversation with the wider breastfeeding literature.

CHAPTER IX

SUMMARY, IMPLICATIONS AND FUTURE DIRECTIONS

This final chapter of the dissertation restates the overarching research question and reviews the main methods used to investigate this question. The main sections of this chapter review the key results of the study and discuss their implications for anthropological theory and practice, as well as for public health programming in São Paulo. The chapter closes with an outline of future research to be undertaken.

Review of Research Objective and Methodology

The objective of this research was to draw on biological and ethnographic data to examine a central question: what stressful life experiences (structural, cultural, experiential) lead women from the Eastern Zone of São Paulo to supplement and/or wean their infants before 12 weeks post-partum when they planned to breastfeed for longer? This approach places the biological aspects of lactation in direct interaction with women's experiences of breast feeding. From this perspective, we can examine the interconnections between life conditions and events, biological processes, and eventual breastfeeding outcome.

The research reported here used a bio-experiential theoretical approach designed to examine multiple factors that influence breastfeeding. Demographic information, biological data (oxytocin and Epstein-Barr Virus antibodies) and ethnographic data were collected using a combined qualitative-quantitative methodology in order to begin to understand the impact of the various factors on breastfeeding outcome. Some of the key findings from analysis of this data are presented in the following section.

Summary of Results

The study investigated the question of breastfeeding cessation from a variety of angles. In this section, the central results drawn from each type of analysis (statistical, biological and ethnographic) will be summarised.

Statistical Analyses

Statistical analyses of social and structural factors revealed that this group of women, who were breastfeeding for the first time, were largely young and economically disadvantaged. Many were single mothers who had not intended to become pregnant, were unemployed, had minimal levels of education and were living with parents.[22] In the multi-variate analyses age and unplanned pregnancy proved to be important factors predicting breastfeeding outcome.

Hypothesis Testing

Four explicit hypotheses regarding breastfeeding outcome at 12 weeks were tested statistically. The hypothesis that oxytocin (OT) suppression due to stress is the mediating link between life stress and breastfeeding had previously been identified as a fruitful avenue for biocultural anthropology (Allen & Pelto 1985), as well as for research in biology (Lau 2001). In the current project, three hypotheses were designed to test the predicted relationship between OT and stressful experiences of day-to-day life. The first two hypotheses predicted that women with more stressful day-to-day life experiences would have lower OT levels. The first of these two hypotheses examined OT level in relation to self-reported stress scores and structural factors associated with stressful day-to-day life experiences. The second tested the relationship of a biological indicator of

[22] As mentioned in Chapter VI, the women themselves identified living with parents as a negative rather than positive situation; their idealised "established" woman has a home of her own and lives with a partner.

stress (EBV-ab) with OT level. The third hypothesis regarding OT tested the prediction that women with lower OT levels would be more likely to fall into the weaned category at 12 weeks post-partum.

The three hypotheses regarding OT were all rejected. It seems clear that day-to-day stressful experiences do not suppress OT levels in the way that was predicted from studies of acute stress. Briefly leaving aside the hypothesis regarding EBV-ab, I would like to examine the other two OT related hypotheses. Rather than these hypotheses simply being disproved and there being *no* association between OT and stress, it appears that the relationship was found to be the inverse of what was predicted. *Higher* levels of self-reported stress were associated with *higher* OT. This finding echoes the work of Taylor and colleagues (2006) and of Turner and colleagues (1999) who found that in women OT levels are higher among women who experience certain types of interpersonal stress. As in other studies, among the participants in the present study higher OT levels appeared to be associated with stressful interpersonal life experiences, but not with the other stressful experiences that they reported, such as diminished/low self-esteem, lack of sleep or financial troubles.

In Hypothesis 3, the direction of the association between OT level and breastfeeding outcome was also the opposite of that predicted: higher OT was associated with a *lower* likelihood of breastfeeding to 12 weeks post-partum. Looking at the outcome of Hypothesis 4, we may see the explanation for this. Hypothesis 4, that women with higher reported stressful experiences would be more likely to wean by 12 weeks was supported by the data: stressful life experiences did show a strong association with breastfeeding outcome at 12 weeks. If, as suggested above, OT levels mark women's

exposure to stressful day-to-day experiences (specifically those from interpersonal relationships), it would therefore make sense that the direction of association between OT and breastfeeding outcome would be the same as that between reported stressful experience and breastfeeding outcome.

Returning to Hypothesis 2— that increased EBV-ab levels will be associated with decreased OT levels—given the positive association shown between OT and reported stressful experience in Hypothesis 1, a similar positive association might be expected. However, this hypothesis was also rejected: a complete lack of association between EBV-ab and OT was found. Since OT *was* associated with higher self-reported interpersonal stress, it therefore appears that EBV-ab is *not* associated with such stress. In practical terms, this suggests that HPA activation was not occurring in response to the stressful lives of these women, and so EBV-ab were not being reactivated. It is unclear whether the lack of association between EBV-ab and reported stressful life circumstances is due to the *type* of stress, the *degree* of stress, to a possible suppression of cortisol by the pulsatile OT released during breastfeeding or to some other effect. Nonetheless, the results of this study suggest that EBV-ab levels may not function as a biomarker of stressful life experience among breastfeeding women in the way that it has been shown to in other groups (McDade, Stallings, Angold, et al. 2000).

This failure of EBV-ab to register life stresses that were clearly visible through other means (self-reports, mental health scales, OT levels), suggests that it will be important in future to carefully break down the concept of "stress," if we hope to study biomarkers of stressful life experience. By teasing apart the effects of interpersonal, mental health related and physical stress (e.g. heavy work load), we can hope to gain a

more complex understanding of the effects of experiences on the stress systems of the embodied subject.

Ethnographic Analyses

This study was innovative in using an experiential, ethnographic method to understand women's decision-making about infant feeding. To date virtually all research of this type has been done in just a handful of countries, all industrialised (Choi, Henshaw, Baker, et al. 2005; Flacking, Ewald, & Starrin, et al. 2007; Marshall, Godfrey, & Renfrew, et al. 2007; Nelson & Sethi 2005; Shelton & Johnson 2006). The ethnographic data collected in this study provided a rich context for the statistical results and shed light on possible reasons that women stopped breastfeeding before 12 weeks post-partum. The bio-medicalisation of breastfeeding and its implication in the "good mother" discourse revealed whole arenas of self-inflicted and externally-imposed stress and guilt related to infant care. Deference to the expertise of medical personnel on the part of women was revealed to be widespread, while resistance to this domination was mostly passive and silent, rather than active and vocal. Women who had become pregnant unintentionally and who fell into the "reluctant mother" category discussed themes of ambivalence towards the new role they were playing as a mother, and towards breastfeeding as the quintessence of that new role.

Bio-Experiential Approach: Putting the Results Together

A bio-experiential theory asserts that the wide-ranging results of these differing forms of analysis, when used collectively, should contribute to a more complete understanding of the question of breastfeeding duration in the lives of women in the Eastern Zone of São Paulo. This section will briefly discuss the ways that the results of

these different types of analysis inform and reinforce one another, and promising avenues for future bio-experiential work.

In the current study the significance of unplanned pregnancy for exclusive breastfeeding duration was where the quantitative and qualitative results came together most effectively. The exclusive breastfeeding risk curve showed a dramatic decline for women who had become pregnant unintentionally compared to those who had planned pregnancies. Women who had not planned their pregnancy told stories of depression, denial and rejection of the pregnancy. They shared their continuing sense of unreality and, at times, lack of connection with their baby. Most significantly, these women told stories of intense discomfort—both physical and psychological—with breastfeeding. These women who became mothers reluctantly had even greater difficulty surmounting these challenges than other first time mothers. As was shown in Chapter VIII, women who had planned the pregnancy were already in a better position to claim "good mother" status, since they were more likely to conform to the Brazilian ideal for a first time mother (correct age, stable partnership, own home, etc). Thus, these women were more invested in living up to and enforcing the recommended length of breastfeeding than women who were already far from the "good mother" ideal by virtue of their circumstances. In a context where breastfeeding is tied to being a "good mother" this latter group of women was at a disadvantage from the very beginning. Since planned pregnancy and financial circumstances were closely associated, labelling women as bad mothers due to their infant feeding decisions served to perpetuate existing inequalities.

In exploring the impact and meaning of unplanned pregnancy on breastfeeding duration, the combination of statistical analysis of structural factors and ethnographic

data was successful. Each type of data influenced the interpretation of the other. But is there truly a place for biological data? In spite of the rejection of the biological hypotheses laid out at the beginning of this research project, I would argue that the potential of the bio-experiential approach is supported. From a practical standpoint, I argue this on the basis that the rejection of the hypotheses regarding OT was not based on a *lack* of association, but rather an association in the opposite direction from that which was predicted. When put in context of other work that has identified OT as marker of stress in women (S. E. Taylor, Klein, Lewis, Gruenewald, Gurung, & Updegraff 2000; S. E. Taylor, Gonzaga, Klein, Hu, Greendale, & Seeman 2006; R. A. Turner, Altemus, Enos, et al. 1999) the findings of this study actually indicate a relationship between OT and stressful life experience that may be useful to future analyses.

Potentially, OT could be used to provide a separate measure of stress as expressed biologically in a woman's body that would complement self-reports. The usefulness of OT as a biomarker of stress among nursing women is of increased importance given the finding that EBV-ab levels do not serve as a biological marker of stressful experience in this population. Drawing on biological data would contribute to a more complete understanding of on-going experience of the embodied subject in the world, and destabilise the idea of the inert, "natural" body in favour of a sensing, responsive body-subject.

Implications for Public Health and Breastfeeding Promotion

With regard to unplanned pregnancy as a risk factor for early introduction of supplemental foods larger questions about the economic marginalisation of women (and men) in these communities need to be considered in breastfeeding promotional programs.

Young women who have little hope for a fulfilling life may make sexual choices that are not in their own best interest (Hoga 2008; Hoga 2008; Rosengard, Pollock, Weitzen, Meers, & Phipps 2006) and often find themselves "reluctant mothers," as characterised in Chapter VIII. Young men who have few prospects may be more unwilling to provide support and care to a partner and child than less economically disadvantaged young men (Hoga & Manganiello 2007). Among the 50 women in the current study who reported their monthly income, lower monthly per capita income was predictive both of likelihood of having weaned by 12 weeks, and of how long in those 12 weeks the woman breastfed. Breastfeeding programs in São Paulo should take these effects of economic marginalisation into consideration in their breastfeeding programming.

Implications for Breastfeeding Promotion in the Santa Marcelina Foundation

The Santa Marcelina Foundation (SMF) and other such organisations combat inequality daily by providing free health care services to a generally underserved and impoverished population. The commitment on the part of the administration and many of the doctors and nurses of SMF to caring for the health of this population is genuine. However, SMF's breastfeeding programming can in some cases reproduce these inequalities, by ignoring the ways that inequality, acting on the embodied subjectivity of young women, impacts decisions about breastfeeding. Breastfeeding is intensely promoted in the SMF network. As in other contexts (Marshall, Godfrey, & Renfrew, et al. 2007; Stearns 1999), a great deal of this promotion is based on an idealised "good mother" who is willing to sacrifice herself for her child on the basis of expert advice and recommendations. The current study has clearly demonstrated the way in which factors that have antecedents in structural inequalities (unplanned pregnancy, monthly income

per capita) strongly influence women's decisions about breastfeeding, in combination with other personal factors.

While evidence overwhelmingly indicates that breastfeeding offers benefits for infant health and growth (as well as benefits for women's own health), health professionals need to become conscious of the ways that structural inequalities such as these impinge on women's embodied experience of breastfeeding—often in ways that make the ideal of being a "good mother" difficult or impossible to attain. When an entire group of women (those with unplanned pregnancies) are found to have a significantly higher likelihood to wean, and those women also describe their experiences of breastfeeding and motherhood with great ambivalence, it seems clear that these inequalities are influencing the experience and practice of the women.

Health workers need to be conscious of and conscientious about the tactics they use to encourage breastfeeding. The starting point should be one of mutual respect and autonomy for women. Women have a right to determine what they do with their bodies when lactating, as at other times, and their infant-feeding decisions should be respected.

If unplanned pregnancy is one of the most important factors increasing the likelihood that women will supplement, the solution is not to chastise and judge the individual. Neither is educating women who become pregnant unintentionally about the benefits of breastfeeding a panacea, despite the conclusions of some breastfeeding researchers (J. S. Taylor & Cabral 2002). Instead, resources could be better spent to improve access to contraceptives among young women, especially teenagers (Guilhem & Azevedo 2007), while educational efforts should be targeted towards sex education, and fertility awareness.

Future Research

During a two-year post-doctoral fellowship, I will be conducting follow-up research among low-income women from the Eastern Zone of São Paulo, Brazil. I will continue to use a bio-experiential approach to examine factors and co-factors in the relationship between unintended pregnancy, maternal ambivalence, and breastfeeding duration. The central aim of the proposed research is to investigate how women's experiences with unintended pregnancy serve as one cause of early breastfeeding cessation and the effect of this on infant health.

The project will again combine quantitative and ethnographic research to accomplish four main objectives. First, to explore the cultural, social and economic significance of unintended pregnancy in the wider community, to understand the magnitude of the issue in the lives of low-income women in São Paulo. Second, to determine through which channels unintended pregnancy influences the pattern of breastfeeding, the timing of introduction of supplementary infant foods, and the timing of weaning. Third, to investigate factors that may mediate the association between unintended pregnancy and breastfeeding practice. Fourth, to examine growth and morbidity over the first six months of life, among infants from intended and unintended pregnancies, to measure the effect of differing breastfeeding patterns on infant health.

Although the focus of my doctoral research was the impact of stressful life experiences on hormonal levels, unintended pregnancy emerged as a category of great importance in the lives of these participants and an important factor impacting breastfeeding choices and behaviour. Additionally, structural factors were implicated both in women's likelihood of experiencing an unplanned pregnancy and in their

likelihood to breastfeed to 12 weeks. During my post-doctoral research, I will build on the knowledge, language skills and connections that I developed during my doctoral research in the SMF network. Through my previous research in the area, I have established contacts at clinics throughout the network and gained familiarity with the challenges faced by women in this region, both generally and in the context of breastfeeding.

My post-doctoral research will expand on the information collected in my dissertation in several ways. In my postdoctoral research, women's voices and choices will be central to the investigation, but, to understand the context and salience of unintended pregnancy more fully, I will incorporate data collected from the larger community in addition to the narratives of individual women. I will widen my focus to examine whether women with intended and unintended pregnancies show different patterns of breastfeeding, not solely whether the duration of breastfeeding varies. Finally, I will incorporate data on health and growth differentials between infants of intended and unintended pregnancies, in order to examine the ultimate impact of differential breastfeeding practices on infant health in the first six months of life.

APPENDIX A

TABLES

Table 6.1: Frequency distribution—recruitment by clinic

Clinic Code	Frequency	Percent
JB	4	6.2
JC	11	16.9
PSR	19	29.2
RB	15	23.1
ST	4	6.2
VCN	12	18.5
Total	65	100.0

Table 6.2 Marital Status* Planned vs. Unplanned Pregnancy cross-tabulation

		Planned Pregnancy		
Single vs. Partnered status		No	Yes	Total
Single				
	N	24	0	24
	Percent	100.0%	0%	100.0%
"Together"				
	N	11	4	15
	Percent	73.3%	26.7%	100.0%
Married				
	N	9	17	26
	Percent	34.6%	65.4%	100.0%
Total				
	N	44	21	65
	Percent	67.7%	32.3%	100.0

Table 6.3: Descriptive Statistics for OT levels 2-12 weeks post-partum

	Samples available	Percent of participants with associated sample	Mean OT value of samples	Standard Deviation
OT level 2 weeks post-partum	28	44%	97.84	46.57
OT level 4 weeks post-partum	34	54%	108.41	48.83
OT level 6 weeks post-partum	26	41%	107.47	82.08
OT level 8 weeks post-partum	25	40%	130.71	123.70
OT level 10 weeks post-partum	33	52%	88.43	48.13
OT level 12 weeks post-partum	25	40%	93.20	32.15
Mean OT level weeks 2-12 post-partum	59	94%	104.86	63.77

Table 6.4: EBV-ab titres at each interview from 2-12 weeks post-partum

	N	Mean	Standard Deviation
EBV level 2 weeks post-partum	43	66.55	55.01
EBV level 4 weeks post-partum	51	79.82	71.16
EBV level 6 weeks post-partum	51	79.45	64.45
EBV level 8 weeks post-partum	53	86.89	71.11
EBV level 10 weeks post-partum	52	84.91	77.27
EBV level 12 weeks post-partum	48	91.98	91.34
Mean EBV level 2-12 weeks post-partum	60	83.74	43.90
Log of mean EBV level 2-12 weeks post-partum	60	1.85	0.26

Table 6.5: Descriptive statistics for Composite, Cohen and 10-point stress scales

Variable	N	Mean	Standard Deviation
Composite scale mean score 2-12 weeks	61	32.39	4.16
Cohen Stress scale	36	15.90	6.58
10-point stress scale mean score 2-12 weeks	61	4.92	2.19

Table 6.6 Breastfeeding Outcome at 12 weeks post-partum

Outcome	Frequency	Percent
Exclusive/Predominant	36	59.0
Partial	11	18.0
Token/Weaned	14	23.0
Total	61	100.0

Table 6.7: Pre-partum Breastfeeding Intention

How long will you breastfeed?	Frequency	Percent
< 6 months	9	13.9
6 months+	42	64.6
baby-driven	8	12.3
milk-driven	5	7.7
Undecided	1	1.5
Total	65	100.0

Table 6.8: Breastfeeding Intention Pre-partum * Breastfeeding Mode at 12 weeks post-partum cross-tabulation

Breastfeeding Intention Pre-partum	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
< 6 months	2 25.0%	5 62.5%	1 12.5%	8 100.0%
6 months+	26 65.0%	6 15.0%	8 20.0%	40 100.0%
Baby-driven	6 75.0%	0 0	2 25.0%	8 100.0%
Milk-driven	2 40.0%	0 0	3 60.0%	5 100.0%
Total	36 59%	11 18%	14 23%	61 100.0%

Fisher's Exact p=.020

Table 6.9: Positive/Negative Breastfeeding Intention Pre-partum * Breastfeeding Mode at 12 weeks post-partum cross-tabulation

Breastfeeding Intention Pre-partum	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
Positive Expectation	32 66.7.0%	6 12.5%	10 20.8%	48 100.0%
Negative Expectation	4 30.8%	5 38.5%	4 30.8%	13 100.0%
Total	36 59%	11 18%	14 23%	61 100.0%

Fisher's Exact p=.032

Table 6.10: Regression of mean OT on mean EBV-ab titres

Equation	Model Summary					Parameter Estimates			
	R Square	F	Df	df2	Sig.	Constant	b1	b2	b3
Linear	.001	.029	1	56	.866	1.944	.017		
Quadratic	.008	.231	2	55	.795	2.646	-.786	.224	
Cubic	.011	.296	2	55	.745	2.251	.000	-.277	.103

Dependent variable mean OT value 2-12 weeks post-partum (log)
Independent variable mean EBV level 2-12 weeks post-partum (log)

Table 6.11: Correlation of stress scale scores and EBV-ab titres

	Stress scale score	Cohen stress scale score	Composite stress scale score	Mean EBV level 2-12 weeks post-partum (log)
Stress scale score				
Pearson Correlation	1	.468**	-.548**	-.203
Significance		.005	.000	.127
N	61	35	59	58
Cohen stress scale score				
Pearson Correlation		1	-.671**	-.162
Significance			.000	.367
N		36	35	33
Composite stress scale score				
Pearson Correlation			1	.109
Significance				.414
N			61	58
Mean EBV level 2-12 weeks post-partum (log)				
Pearson Correlation				1
Significance				
N				60
**Correlation is significant at the 0.01 level (2-tailed)				

Table 6.12: ANOVA of mean OT level weeks 2-12 weeks (log) by Breastfeeding Outcome

Breastfeeding mode at 12 weeks (1)	Breastfeeding mode at 12 weeks (2)	Mean difference (1-2)	Standard Error	Sig.	95% Confidence Interval	
					Lower	Upper
Exclusive/Predominant	Partial	-.03485	.06433	.590	-.1637	.0940
	Token/Weaned	-.17567*	.05823	.004	-.2923	-.0590
Partial	Exclusive/Predominant	.03485	.06433	.590	-.0940	.1637
	Token/Weaned	-.14083	.07569	.068	-.2925	.0108
Token/Weaned	Exclusive/Predominant	.17567*	.05823	.004	.0590	.2923
	Partial	.14083	.07569	.068	-.0108	.2925

Dependent variable mean OT level 2-12 weeks (log)
* the mean difference is significant at the .05 level

Table 6.13: t-test comparison of mean OT level weeks 2-12 by Breastfed vs. Weaned Outcome

Mean OT level 2-12 weeks (log)	t-test for Equality of Means					
	t	df	Sig. (2-tailed)	Mean diff.	95% confidence interval of the difference	
					Lower	Upper
	-2.746	59	.008	-.15901	-.27490	-.04313

Table 6.14 Cross-tabulation Ideal vs. Non-Ideal age* Breastfeeding Outcome at 12 weeks

Age categories	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
Ideal* (19-30) N Percent	22 73.3.0%	2 6.7%	6 20.0%	30 100.0%
Non-ideal (under 19, 30+) N Percent	14 45.2.0%	9 29%	8 25.8%	31 100.0%
Total N Percent	36 59.0%	11 18.0%	14 23.0%	61 100.0%

χ^2=6.503, p=.039

Table 6.15 Cross-tabulation Pregnancy planned? *Breastfeeding Outcome at 12 weeks

Pregnancy planned?	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
No N Percent	20 48.8%	8 19.5%	13 31.7%	41 100.0%
Yes N Percent	16 80.0%	3 15.0%	1 5.0%	20 100.0%
Total N Percent	36 59.0%	11 18.0%	14 23.0%	61 100.0%

Fisher's Exact p=.034

Table 6.16 Cross-tabulation Marital status*Breastfeeding Outcome at 12 weeks

Marital Status	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
Single				
N	11	5	7	23
Percent	47.8%	21.7%	30.4%	100.0%
"Together"				
N	8	0	5	13
Percent	61.5%	0	38.5%	100.0%
Married				
N	17	6	2	25
Percent	68.0%	24.0%	8.0%	100.0%
Total				
N	36	11	14	61
Percent	59.0%	18.0%	23.0%	100%

Fisher's Exact p=.057

Table 6.17 Cross-tabulation Living with Partner*Breastfeeding Outcome at 12 weeks

Living with Partner	Breastfeeding Mode at 12 weeks post-partum			Total
	Exclusive	Partial	Weaned	
No				
N	7	5	7	19
Percent	36.8%	26.3%	36.8%	100.0%
Yes				
N	29	6	7	42
Percent	69.0%	14.3	16.7%	100.0%
Total				
N	36	11	14	61
Percent	59.0%	18.0%	23.0%	100%

Fisher's Exact p=.059

Table 6.18 Cross-tabulation Breastfeeding Outcome at 12 weeks*Post-partum Depression Risk at 2 weeks post-partum

Breastfeeding Mode at 12 weeks post-partum	Post-partum Depression Risk (2 weeks post-partum)		Total
	Not at Risk (0-11)	At Risk (12+)	
Exclusive			
N	28	8	36
Percent	77.8%	22.2%	100%
Partial			
N	7	3	10
Percent	70.0%	30.0%	100%
Weaned			
N	8	5	13
Percent	61.5%	38.5%	100%

Fisher's Exact p=.5493

Table 6.19 Cross-tabulation Breastfeeding Outcome at 12 weeks*Post-partum Depression Risk at 12 weeks post-partum

Breastfeeding Mode at 12 weeks post-partum	Post-partum Depression Risk (12 weeks post-partum)		Total
	Not at Risk (0-11)	At Risk (12+)	
Exclusive			
N	25	9	34
Percent	73.5%	26.5%	100%
Partial			
N	8	2	10
Percent	80.0%	20.0%	100%
Weaned			
N	2	7	9
Percent	22.2%	77.8%	100%

Fisher's Exact p=.011

Table 6.20: MLR Parameter estimates

Breastfeeding mode at 12 weeks (the reference category is Exclusive and Predominant)	df	Sig.	Exp(B)	95% confidence interval For Exp(B)	
				Lower	Upper
Partial					
Intercept	1	.827			
Unplanned pregnancy	1	.237	3.980	.403	39.263
Planned pregnancy	0[a]	.	.	.	.
Positive Breastfeeding intention pre-partum	1	.015	.106	.017	.647
Negative Breastfeeding intention pre-partum	0[a]	.	.	.	.
Age	1	.998	1.000	.819	1.222
Mean OT level weeks 2-12	1	.755	.996	.969	1.023
Birth weight	1	.698	1.000	.998	1.001
Token and Weaned					
Intercept	1	.281			
Unplanned pregnancy	1	.014	280.602	3.117	25263.874
Planned pregnancy	0[a]	.	.	.	.
Positive Breastfeeding intention pre-partum	1	.256	.244	.021	2.784
Negative Breastfeeding intention pre-partum	0[a]	.	.	.	.
Age	1	.014	1.450	1.079	1.949
Mean OT level weeks 2-12	1	.019	1.035	1.006	1.066
Birth weight	1	.021	.996	.993	.999

a. This parameter is set to zero because it is redundant.

Table 6.21: BLR best fit model Breastfed vs. Weaned outcome

	df	Sig.	Exp(B)	95% confidence interval For Exp(B)	
				Lower	Upper
Mean score Financial situation weeks 2-12	1	.095	3.957	.788	19.862
Age	1	.003	1.606	1.177	2.192
Unplanned pregnancy	1	.009	330.698	4.256	25969.998
Mean OT level weeks 2-12	1	.014	1.056	1.011	1.102
Birth weight	1	.032	.996	.993	1.000
Constant	1	.037	.000		

Table 6.22: Cox Regression model for Breastfeeding Survivorship

	df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Mean score Financial situation weeks 2-12	1	.024	4.771	1.234	18.444
Age	1	.000	1.450	1.202	1.750
Unplanned pregnancy	1	.008	29.588	2.422	361.395
Mean OT level weeks 2-12	1	.000	1.020	1.009	1.030
Interpersonal components	1	.001	.392	.392	.671

Table 6.23: Cox Regression model for Exclusive breastfeeding survivorship

	Df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Age	1	.026	1.079	1.009	1.155
Unplanned pregnancy	1	.017	4.206	1.297	13.644
Interpersonal components	1	.033	.765	.598	.978

Table 6.24: BLR Breastfed vs. Weaned status, controlling for Monthly Income (n=50)

	df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Age	1	.010	1.315	1.069	1.619
Unplanned pregnancy	1	.052	22.767	.975	531.497
Mean OT level 2-12 weeks	1	.077	1.025	.997	1.053
Constant	1	.003	.000		

Table 6.25: BLR Breastfed vs. Weaned status, controlling for Monthly Income per capita (n=50)

	df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Age	1	.015	1.869	1.130	3.091
Monthly Income per capita	1	.027	.978	.960	.998
Mean OT level 2-12 weeks	1	.176	1.028	.988	1.070
Constant	1	.016	.000		

Table 6.26: Cox Regression model for Time to Weaning—controlling for Monthly Income per capita (n=50)

	df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Monthly Income per capita	1	.010	.983	.971	.996
Age	1	.002	1.577	1.181	2.105

Table 6.27: Cox Regression model for Time to Supplementation—controlling for Monthly Income per capita (n=50)

	df	Sig.	Exp(B)	95% confidence interval for Exp(B)	
				Lower	Upper
Unplanned pregnancy	1	.012	5.495	1.459	20.689
Age	1	.037	1.086	1.005	1.174

APPENDIX B

FIGURES

Figure 2.1: Anatomy of the breast (redrawn from Ramsay et al 2005)

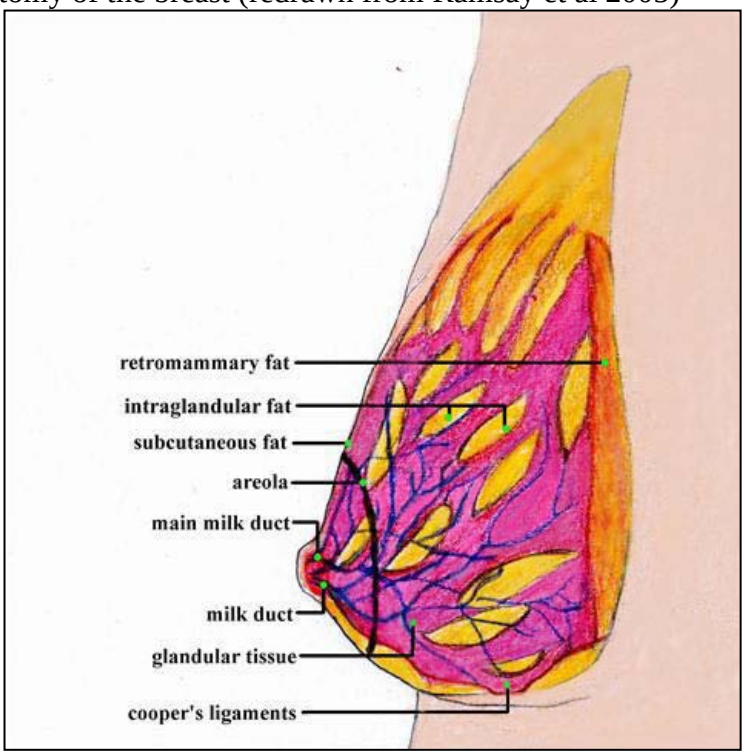


Figure 5.1 Epstein-Barr antibody ELISA plate showing sample aliquot pairs

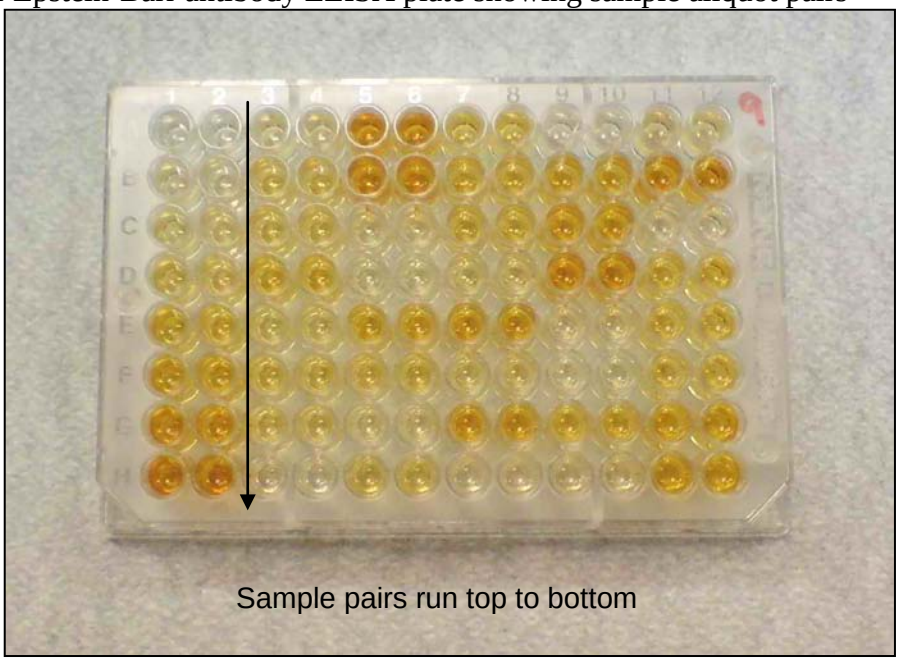
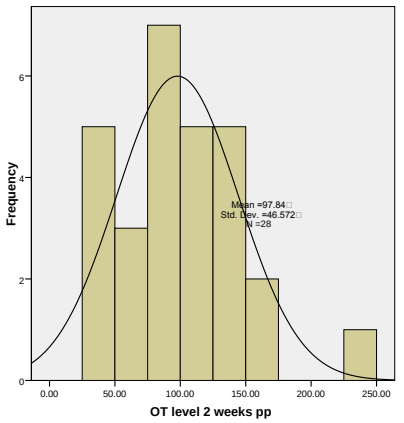
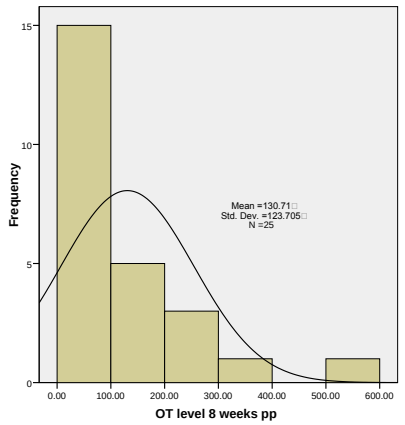


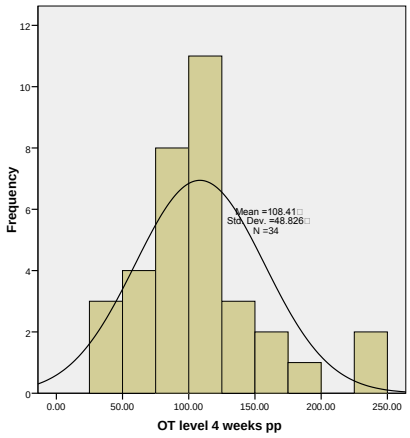
Figure 5.2: “Breastfeeding Week” display. Caption—“No to Industrial Feeding/Babies who nurse at the breast are well protected against illnesses like colic, pneumonia and skin infections/Your healthy and happy child is a baby who nurses at the breast/An act of LOVE. Breastfeed your child…at least until 6 months at minimum.”

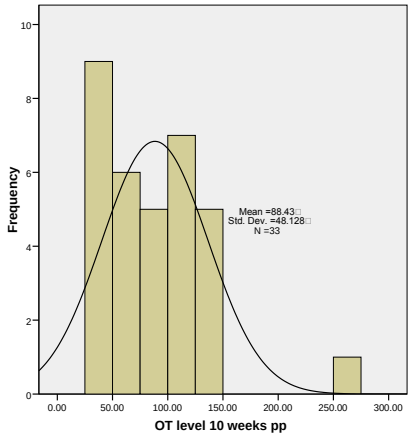
Figure 5.3: “Breastfeeding Week” display. Caption—“I’m a healthy and happy baby. I was fed only with breast milk until 6 months of life!/Say No to Industrial Feeding”

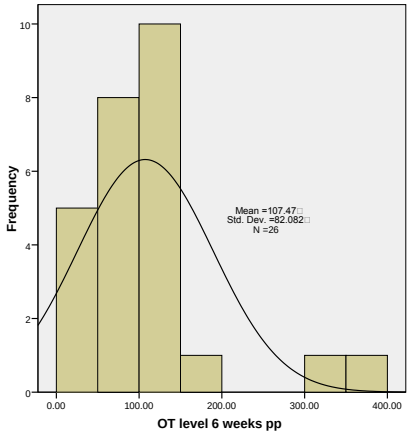
Figure 5.4–5.9: Untransformed distribution of OT levels at 2-12 weeks post-partum











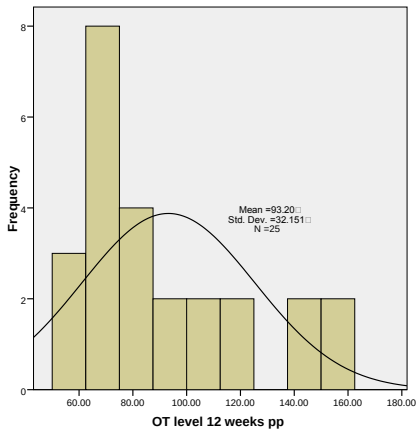


Figure 5.10 Untransformed distribution of OT levels at 8 weeks post-partum

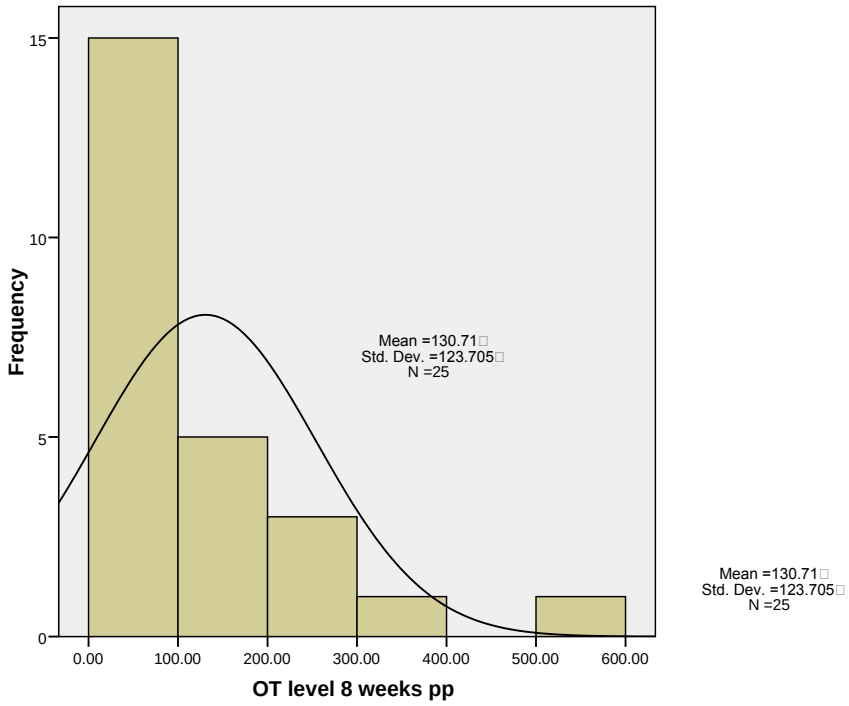


Figure 5.11 Log-transformed distribution of OT levels at 8 weeks post-partum

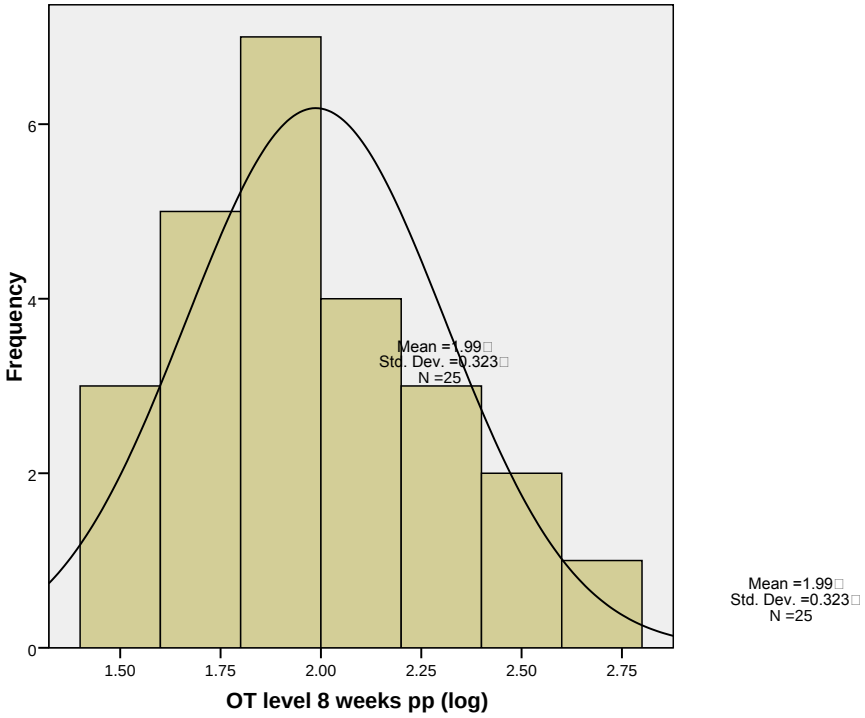


Figure 6.1: Curve estimation—relationship between Ponderal Index at Birth and maternal Body Mass Index at 2 weeks post-partum

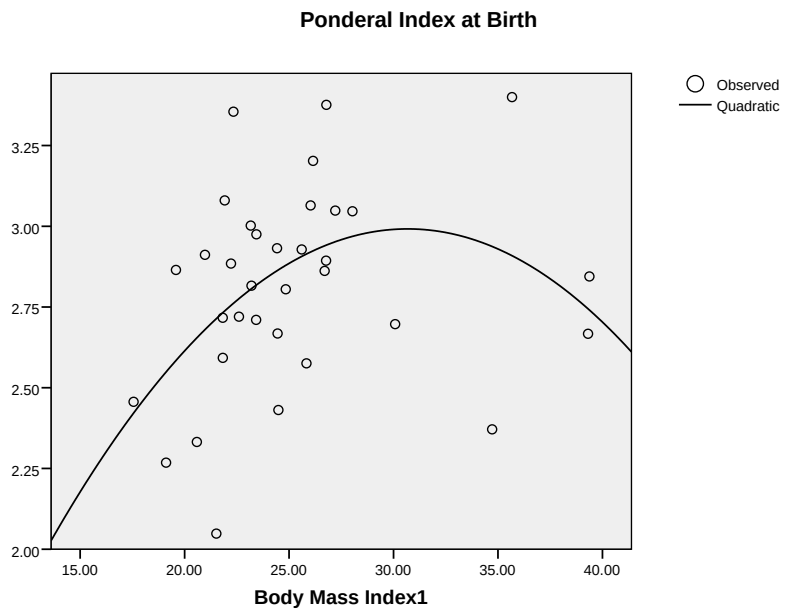


Figure 6.2: Curve estimation—relationship between Ponderal Index at Birth and maternal Body Mass Index at 2 weeks post-partum with outliers (BMI>30) removed

Figure 6.3: Untransformed distribution of mean OT levels 2-12 weeks

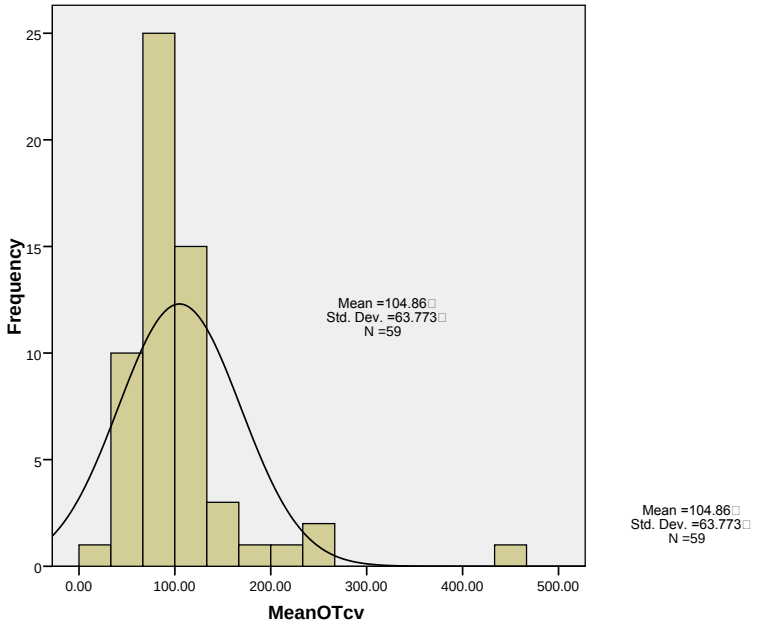


Figure 6.4: Log-transformed distribution of mean OT levels 2-12 weeks

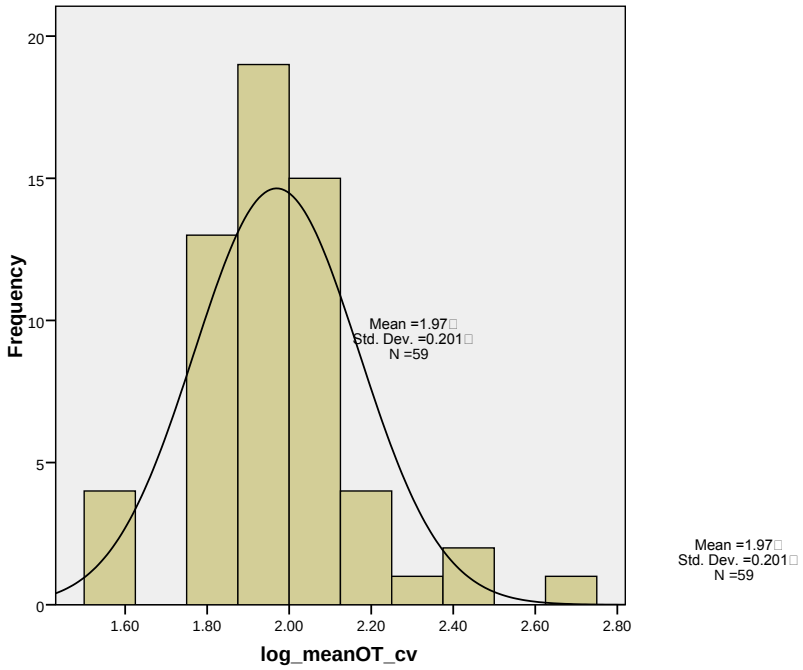


Figure 6.5: Change over time for maternal Body Mass Index

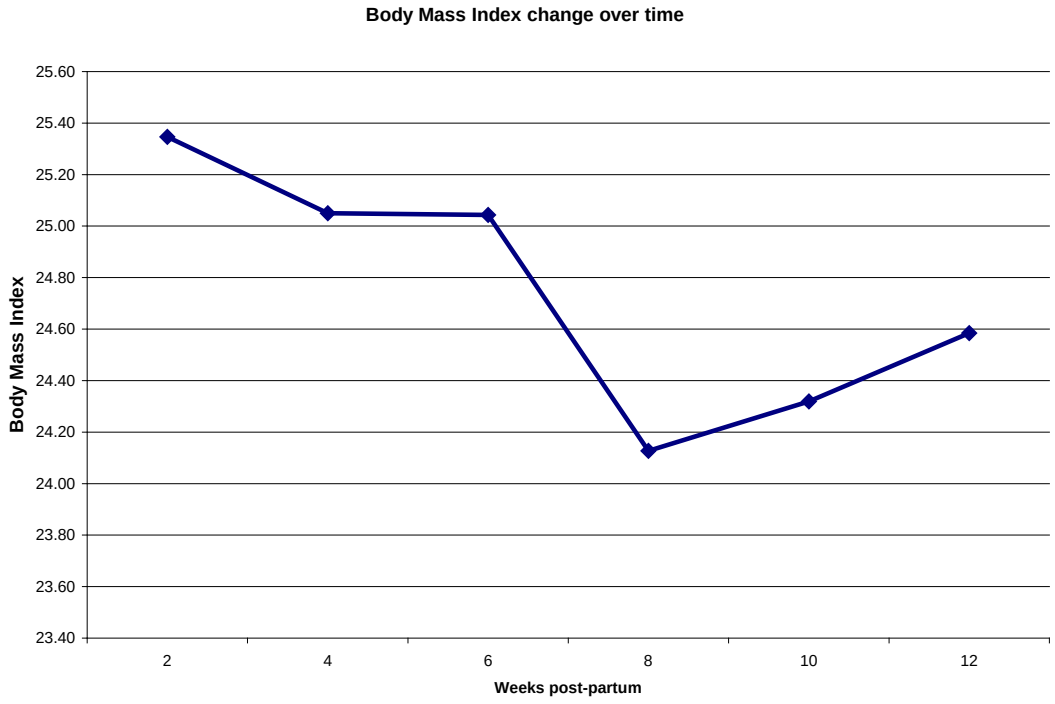


Figure 6.6: Change over time maternal Body Fat

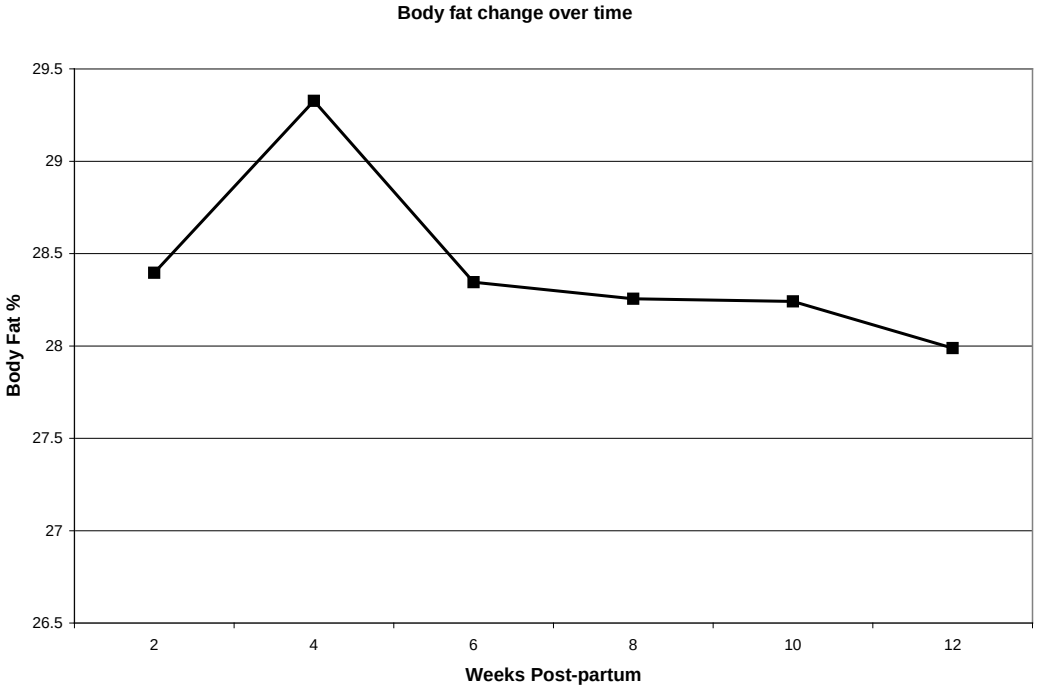


Figure 6.7: Change over time maternal Weight

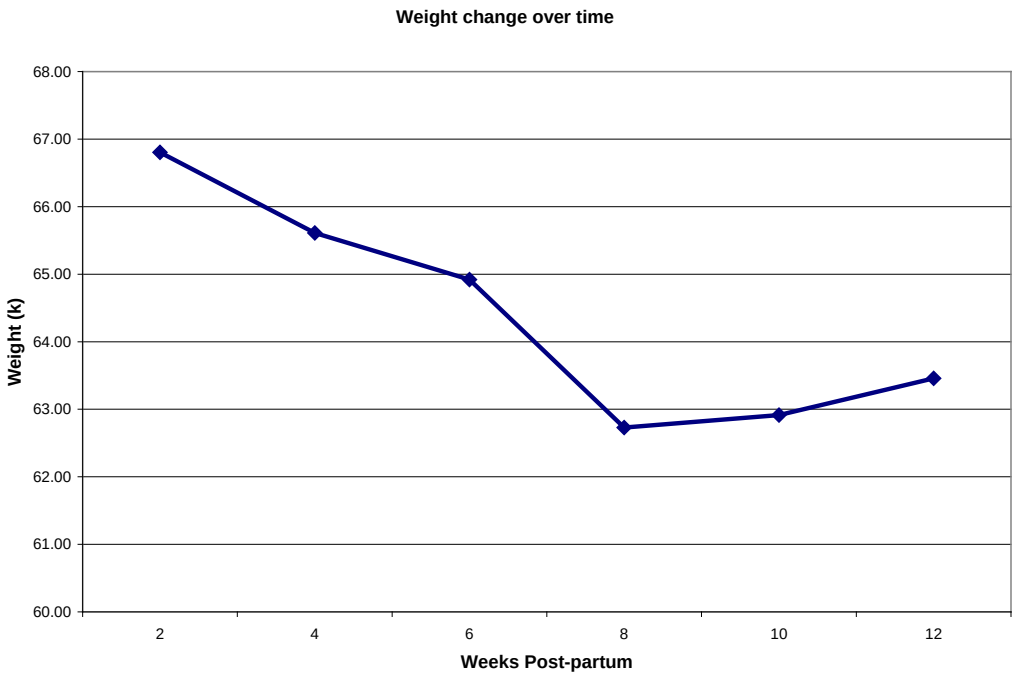


Figure 6.8: Bar chart Count of Individuals by Post-Partum Depression Score (2 weeks post-partum)

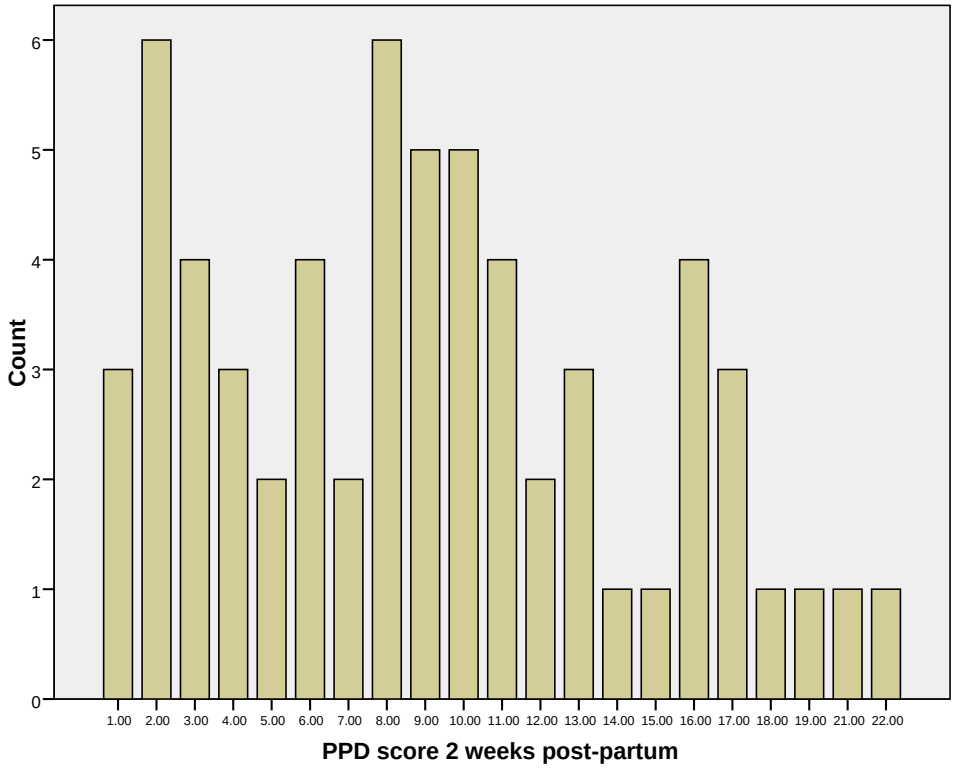


Figure 6.9: Bar chart count of Individuals by Post-Partum Depression Score (12 weeks post-partum)

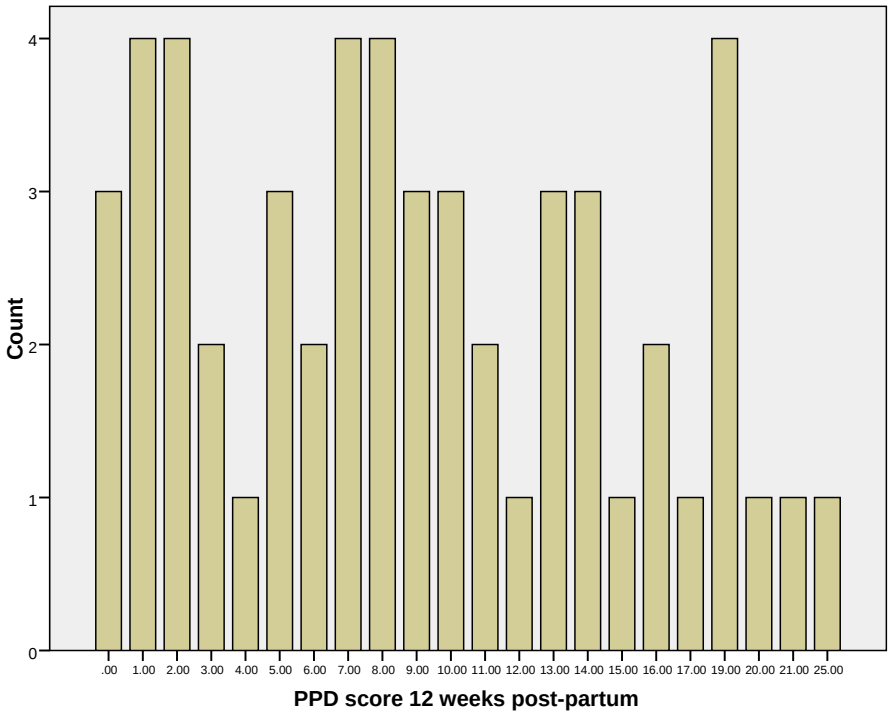


Figure 6.10: Bar chart count of Individuals by change in Post-Partum Depression Score between 2 and 12 weeks post-partum

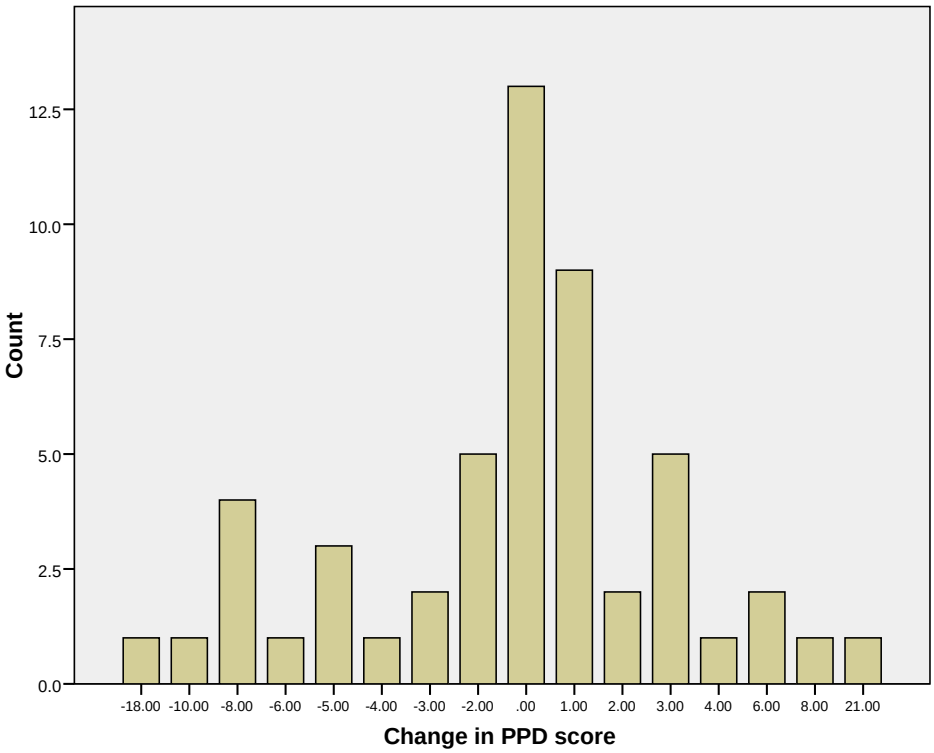


Figure 6.11: Distribution of Cohen Stress scale scores

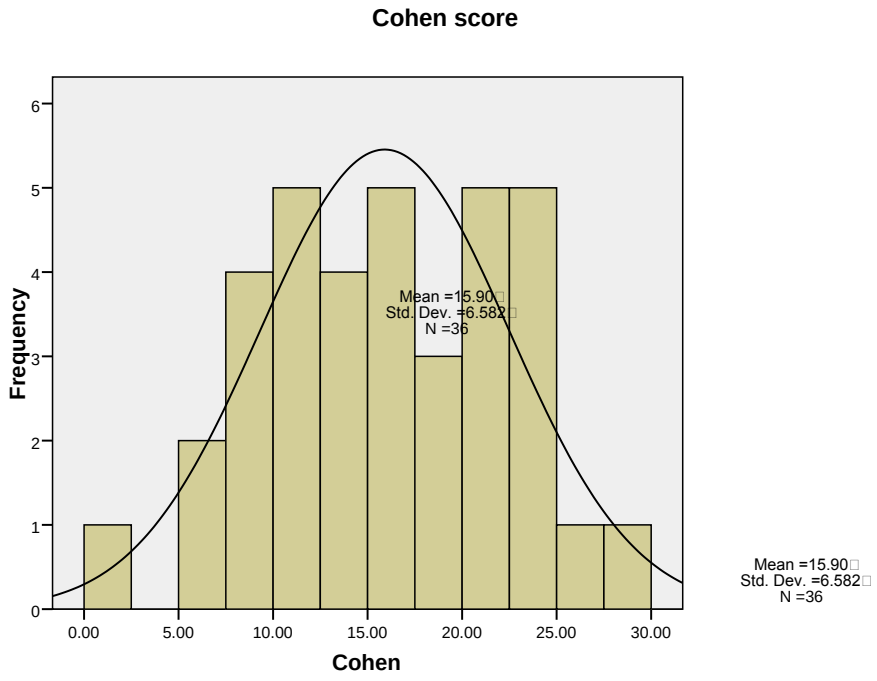


Figure 6.12: Distribution of average 10-point stress scale score 2-12 weeks post-partum

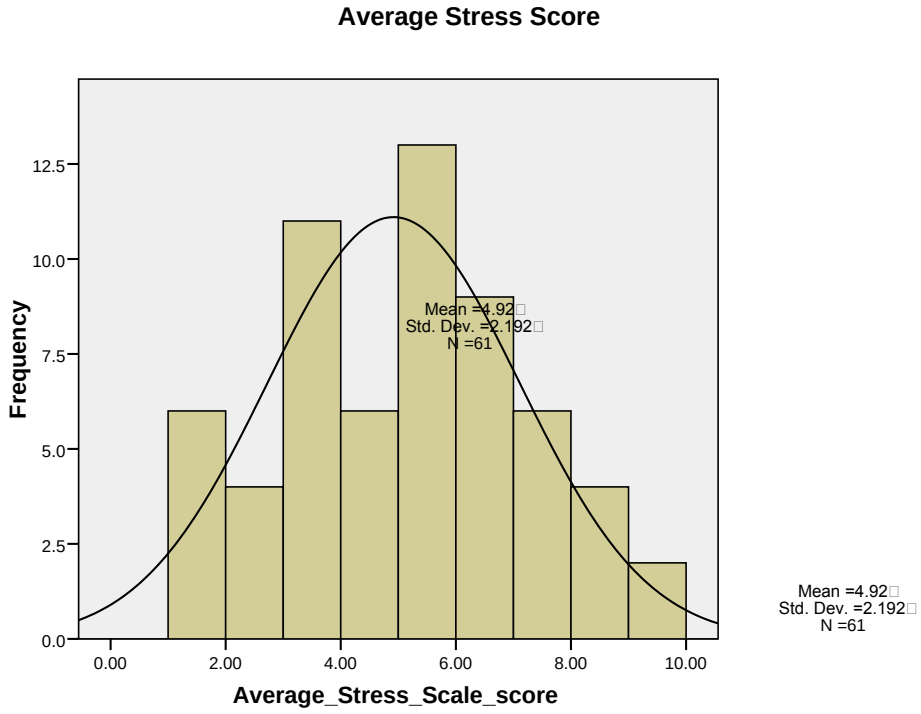


Figure 6.13: Distribution of average Composite Stress Scale scores 2-12 weeks post-partum.

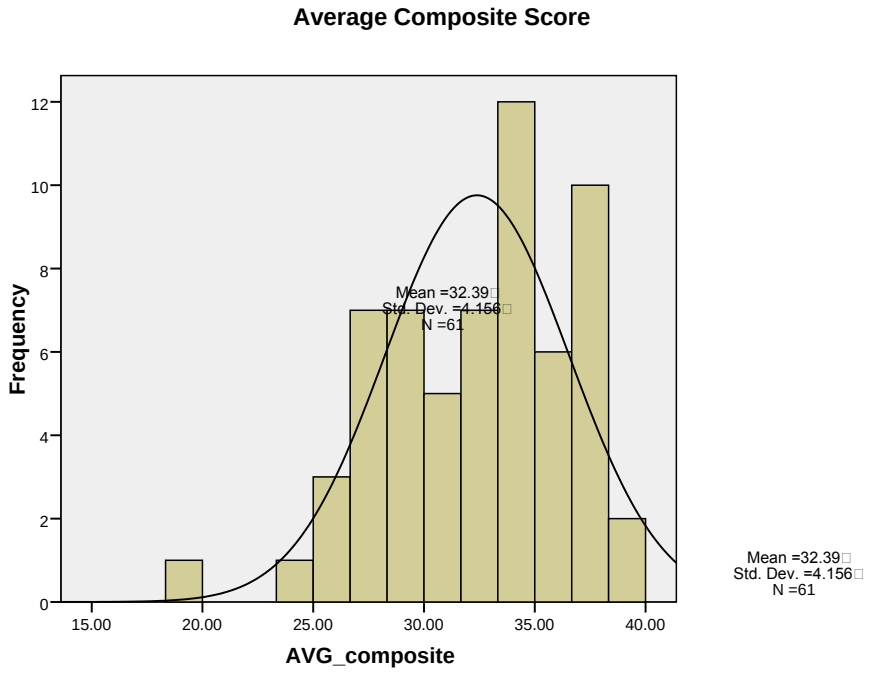


Figure 6.14 Boxplot of mean OT levels weeks 2-12 (log) by Living Situation

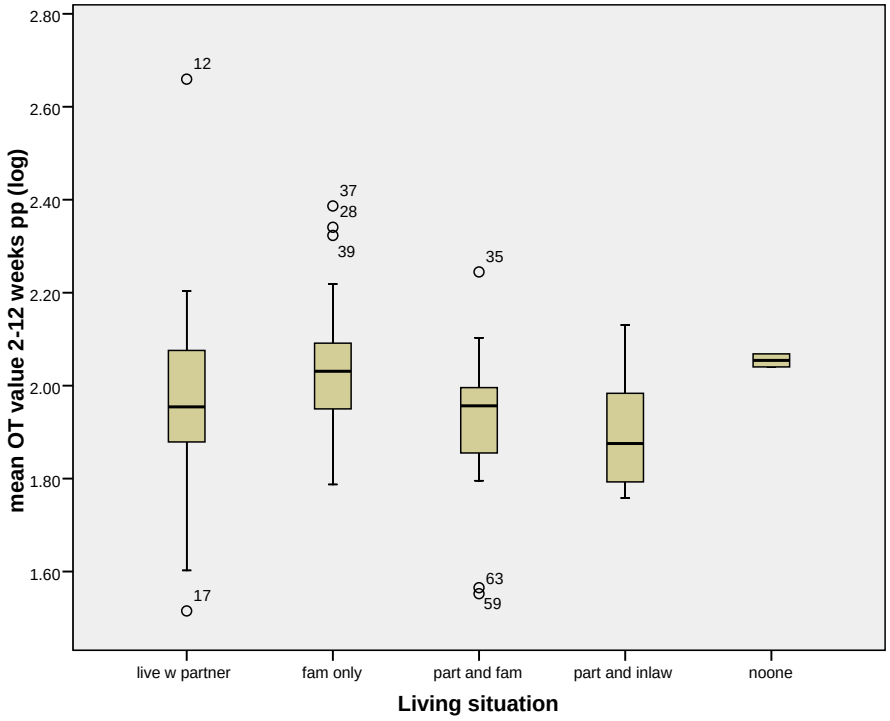


Figure 6.15: Curve estimation: mean OT levels 2-12 weeks post-partum vs. mean 10-point stress scale score (R^2=.173)

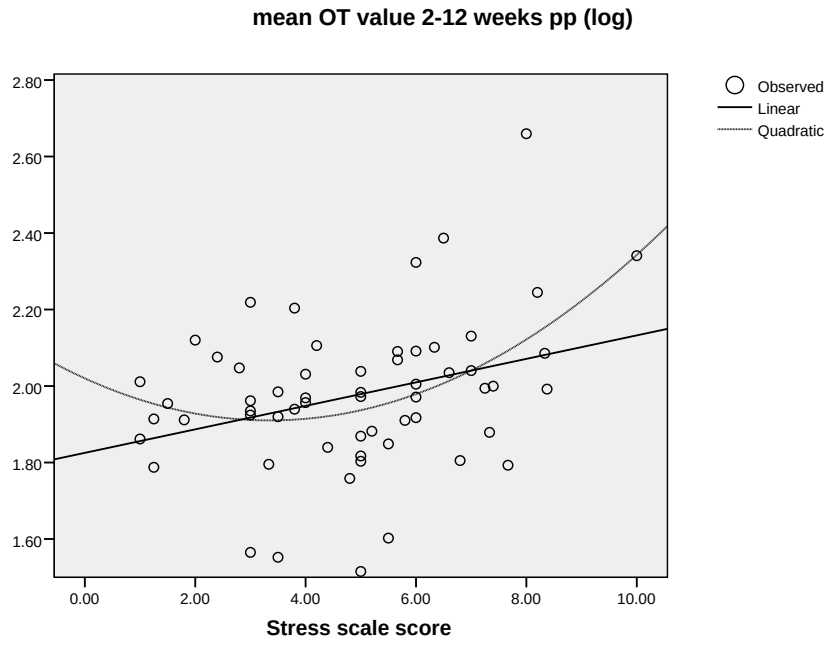


Figure 6.16: Curve estimation: mean OT levels 2-12 weeks post-partum vs. mean Composite score (R^2=.064)

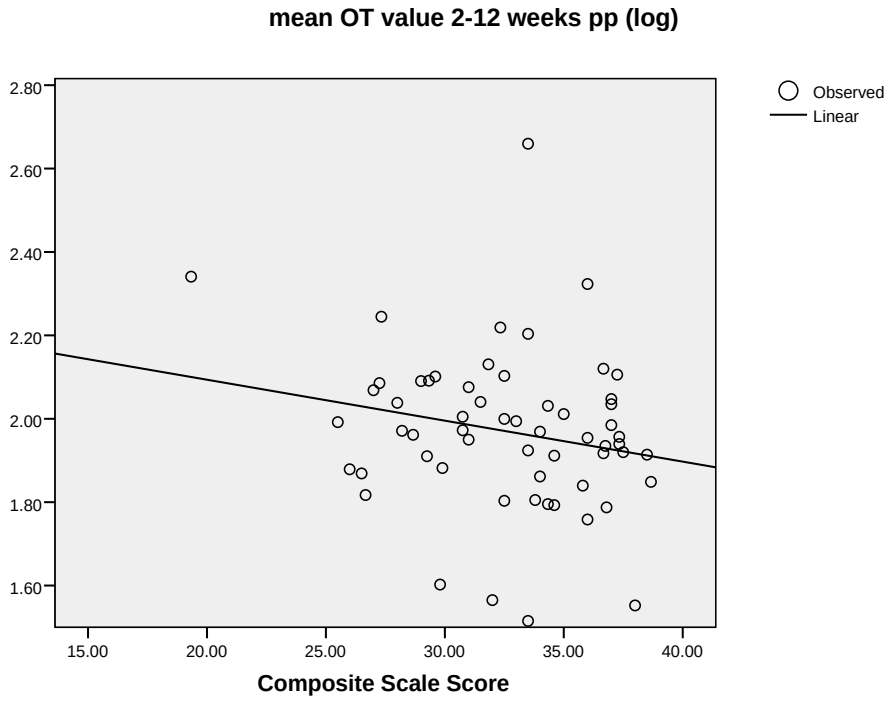


Figure 6.17: Curve estimation mean OT levels 2-12 weeks post-partum vs. Cohen stress score (R^2=.217)

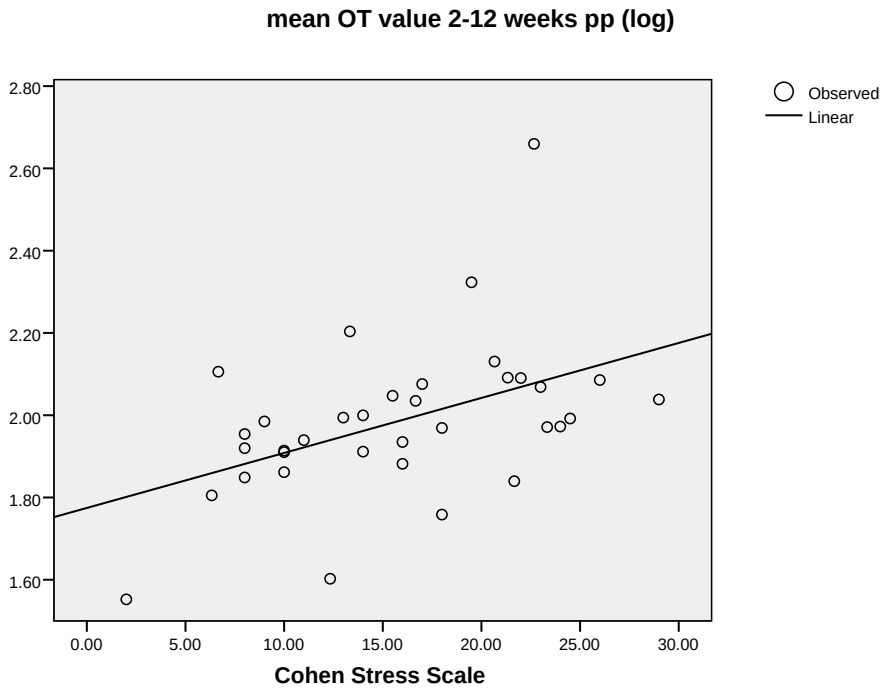


Figure 6.18: Boxplot of mean OT levels weeks 2-12 (log) by Breastfeeding Outcome (overall p=.015, exclusive vs. weaned p=.004)

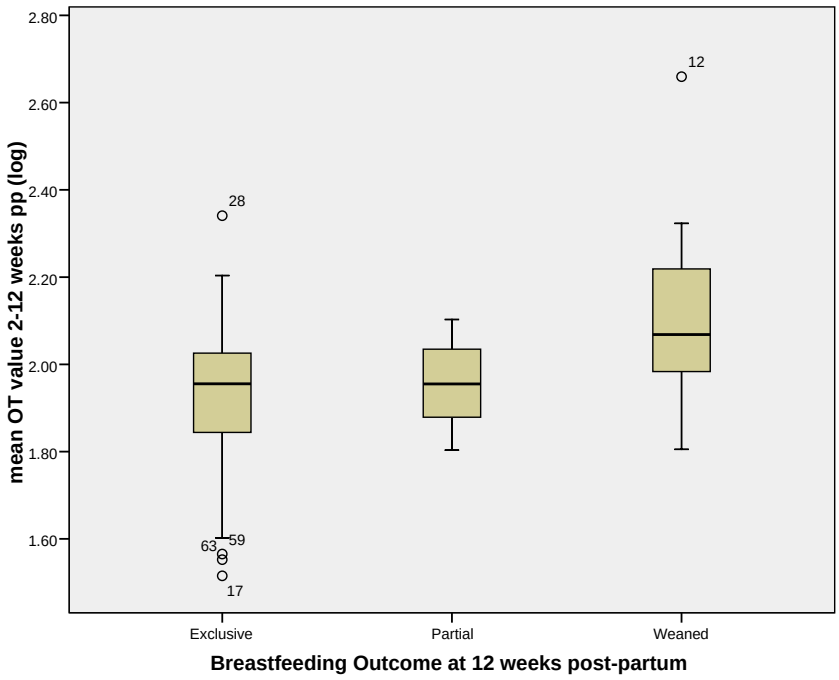


Figure 6.19: Boxplot of mean OT levels weeks 2-12 (log) by Breastfed vs. Weaned Outcome (p=.008)

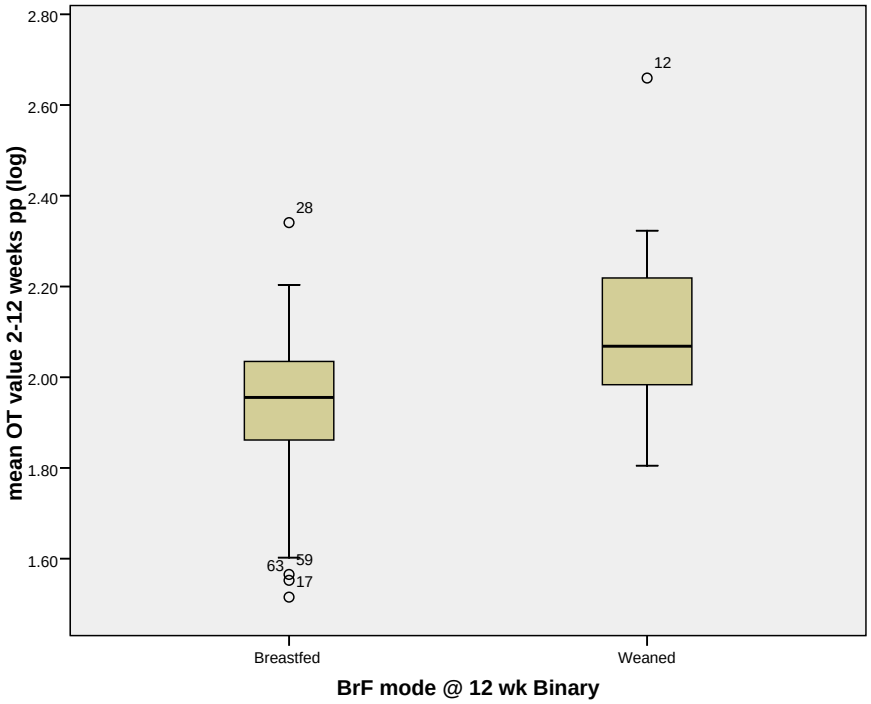


Figure 6.20: Cumulative risk of Supplementation 2-12 weeks post-partum, by Planned Pregnancy group

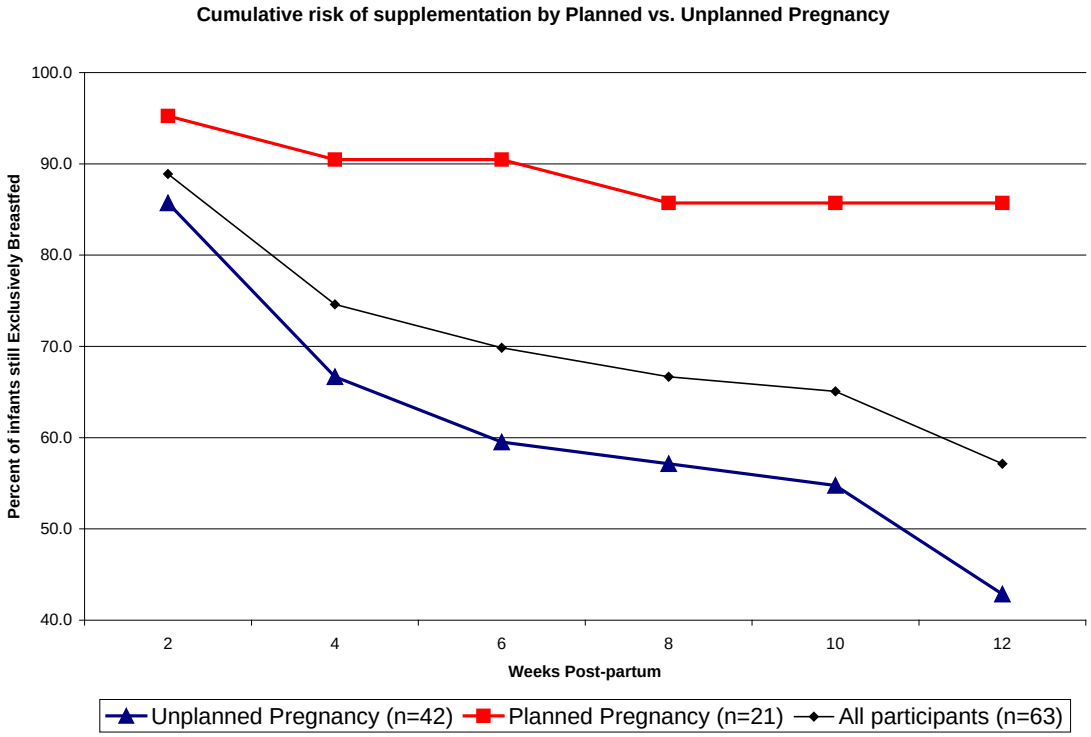


Figure 6.21: Cumulative risk of Weaning 2-12 weeks post-partum, by Planned Pregnancy group

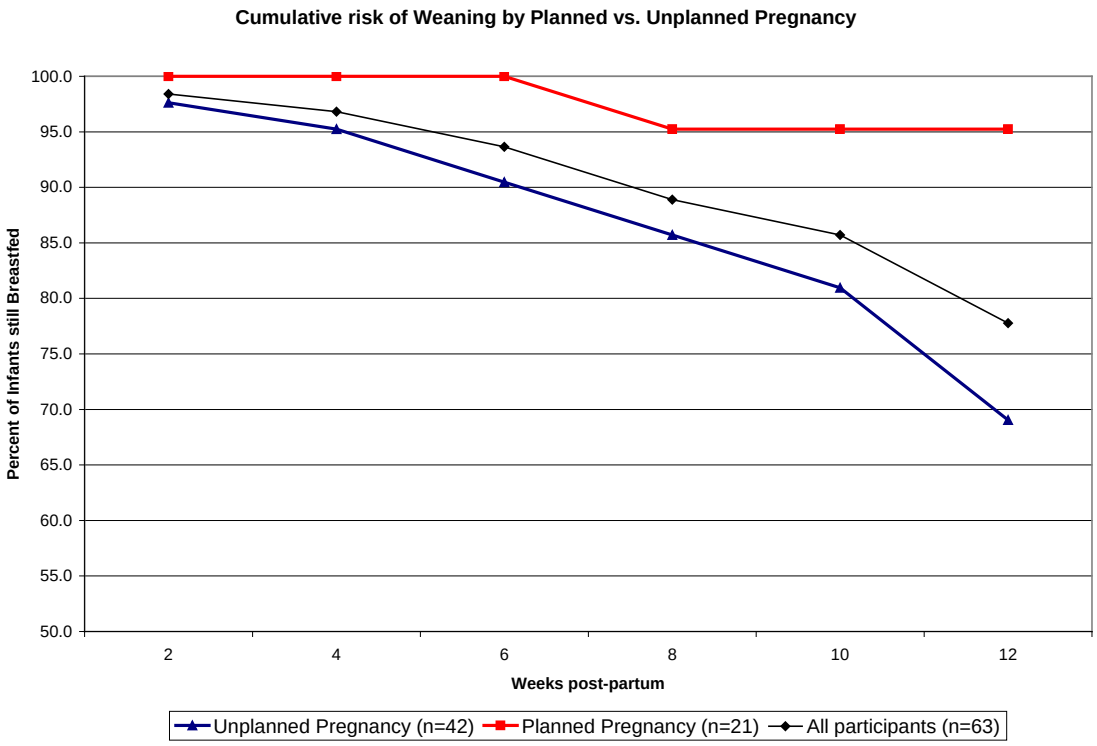


Figure 6.22: Boxplot of Infant weight (g) at 2 weeks post-partum by Breastfeeding outcome (overall p=.022, exclusive vs. weaned p=.012, partial-weaned p=.016)

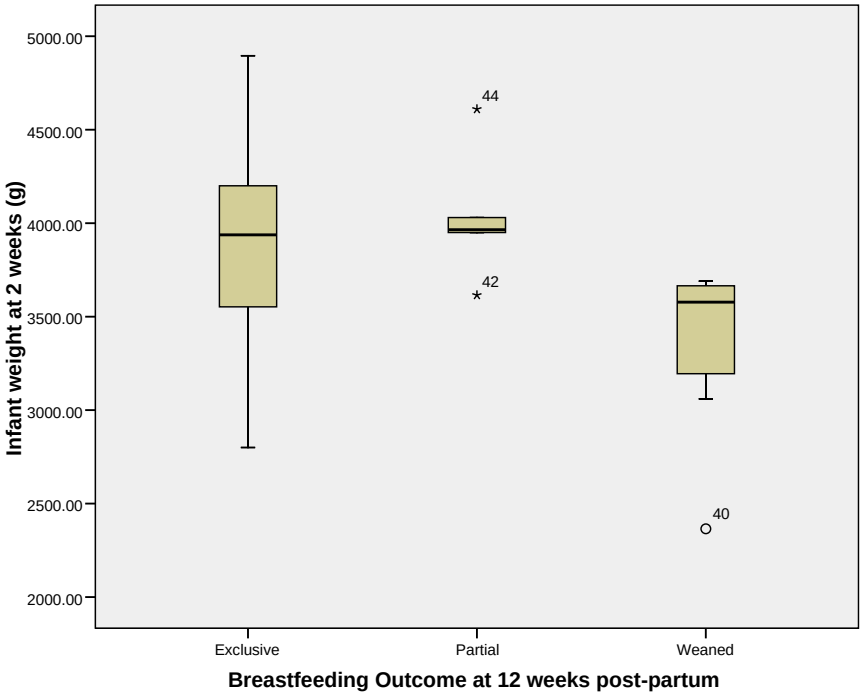


Figure 6.23: Boxplot of mean OT level weeks 2-12 (log) by Breastfeeding Outcome (overall p=.015, exclusive vs. weaned p=.004)

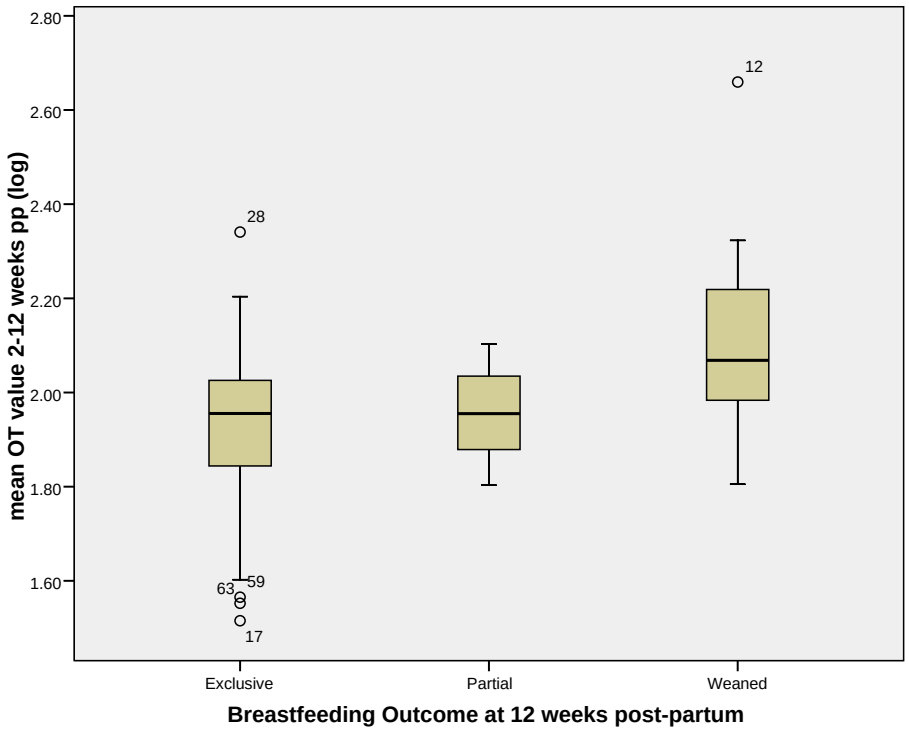


Figure 6.24: Boxplot of maternal Body Mass Index at 2 weeks post-partum by Breastfeeding Outcome (overall p=.125, exclusive vs. weaned p=.030)

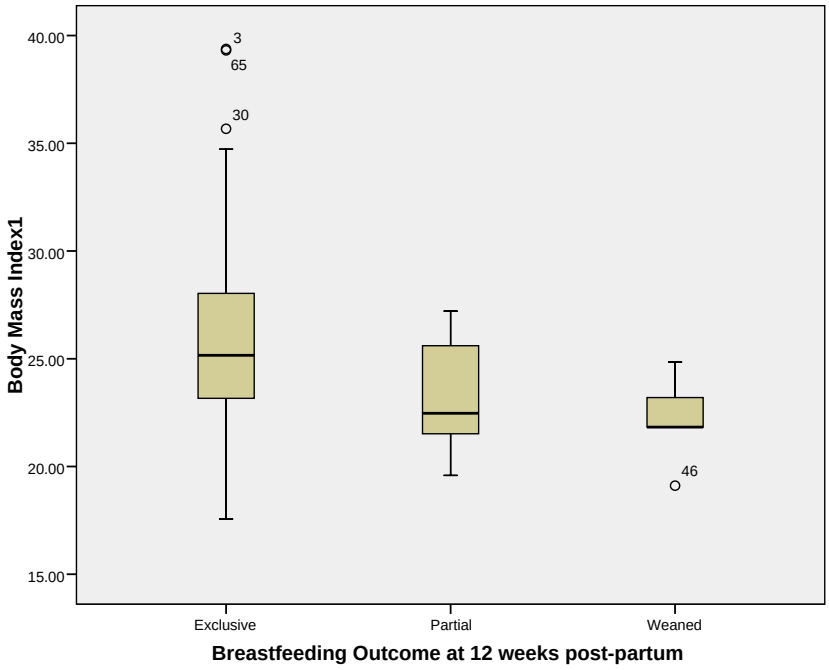


Figure 6.25: Boxplot of infant Birth weight in grams by Breastfeeding Outcome (overall p=.126, exclusive vs. weaned p=.043)

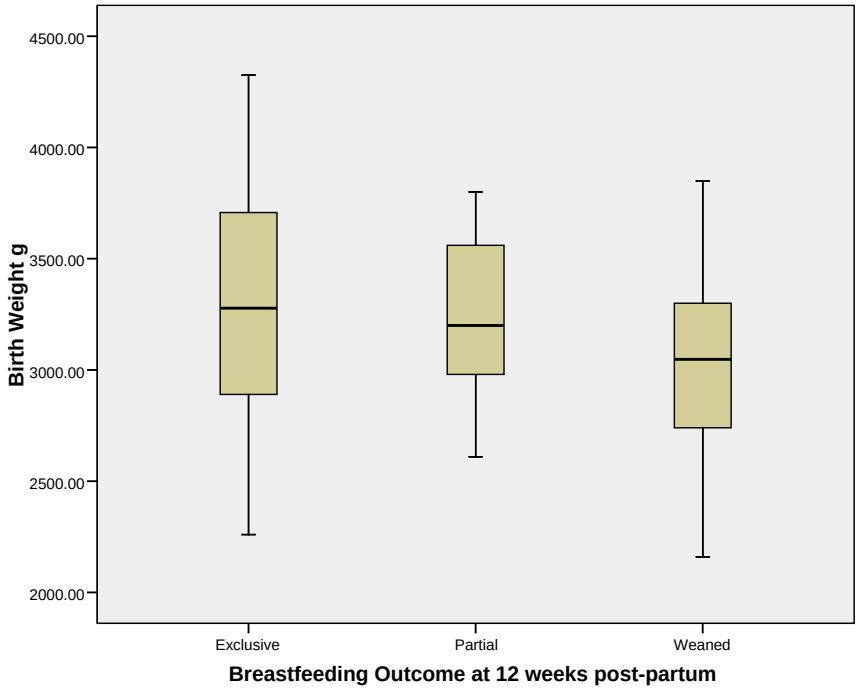


Figure 6.26: Boxplot of infant Weight (g) at 4 weeks post-partum by Breastfeeding Outcome (overall p=.076, exclusive vs. weaned p=.028)

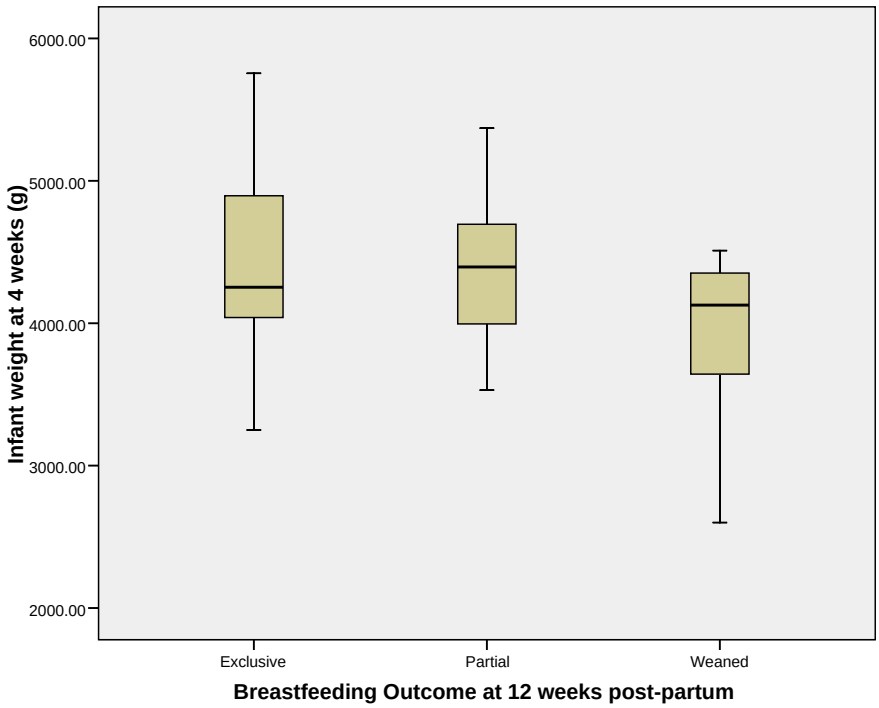


Figure 6.27: Boxplot of infant Length (cm) at 4 weeks post-partum by Breastfeeding Outcome (overall p=.061, exclusive vs. weaned p=.024)

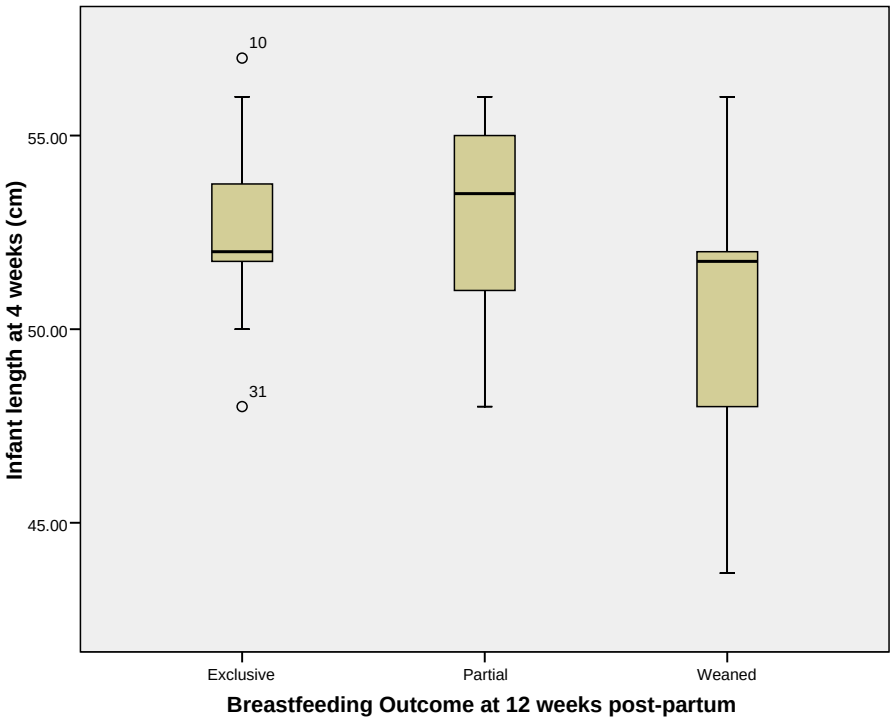


Figure 6.28: Boxplot of infant Length (cm) at 6 weeks post-partum by Breastfeeding Outcome (overall p=.105, exclusive vs. weaned p=.035)

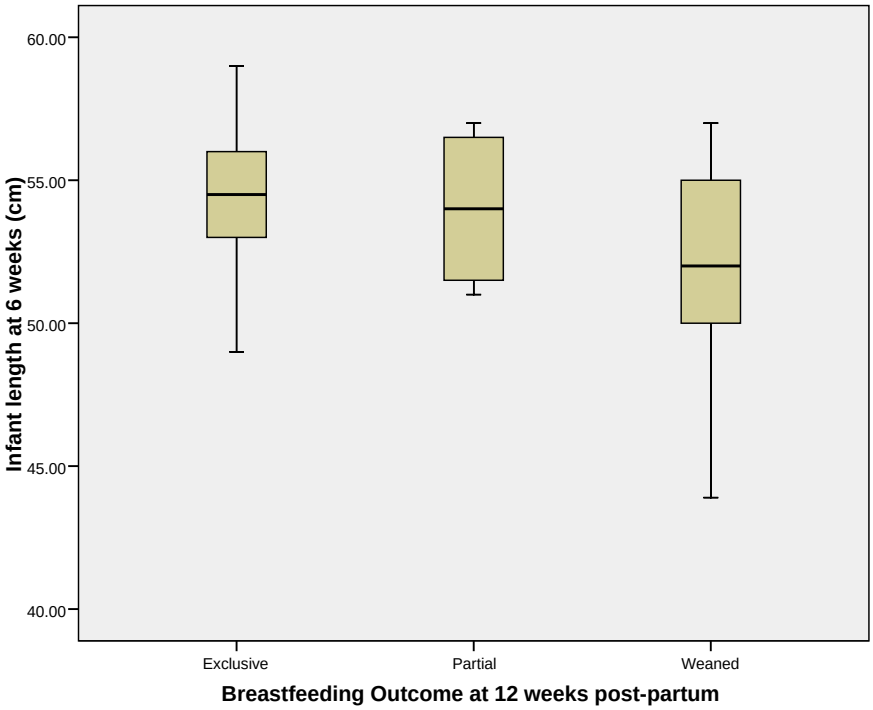


Figure 6.29: Boxplot of mean 10-point stress scores weeks 2-12 by Breastfeeding Outcome (overall p=.034, exclusive vs. weaned p=.010)

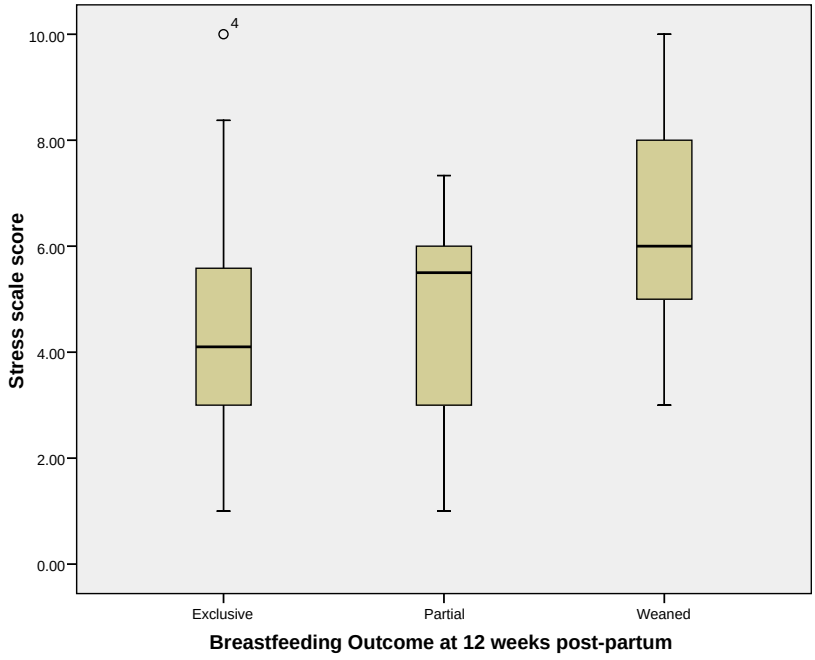


Figure 6.30: Boxplot of Cohen stress scores by Breastfeeding Outcome (overall p=.068, exclusive vs. weaned p=.022)

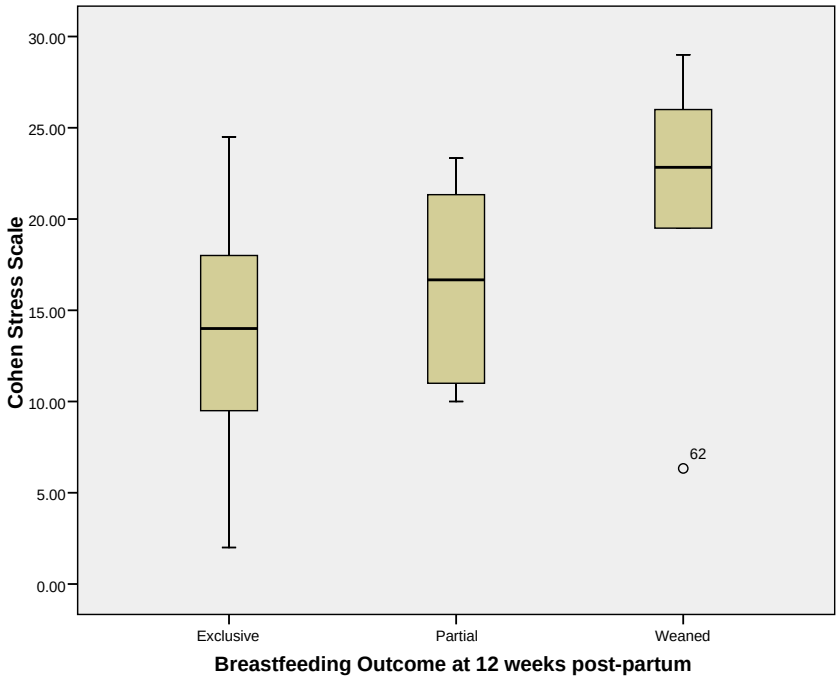


Figure 6.31: Boxplot of Composite stress scores weeks 2-12 by Breastfeeding Outcome (overall p=.049, exclusive vs. weaned p=.022)

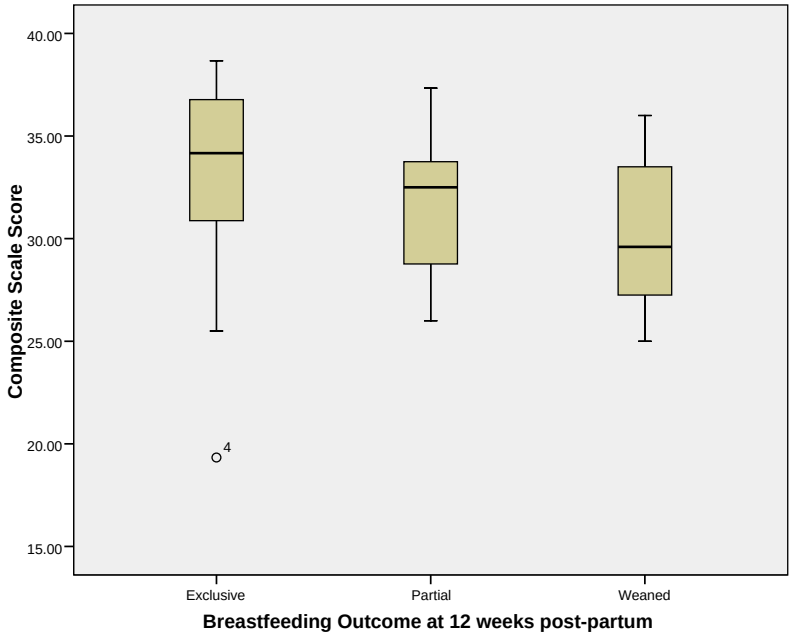


Figure 6.32: Mean scores on each aspect of the Composite scale, by Breastfeeding Outcome

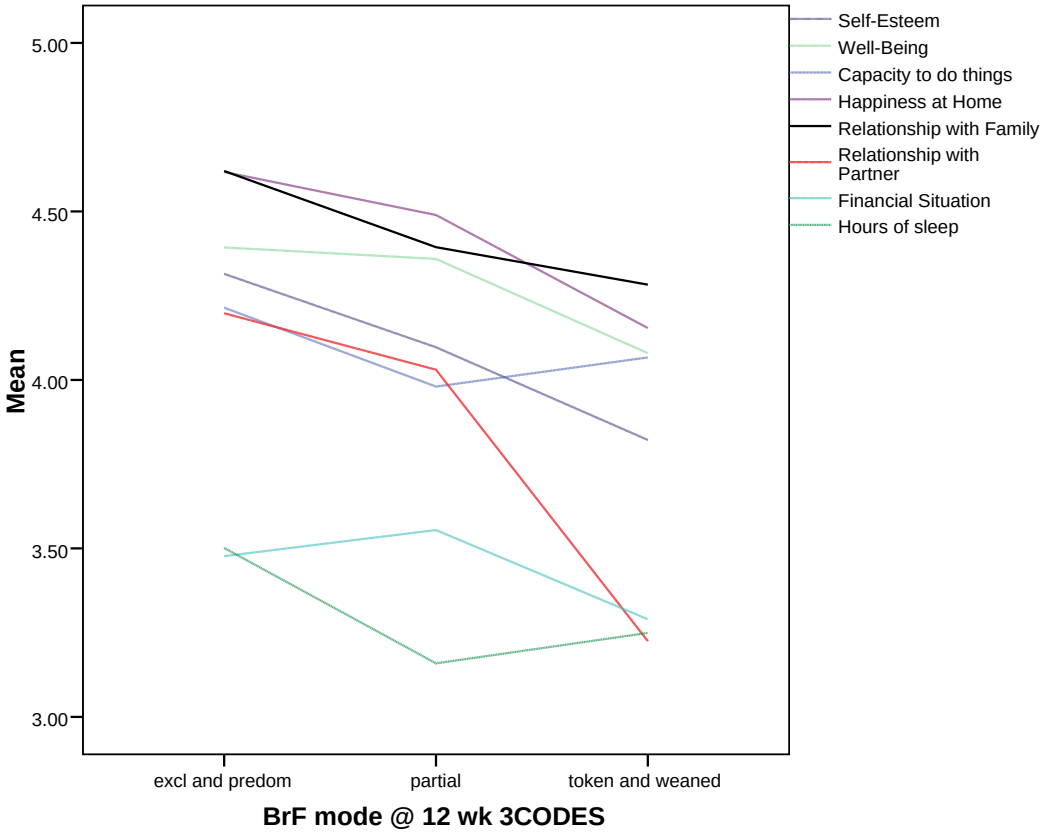


Figure 6.33: Boxplot of mean Happiness at Home scores weeks 2-12 by Breastfeeding Outcome (overall p=.021, exclusive vs. weaned p=.006)

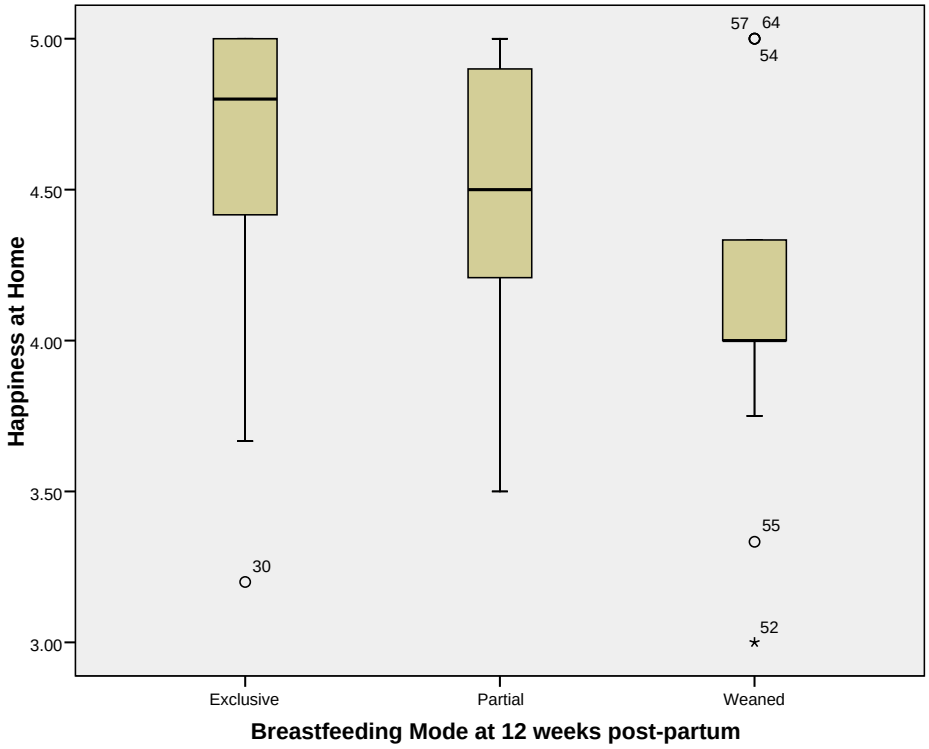


Figure 6.34: Boxplot of mean Relationship with Partner scores weeks 2-12 by Breastfeeding Outcome (overall p=.037, exclusive vs. weaned p=.011)

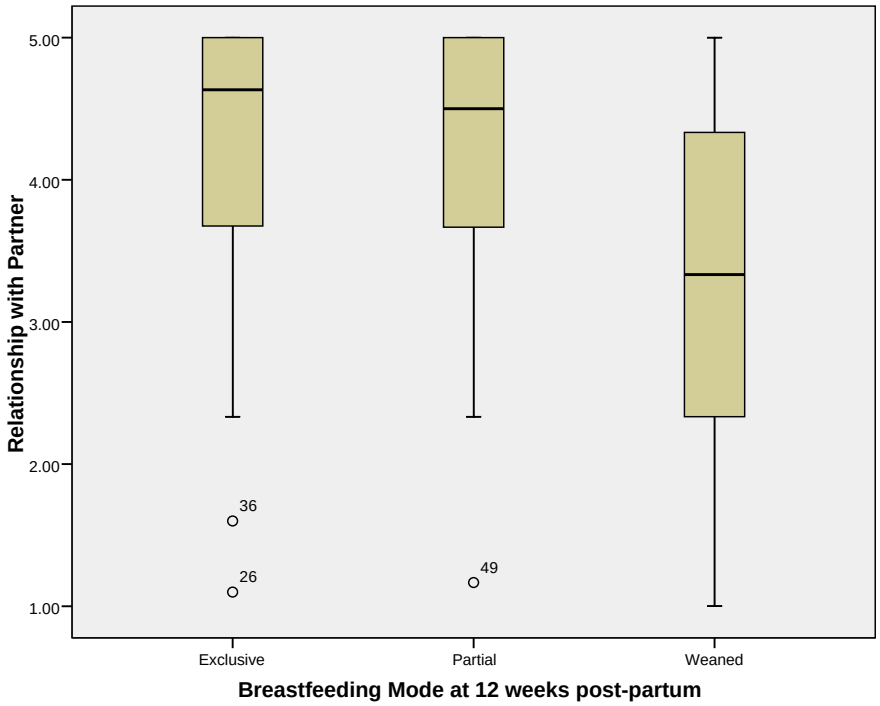


Figure 6.35: Boxplot of mean Self-Esteem scores weeks 2-12 by Breastfeeding Outcome (overall p=.154, exclusive vs. weaned p=.058)

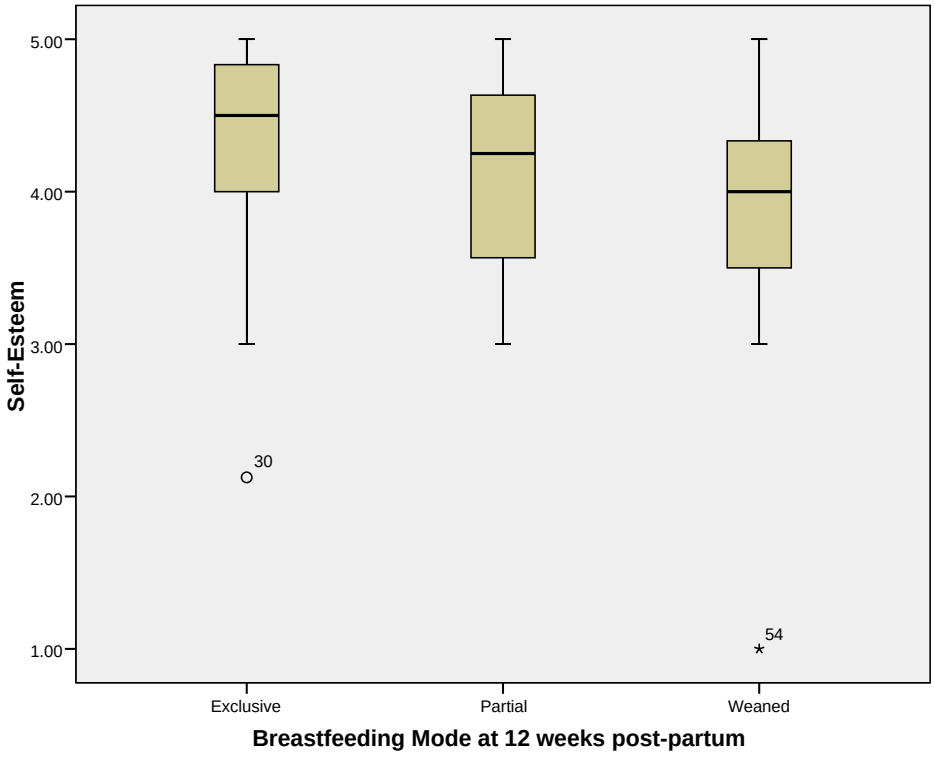


Figure 6.36: Breastfeeding survivorship by Planned Pregnancy status

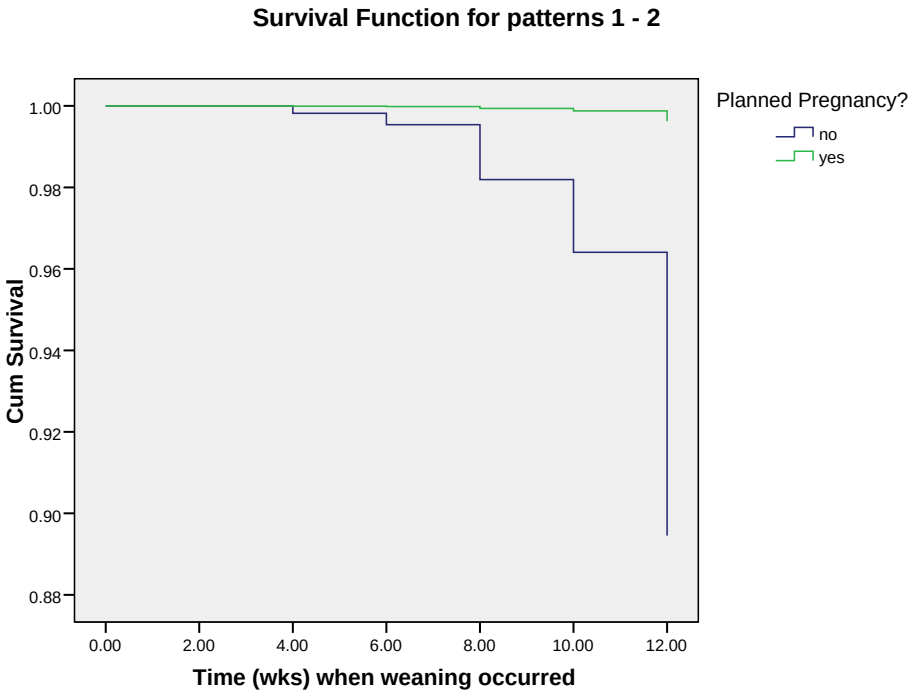


Figure 6.37: Survival function for Exclusive Breastfeeding by Planned Pregnancy

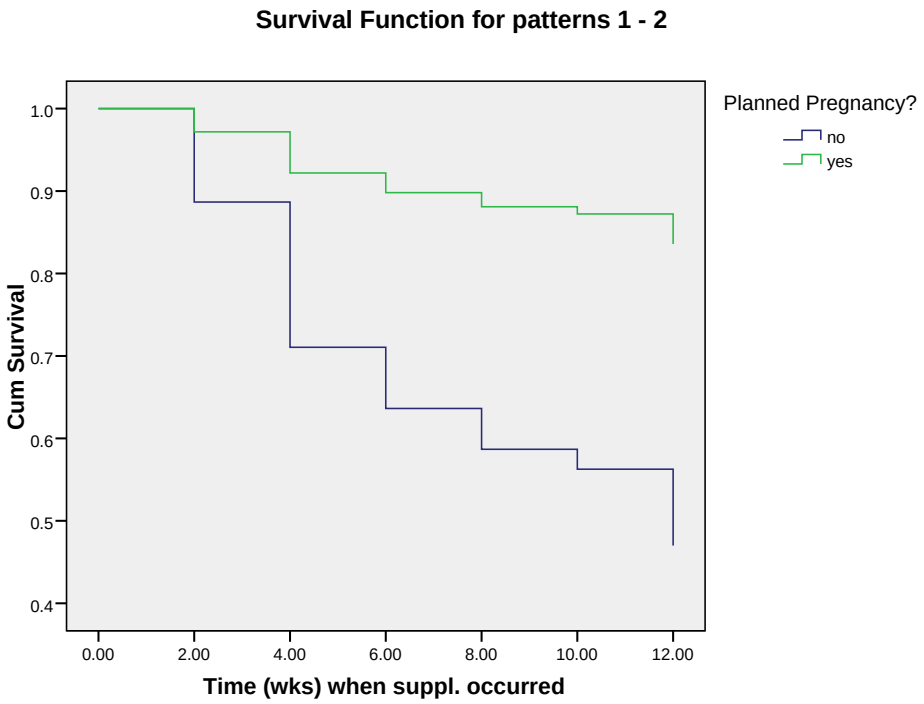
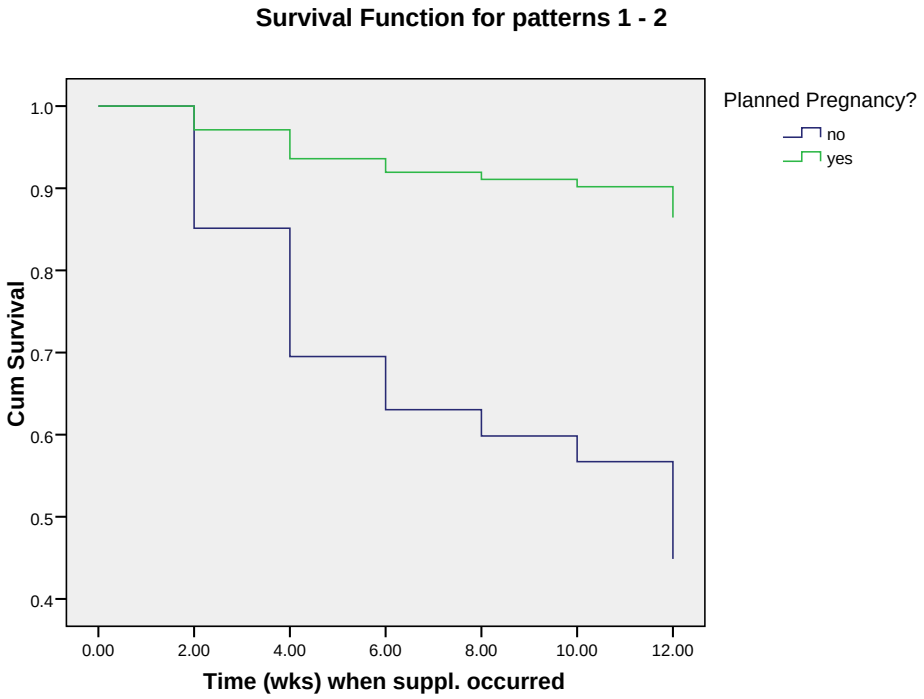


Figure 6.38: Survival function for Exclusive Breastfeeding by Planned status of pregnancy, controlling for Monthly Income per capita



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