Using Life-History Theory to Evaluate the Nighttime Parenting Strategies of First-Time Adolescent and Adult Mothers

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ABSTRACT

This study explores the nighttime parenting behaviour of first-time adolescent and adult mothers. Two theoretical approaches are evaluated. The first model suggests that differences in parenting behaviour between teens and adults occur because teen mothers are less well-prepared for nighttime infant care compared to more mature mothers. The second draws on evolutionary theory and suggests that nighttime parenting figures into the suite of behaviours that comprise parental investment, which varies depending on the life-history trajectories and reproductive strategies of individual mothers. The project addresses how understanding nighttime parenting behaviour as part of an individual's life-history trajectory can inform public health policies and interventions related to infant sleep.

Methods

A sub-sample of adolescent and adult mothers was drawn from a larger, prospective longitudinal study on transition to parenting in Indiana, U.S.A. Overnight, infra-red video recordings of the nighttime parenting behaviours of mother-infant dyads were collected for 23 adolescent and 22 adult mothers when infants were approximately 4 months of age. The video recordings were reviewed in real time in their entirety and coded using a behavioural taxonomy designed for this study which was entered into the Noldus Observer software. Data were analysed for group differences and were assessed against the predictions derived from the two models to determine which theoretical framework better fit the behavioural outcomes. Additionally, qualitative descriptions of focal behaviours related to infant risk were produced.

Results

Teen mothers exhibited closer physical proximity while infants were awake and asleep, mother-infant bedsharing, and a higher number of sleep environments for infants. There was more compatibility between maternal and infant sleep periods in the teen group, with mothers going to sleep sooner after their infants did compared to adults. There was also a trend toward teen mothers having more frequent but shorter awakenings during the night. Adults spent more time at greater distances from their infants, and more often placed infants to sleep in a cot in a separate bedroom. Both groups were prompt to respond to infant crying, although there was a trend towards shorter crying bouts among infants of teen mothers. Fewer teen mothers breastfed their infants, and infant self-feeding from bottles propped on blankets or other materials was more frequent among teen mothers. There was a trend towards more frequent placement of infants in the prone sleeping position among the teen mothers, although intervention by research staff in such instances obscured the outcomes. More teen mothers placed their infants' heads on pillows compared to adult mothers, but for the major categories of risk that were coded (breathing risks, feeding risks, and other types of potential risk) there were no group differences between teens and adult.

Conclusions

The findings of this study revealed significant differences between teen and adult mothers in how they managed the costs of caring for infants at night. The predictions generated by the life-history model were a better fit for the behavioural outcomes overall. Life-history theory predicted that teens would engage in cost-reducing measures in order to meet their own growth and development needs as well as those of their infants while adult mothers could afford to exhibit greater parental investment relative to self-investment. Teen cost-cutting measures were evident, and were accomplished by pursuing a behavioural strategy that minimised parent-infant conflict and brought maternal and infant needs in line with each other during the night. The teen strategy achieved a reduction in maternal costs through increased involvement with and proximity to infants, rather than through the withdrawal and distancing that would be predicted by existing literature on the sub-optimal parenting styles of adolescents. The conventional model suggested that the sub-optimal parenting style of adolescents would lead to greater sleep-related risk exposure. However, the data revealed that risks occurred for both groups, although they involved different sleep environments.

Implications

The findings of this study also contradict the assumption that any sleep environment is inherently safe or inherently risky, and suggests ways in which an evolutionary perspective might be applied to modifying public health policy related to infant sleep. The findings reinforce the idea that parental behaviour affects the risks to which infants are exposed and that nighttime parenting behaviours are shaped by maternal reproductive and parental investment strategies. This study therefore supports the idea that one-size-fits-all approaches to health and behaviour are inappropriate, and that public health recommendations related to infant sleep should be sufficiently elastic and/or tailored to allow for the range of contexts within which infant care occurs. Because mothers arrive at parenting from very different life trajectories, and because each of these trajectories causes them to evaluate and tolerate parenting costs and risks to infants in variable ways, it is incongruous to expect that they should all be encouraged to parent in a similar manner or to structure their infants' nighttime routines in a uniform way.

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CHAPTER 1
INTRODUCTION

1.1 Evolutionary Medicine: Understanding Human Health and Behaviour

The present study is situated within the field first referred to as 'Darwinian Medicine' by Williams and Nesse (Nesse & Williams 1994; Williams & Nesse 1991), and subsequently named evolutionary medicine (Trevathan, Smith & McKenna 2008). The term evolutionary medicine refers to a body of research that examines the relationship between biology and behaviour and looks at disease patterns through an evolutionary lens, exploring topics such as the mismatch between modern environments and the evolutionary conditions to which human biology is adapted (Trevathan, Smith & McKenna 1999). Evolutionary medicine crosses disciplinary boundaries and employs multiple methodologies that combine the strengths and unique perspectives of social, biological, and clinical discourse (Trevathan, Smith & McKenna 1999). A well-recognised example of research in evolutionary medicine that has been successfully embraced and thoroughly integrated into clinical practice involves the widespread use of antibiotics and the concurrent evolution of antibiotic-resistant bacteria, with concomitant consequences for contemporary health and the future of infectious disease aetiology (see Ewald 1999).

Although the full impact of evolutionary medicine on medical research and medical practice has been somewhat limited to date, the strength of the evolutionary medicine approach lies in its ability to suggest new questions and generate alternative hypotheses related to a wide variety of health-related subjects (Trevathan, Smith & McKenna 2008; Nesse 2008). The union of evolutionary perspectives with public health topics offers an opportunity for both theoretical and clinical advancement. Existing research at the intersection of evolutionary theory and medicine illustrates "the relevance of evolutionary theory for practical problems in public health, and it suggests the utility of public health outcomes for addressing evolutionary questions" (McDade 2001: 9). Indeed, by reframing questions about disease in evolutionary terms, novel research agendas are inspired and new approaches to treatment are generated (Trevathan, Smith & McKenna 2008). Central to the field of evolutionary medicine is the use of life-history theory as an "organising set of principles to examine how natural selection operates at different stages of the life cycle", including an emphasis on how life-history traits that confer advantage or protection at one

stage might have negative implications at another stage (Trevathan, Smith & McKenna 2008: 10). The use of life-history theory also focuses attention on the concept of trade-offs in which humans must make real decisions about how to maximise fitness within a given context.

A model created by McDade (2001) represents a prime example of the utility of the life-history perspective for public health work. Using an evolutionary model that examined breastfeeding duration and timing of weaning as a function of parent-offspring conflict, he used life-history theory to specifically predict when weaning would occur based on the relative balance between benefits and costs of continued lactation. This approach offered a unique perspective on maternal behaviour and child outcomes, and challenged the idea that maternal and child interests necessarily coincide. This model represented a seminal work in the field of evolutionary medicine because it showed the predictive value of life-history theory for understanding heath-related behaviour and for informing intervention work. McDade's model pointed out that women cannot be expected to continue engaging in a behaviour that is more expensive than their circumstances allow them to tolerate, and that efforts to extend breastfeeding duration must be accomplished by resolving parent-infant conflict through the provision of augmented supports aimed at producing a reduction in maternal costs.

1.2 Evolutionary Medicine and Infant Sleep Research

A fruitful application of evolutionary medicine to health-related behaviours has involved research on infant sleep. A focus on culturally-informed childcare patterns is an ideal subject for evolutionary medicine because the discrepancies between culturally-informed behaviours, which can change rapidly, and evolutionary biology, which changes quite slowly, have very real implications for contemporary health outcomes. Indeed, given the life-or-death consequences of childcare decisions, "the lack of evolutionary constraints about what parents actually do with their infants is remarkable" (Trevathan, Smith & McKenna 2008: 26). Over the past two decades, anthropologists have examined the intersection between culturally-influenced caregiving practices related to infant sleep and the evolved biology of infancy. McKenna and colleagues (McKenna & Mosko 1993; McKenna, Mosko & Richard 1999) used this perspective to examine the behaviour and sleep physiology of mother-infant dyads sleeping separately and together, and argued that proximity during sleep coupled with nighttime breastfeeding represented the most appropriate sleep environment for infants and the one that is most congruent with the

environment of evolutionary adaptedness within which infant sleep evolved. They also argued that evolutionary medicine has much to contribute to ongoing research related to Sudden Infant Death Syndrome (SIDS), and that the regulatory effect of proximity to caregivers on infant sleep physiology could help explain why certain infants succumb to SIDS during periods of separation. Similarly, Ball and colleagues (Ball, Hooker & Kelly 1999; Ball 2002; Ball 2003; Ball 2007a; Ball 2009; Ball & Klingaman 2008) have explored the context of infant sleep from this evolutionary perspective. Their research has examined how infant sleep locations are chosen based on a parent's overall childcare strategy, including choice of feeding method. They suggest that breastfeeding and sleep proximity are inherently related and mutually supporting practices, and that the complicated prospect of providing care to infants during the night causes parents to adopt strategies and behaviours that they had not initially planned (Ball 2007a). Clinical trials conducted in a hospital-based setting have also documented key behavioural differences caused by varying degrees of proximity during the first few postnatal nights, revealing that opportunities for increased proximity during the first hours of life affects long-term outcomes for mothers and infants, including breastfeeding duration (Ball et al. 2006; Ball & Klingaman 2008).

The above studies have contributed to important theoretical advancements in the field of evolutionary medicine, and have had a significant impact on clinical research and practice (Trevathan, Smith & McKenna 2008). The studies illustrate how the manner in which parents approach infant sleep involves a complex mix of biological and cultural forces, and functions as an adaptive complex that balances infant physiological and temperamental needs with parental goals and desires within a particular social and behavioural context (Anders & Taylor 1994). The opportunity to measure and observe specific childcare patterns, including those related to infant sleep, through an evolutionary lens is a scientifically-valid and epidemiologically relevant exercise precisely because "as a species whose distinguishing achievement is a diversity of elaborated cultural systems, the degree to which culturally-informed behaviours coincide with reproductive fitness goals is an empirical question" (McDade 2001: 16).

1.3 Contribution of the Present Study

The current project aims to examine the nighttime parenting behaviour of first-time adolescent and adult mothers through an evolutionary lens. One of the strengths of

anthropological theory is the ability to situate human health and behaviour within a broad sociocultural context and to acknowledge the influence of natural selection on contemporary health-related behaviours, including parenting behaviour. These types of "evolutionary analyses provide a theoretical basis for understanding parental investment strategies and challenge health researchers to recognise fitness maximisation as a motivating force in health-related behaviour" (McDade 2001: 20). This evolutionary perspective will be used to explore the manner in which nighttime parenting figures into the suite of behaviours that comprise parental investment, which varies significantly depending on the life-history trajectories and reproductive strategies of individual parents.

It is likely that nighttime parenting is a form of parental investment that is particularly relevant to life-history theory and that offers a meaningful test of evolutionary hypotheses for two reasons. First, nighttime caregiving practices occur during the sleep period, a time when the infant is experiencing maximum vulnerability. Thus, nighttime parenting behaviour is likely to affect infant health and survival to a degree as great as caregiving practices undertaken during the day. Second, the sleep period potentially represents a peak period of parent-infant conflict. Because the biology of sleep is fundamentally different for infants and adults (Anders & Taylor 1994), it is logical to expect that infant demands at night will be incompatible to varying degrees with maternal needs. This may be particularly true for adolescent mothers whose sleep requirements are different from adults and whose daytime functioning is adversely affected by inadequate sleep (Wolfson & Carskadon 1998). The ways in which individual mothers navigate this period of parent-infant conflict is expected to vary considerably as a function of the particular resources that each mother brings to parenting and as part of the larger childrearing strategy she is pursuing.

The present study also offers to enhance existing discourse on nighttime parenting and infant risk by including high-risk participants in the study sample, including young mothers, smokers, those living in poverty, and non-breastfeeding dyads. Although a great deal of attention is paid to this population, and concern about increased risk of infant mortality among high-risk groups has frequently informed public health policies pertaining to infant sleep for all parents regardless of independent risk factors, almost no direct behavioural observations have been conducted for these parents. Furthermore, the majority of existing studies on infant sleep and nighttime parenting have taken place in a hospital-based setting rather than in a home-based or simulated-home environment (see for exceptions: Ball 2006a; Baddock et al. 2007; Baddock et al. 2006; Baddock 2005). The

present study includes naturalistic observations of these mothers in a non-clinical setting, and adds to the literature a detailed, in-depth description of their actual behavioural practices pertaining to infant sleep and nighttime care.

By observing and cataloguing the suite of nighttime parenting behaviours exhibited by a group of first-time mothers, this project clarifies the behavioural aspects of infant sleep environments that operate to increase or decrease sleep-related risks for individual infants. This type of analysis affords an opportunity to record and measure variability in nighttime parenting practices as well as variability in how particular sleep environments are constructed and modified by mothers. The present study includes direct observations of such behaviours rather than relying on self-reports, which are likely to be limited given the nature of self-awareness during sleep and the likelihood of under-reporting the actual incidence and severity of risk.

1.4 Statement of Purpose

The purpose of this dissertation is to explore the nighttime parenting behaviour of first-time adolescent and adult mothers by examining both an evolutionary framework and conventional assumptions about how the parenting styles of adolescents and adults differ. The outcomes will be used to consider the implications of the two approaches for informing public policies and interventions related to infant sleep risk.

1.5 Structure of the Thesis

1.5.1 Chapter 1

The purpose of this introductory chapter has been to review key aspects of the discourse on evolutionary medicine, and to illustrate how an evolutionary medicine framework has been used to examine topics related to infant sleep. While certain aspects of infant sleep physiology have been related to caregiving styles and variability in the choice and construction of infant sleep environments, the present study is the first of its kind to contrast the behaviours of adolescent and adult mothers during nighttime caregiving. The remainder of the thesis is organised as follows:

1.5.2 Chapter 2

Chapter 2 outlines the theoretical framework for this study and presents an overview of the literature on life-history theory, including a review of parental investment

theory. This chapter introduces the concept of life-history trade-offs, where all individuals strategically allocate resources to growth, maintenance and reproduction, and make parenting decisions such as how to allocate resources between self and offspring, for example. Life-history theory also provides a framework for predicting and understanding how, why and when parental investment strategies will vary. Reproductive timing and patterns of investment can vary based on such factors as environmental conditions, social organisation, maternal characteristics, or infant health status. The chapter also reviews the application of life-history theory to infant sleep and nighttime parenting research, and describes how anthropological studies have addressed infant sleep in light of the evolved biology of infancy, which may or may not be compatible with social norms concerning nighttime infant care.

1.5.3 Chapter 3

Chapter 3 reviews the clinical literature on adolescent parenting, and discusses two different conceptual frameworks for understanding the outcomes associated with teenage reproduction and childrearing. An overview of existing research on topics related to infant sleep is presented, including research concerning SIDS and other sleep-related causes of infant mortality. A review of research on bedsharing is also provided, including an examination of the ongoing debate over the implications of this particular infant sleep location for health and safety outcomes. The chapter examines current health messages pertaining to infant sleep, including targeted campaigns designed for adolescent mothers, and discusses the utility of anthropological approaches for informing future directions in the formulation and implementation of public health policies.

1.5.4 Chapter 4

Chapter 4 presents the hypotheses for the present study, informed by the body of literature discussed in Chapters 2 and 3. Two alternative models suggested by the literature are described, each of which generate specific and at times divergent predictions about the nighttime parenting behaviour of teen and adult mothers. The predictions of the two models are presented for each category of behaviour measured by the present study.

1.5.5 Chapter 5

Chapter 5 presents the methods used in the present study, including an overview of participant recruitment, ethics procedures, overnight sleep study format and procedures,

and design and implementation of a behavioural taxonomy used for coding the data using the Noldus Observer 5.0 software.

1.5.6 Chapter 6

Chapter 6 presents the results of the hypothesis testing. For each behavioural category, the analytical rationale is presented, the predictions of the two theoretical models are reviewed, and the results of the statistical analyses are provided.

1.5.7 Chapter 7

Chapter 7 reviews six case studies involving sleep-related risks to infants that occurred during the course of the overnight sleep studies. These scenarios involve key behaviours that have been identified by previous research as posing a significant threat to infant health and safety, but the large-scale studies that have identified these risk factors generally lacked a detailed and thorough description of how and in what context the behaviour occurred. The case studies included here are designed to offer this type of detailed description in order to more fully illuminate how risk factors play out for individual mothers and their infants.

1.5.8 Chapter 8

Chapter 8 presents a discussion of the findings of the present study. The outcomes are reviewed in light of the two theoretical models, and implications for both future research and clinical practice are considered. The limitations of the study are reviewed, and directions for future work are discussed.

1.5.9 Chapter 9

Chapter 9 concludes the study by reflecting on the purpose of the study, the results of the behavioural analysis, and the implications of using life-history theory for understanding contemporary health-related behaviours.

CHAPTER 2
LIFE-HISTORY THEORY: PARENTAL INVESTMENT AND HUMAN INFANCY

2.1 Life-History Theory

Life-history theory is a product of evolutionary perspectives on how time and energy are allocated, both across and within species, among various life stages and reproductive efforts. Life-history models explore the entire life cycle of a given organism, including processes involving growth, development, and maturation, with a particular emphasis on reproductive events (Morbeck, Galloway & Zihlman 1997). The application of life-history theory to field studies created a focus on the ways in which natural selection has shaped and adjusted the allocation of resources between somatic efforts and reproductive efforts across different species. Life-history theory can be applied at both the species and the individual level. Because patterns of energetic distribution vary between individuals of a given species, they are especially subject to the effects of natural selection. For mammalian species, key life-history traits include age at first reproduction, timing of subsequent reproduction and intervals between births, number and size of offspring, length of parental investment, and length of life span (Chisholm & Coall 2008). Life-histories are complex and involve considerable plasticity for some species, and behavioural as well as morphological traits operate to determine an individual's fitness (Draper & Harpending 1987). Within a single species, for any given organism individual fitness is determined by the ability to strategically distribute resources between one's own growth, physical maintenance, and ability to successfully reproduce. Patterns of energetic and resource allocation over time constitute an individual's life-history, and the ways in which those allocations are exhibited over any given time period are understood as life-history strategies (Borgerhoff Mulder 1992).

One of the central tenets of life-history theory is the idea that individuals are constantly faced with negotiating a variety of trade-offs throughout the life course. Trade-offs are an inevitable aspect of any individual's life-history trajectory since finite resources must be strategically allocated between growth, maintenance, and reproduction. Therefore, natural selection "favours organisms with mechanisms to allocate limited resources preferentially to the particular component of fitness that most increased their ancestors'

chances of leaving descendants under similar socioecological conditions" (Chisholm & Coall 2008: 135). While the concept of trade-offs is particularly relevant to human reproductive decisions, life-history theory must accommodate added complexities when applied to mammals such as primates, whose relatively long life spans and complex social organisation lend themselves to less distinct and less mutually-exclusive life-history traits and stages. Indeed, life-history trade-offs have been discussed in terms of "a consistent level of energy and time available to the organism. In real life, the amount of available energy is a constantly shifting quantity. . . Although the concept of trade-offs may be appropriate in some tightly controlled situations, in the real world the complexity of the choices confounds attempts to force them into a simple dichotomy" (Morbeck, Galloway & Zihlman 1997: xviii).

The primary categories of life-history trade-offs related to parental effort involve investing in current versus future reproduction, own growth and maintenance versus infant's growth and maintenance, and offspring quantity versus quality (e.g. Borgerhoff Mulder 1992). The absolute quantity of offspring produced is expected to be maximised only if increased reproduction does not ultimately decrease the number of surviving descendants. If the costs of additional offspring cause an undue burden to the survival of the parent, or threaten the survival of existing offspring, or if they effectively prevent opportunities for future reproduction, then natural selection will not simply favour the production of maximum numbers of offspring. Producing the greatest numbers of offspring only becomes adaptive when individuals have little or no control over offspring quality or likelihood of survival, and therefore base their reproductive strategies on a "nothing left to lose" strategy (Chisholm & Coall 2008: 136). For a parent who requires additional investment because of their own growth and development, the trade-off between self-investment and reproductive investment may result in reductions in parental effort.

2.1.1 Parental Investment

Particularly for slow-developing and socially complex species like humans, far more than the energetics of mating, gestation, parturition and lactation are involved in ensuring the representation of an individual's genes into subsequent generations. The way in which parents care for their offspring constitutes an essential component of their reproductive strategies and fundamentally determines their reproductive success. Parental investment theory addresses the ways that individual organisms balance the need to invest substantially in individual offspring while simultaneously ensuring that such investment

does not unduly threaten their own survival or opportunities for future reproduction. Parental investment theory initially grew from the recognition that the reproductive contribution of each sex is not equal and that females, who produce few but energetically expensive gametes, pursue a different strategy than males by investing more heavily in rearing fewer numbers of offspring. Trivers (1972) argued that the operation of sexual selection was determined by the relative degree of parental investment shown by each sex, pointing out that male and female interests are rarely identical. He noted that the initial parental investment of males at fertilisation is quite small compared to that of females, and that females are biologically required to make a substantial investment in gestation and parturition. While females are theoretically free to terminate investment after parturition, doing so would often (although not always; see Hrdy 1997) be evolutionarily disadvantageous since it would waste all energetic investment up until that point (Trivers 1972). This assumption has been criticised, however; Dawkins and Carlisle (1976) have argued that reproductive decisions are made based on expectations related to future gain rather than prior investment. Regardless of how individuals assess the costs and benefits of desertion, the essential point is that all aspects of parental effort ultimately function as an important part of sex-specific reproductive strategies (Lancaster & Lancaster 1987).

Patterns of parental investment are also shaped, in part, by aspects of social organisation. Biparental care is usually associated with pair-bonding, since increased certainty of relatedness increases paternal expenditure (Clutton-Brock 1991). However, uniparental care is more common. While this can involve uniparental male care among some species of birds, fish and amphibians, uniparental female care is the only form of uniparental care found among mammalian species (Clutton-Brock 1991). Given the significant costs of gestation and lactation, females are considered "high obligate investors" (Borgerhoff Mulder 1992: 353).

Parental investment refers to a broad array of traits, behaviours and strategies, but essentially refers to "any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring" (Trivers 1972: 139). Given their particular life-history trajectories, a discussion of parental investment is particularly relevant to primates, and especially to humans, because of the lengthy and highly complex parent-infant relationships that characterise these species. Compared to most other mammals, primates develop slowly, reach reproductive maturity later, have longer gestational periods, and longer intervals between births (Altmann 1987). Much of the phylogenetic

variation in life histories is associated with differences in body size. However, even among closely related species parental care and length of offspring dependence can vary markedly, beyond what can simply be explained by differences in body size, with primate gestational lengths ranging from 6-260 days and weaning ages occurring anywhere from 1-100 months or longer (Clutton-Brock 1991). Regardless of when weaning occurs, parental care for these species often extends beyond the point of nutritional independence, and can include forms of extended investment such as provisioning of material and territorial resources, protection from competition with conspecifics, or strategic positioning of offspring within a social hierarchy (Clutton-Brock 1991).

Because patterns of parental care represent a critical variable in survival and reproductive fitness, they are understood to have undergone intense selective pressures (Draper & Harpending 1987). An evolutionary perspective on parental investment argues that the behaviours of parents and offspring function as adaptive responses that increase or decrease survival and reproductive success (Soltis 2004). Parental investment theory addresses the cost-benefit ratio of efforts extended in order to benefit a particular offspring against the costs incurred by the parent in undertaking such efforts (Altmann 1987). Parenting strategies are sensitive to individual circumstances (Gross 2005), and are calibrated to particular contexts and conditions. Parental care varies between individuals, then, but is also continually adjusted over the lifetime of a single individual and even within a single reproductive event (Daly & Wilson 1981). It is important to note that the adaptive significance of parental investment operates to benefit individuals rather than species (Hrdy 2000; Gross 2005), so even relatively small variations in socio-environmental circumstances between individuals may result in variation in parental investment.

2.1.2 Parental Investment in Humans

Humans are exceptional among all species for the extraordinary degree of parental investment required to successfully rear immature, underdeveloped, and expensive human infants. Cross-culturally, mothers tend to be the primary caregivers, and the behaviour of new mothers and infants "shows both large variations and striking similarities across individuals within a culture and across cultures" (Fleming & Gonzalez 2009: 295). The similarities stem from the basic biological and physical needs that must be met for all human infants to survive. These include nursing (or arranging for alternate forms of nourishment, in certain cases; see Hrdy 1997), cradling, face-to-face orientation, and a

variety of forms of mutual sensory stimulation (Fleming & Gonzalez 2009). Indeed, infants are designed to maximise the probability that mothers will invest in them (Trevathan, Smith & McKenna 2008), thereby ensuring their survival and enhancing the likelihood that they, too, will reach reproductive maturity and leave descendants of their own.

Although infants everywhere share this set of basic caretaking requirements, there exists a remarkable level of cross-cultural variation in the type, amount, and duration of parental care among human societies (Draper & Harpending 1987). At birth, a human infant already represents a substantial investment of resources. The energetic resources required to secure mating opportunities, conceive, sustain gestation and parturition, and lactate are significant. Based on this investment, "one would expect that with so much at stake . . . natural selection would have designed a 'universal' pattern of childcare" to ensure the proper care of so costly an investment (Trevathan, Smith & McKenna 2008: 6). However, given the fluctuating conditions parents must confront, natural selection has instead favoured a more flexible and adaptable model of parenting behaviour that can be altered, enhanced, or even withdrawn depending on the prevailing social and environmental constraints.

Ultimately, fitness maximisation requires parents to "adjust their expenditure on parental care in relation to variations in its benefits to their offspring and in its costs to themselves" (Clutton-Brock 1991: 155). This is especially important where more than material and energetic resources are required to successfully rear offspring. For humans living in a contemporary, developed social context, "physical and psychological fitness (e.g. emotional stability and social and intellectual competence) are important for reproductive success. Thus, parental investment has become more precarious, and distinguishing high from low investment has become more difficult" (Burgess & Drais 1998: 388). Given the complex and fluctuating conditions under which human reproduction occurs, parental investment strategies must be exceedingly fine-tuned and sufficiently elastic. Parenting strategies are thus informed not by immutable laws but instead by "contingent statements" (Hrdy 2000: 79). The actual behaviours that women engage in on a daily basis in both their productive and reproductive capacities constitute "true survival strategies with significant consequences for subsistence, childbearing, and well-being" (Panter-Brick 1997: 241).

2.1.3 Parent-Infant Conflict

While parental investment theory focuses on the behaviours parents undertake in caring for their offspring, it also recognises offspring as agents in determining how parental investment occurs. Trivers (1972) first proposed parent-offspring conflict theory to describe how, in the process of parenting, conflict inevitably arises between parent and offspring about how, when and to what degree to invest in an individual offspring. Such conflict occurs because parents and offspring are not genetically identical, and therefore have overlapping but different interests and agendas about such investment (Clutton-Brock 1991). It behoves offspring to maximise their reproductive success by obtaining greater investment at each time point than the parent is able to provide, while it is in the mother's best interest to set specific limits on investment (Trivers 1972; Clutton-Brock 1991).

While mothers may tend to have the "upper hand" in determining parental investment, researchers have argued that offspring are endowed with the ability to employ psychological rather than physical tactics in order to assert control over the process of investment (Trivers 2002). For example, such tactics can take the form of repeated and exaggerated distress vocalisations meant to wear down a mother's resolve, as in baboons (Trivers 2002). Similarly, since mothers are selected to respond positively to signals when offspring are young and at their most vulnerable, another tactic of offspring is to revert to the mannerisms of an earlier stage of development, a process referred to as regression (Trivers 2002). Such tactics may be particularly visible during weaning, a period of time that is regarded as one of the most overt examples of parent-infant conflict. While mothers have a vested interest in terminating lactation at some specified time point, offspring typically benefit from a more prolonged period of lactation. The process of weaning illustrates the conflicting ways that maternal and offspring fitness are maximised (Trivers 2002; McDade 2001). Since the eventual outcome of an offspring's unregulated attempts to elicit maximum investment at all times would necessarily involve a decrease in maternal fitness, mothers may respond to parent-offspring conflict by setting fixed limits or by raising the cost to the offspring of continued attempts to elicit more investment than the mother is designed to give (Clutton-Brock 1991). The way mothers manage the dispersal of their parenting resources, factoring in their own constraints as well as the demands and agenda of their offspring, demonstrates a "highly facultative maternal response system that varies in line with life-history stage and socioenvironmental conditions" (Hrdy 1997: 414).

2.1.4 Parental Investment Decision Making

Parental behaviour is likely to be adjusted according to the relative balance of costs and benefits in a given set of circumstances. Among humans, as with other mammals, levels of parental investment are typically highest when offspring must face adverse environments, and lowest when resource levels decrease significantly. Additionally, levels of parental investment are often adjusted depending on how much another parent is investing in a given offspring (Clutton-Brock 1991). Parental care tends to operate on a hierarchical basis, with survivorship of offspring as the primary goal of all parenting efforts, followed by investing resources necessary for offspring to become self-sufficient, and finally, instilling cultural and ideological norms in offspring, particularly as they pertain to social status (Trevathan, Smith & McKenna 2008).

Researchers have attempted to systematically measure key aspects of reproductive effort and parental investment, and to analyse variation in levels of investment expended in relation to specific constraints. In examining prenatal investment the earliest form of parental expenditure, Bailey and colleagues (1992) found that marked birth seasonality among Lese subsistence farmers in northern Zaire could be explained by energy restriction during select periods of the year. Their model linked resource fluctuations and energy balance to ovarian function in Lese women, and found that rates of conception were lowest when food production was at its least. Broadly, it makes adaptive sense that "human reproductive physiology displays characteristic patterns that can be viewed as mechanisms that help optimize reproductive effort in the face of environmental energetic constraints" (Ellison 2003). Aspect of human reproduction that can be adjusted according to prevailing conditions and female energetic status include ovarian function, duration of gestation, birthweight, and duration of lactational amenorrhea (Ellison 2003). Nepomnaschy and Flinn (2009) measured the effects of stress on female reproductive functioning, and found that the subjective experience of stress among women in a Mayan community in Guatemala was related to activation of the stress axis and subsequent reproductive suppression. They argued that, from an evolutionary perspective, such suppression was adaptive because "in unfavourable circumstances, avoiding or interrupting reproduction allows females to focus scarce resources on survival, improvement in overall condition, and investment in existing offspring" (Nepomnaschy & Flinn 2009: 367). However, this picture of reproductive suppression is somewhat complicated by the existence of parent-infant conflict over the initiation and continuation of gestation, where the offspring has a vested interest in continuing a pregnancy even under problematic circumstances. The

foetus is thus an active participant in determining its fate, secreting chemicals to maintain the pregnancy even when it is not entirely in the mother's best interest to do so (Nepomnaschy & Flinn 2009).

While life history theory helps explain why reproductive suppression may be advantageous in some circumstances, it also helps explain why reproduction occurs even under extremely difficult circumstances. Although poor environmental conditions may promote hormonal suppression of reproduction in some instances, delayed reproduction only makes adaptive sense if the poor conditions are temporary and likely to improve. If conditions are continually poor, then lifetime reproductive fitness is decreased by waiting for an improvement in circumstances that will never occur. Instead, fitness is maximised by proceeding with reproduction if socioenvironmental improvements seem unlikely. Thus, reproductive strategies must weigh the relative quality of conditions in addition to the absolute quality (Vitzthum 2001).

Where reproduction takes place under poor conditions, the degree of investment can be manipulated in order to best serve the fitness maximisation interests of parents. Chisholm and Coall (2008) have examined the effect of high risk environments on parental investment. They found that high risk environments and lack of adequate material resources altered how parents responded to their children, leading offspring to experience extreme levels of anxiety in response to risky circumstances. Ideally, parental caregiving behaviour is able to compensate for this stress reaction in offspring, but "when parents are not sufficiently buffered against inadequate or uncertain material or socio-emotional resources they are apt to feel anxious and frustrated, and are then less capable of being consistently accepting of and sensitive and responsive to their children, thereby transducing the impact of their environment on themselves to their offspring" (Chisholm & Coall 2008: 139). When parents decrease levels of investment in this way, offspring receive the message that the environment is risky, resources are scarce, and risk of mortality may be high. Studies of female offspring raised under such conditions indicate that the resulting insecure attachment status and pervasive psychosocial stress sets them on a course toward earlier age at menarche and earlier age at first reproduction (Chisholm & Coall 2008). This is consistent with the finding that all offspring progress more rapidly through developmental stages where risk of mortality is high, and that there is an inverse relationship between rates of development and life expectancy (Clutton-Brock 1991). Although a full discussion of infant attachment is beyond the scope of this thesis, it is worth noting here that previous research has suggested that the attachment process

(Bowlby 1969) is the evolved mechanism by which reproductive strategies are entrained (Belsky, Steinberg & Draper 1991), and by which such factors as environmental risk and uncertainty are communicated to offspring via parent-child interactions (Chisholm et al. 2005).

In addition to adjusting levels of investment in individual offspring in response to resource limitation or high risk environments, reproductive timing and birth spacing can also be altered to maximise reproductive success in the midst of environmental constraints. Blurton Jones (1989; 1997) has argued that the long interbirth interval observed among the !Kung of Botswana represents an adaptive advantage that allows mothers to maximise their reproductive fitness while maintaining a tolerable backload during foraging activities. With interbirth intervals of any less than four years, maternal burden outweighs the small gain in birth rates. Furthermore, mothers burdened with more than one small child while foraging ultimately experienced increased child mortality and diminished lifetime reproductive success. According to their model, investing in reproduction no more frequently than every 46-50 months resulted in the greatest number of surviving adolescent offspring (Blurton Jones 1989).

As illustrated by the !Kung interbirth interval, modes of production have significant implications for parental investment strategies. The type of work women engage in determines how costly it is to care for very young offspring while simultaneously engaging in subsistence work. For example, Lancaster and Lancaster (1987) have argued that one of the greatest transformations in parental care was brought about by the transition to agriculture and stratified social systems, which radically altered the context in which parents produced and raised children. Under the new system, reproductive fitness suddenly required not only producing offspring and ensuring their survival, but also guaranteeing their access to extremely limited resources necessary for their own reproduction (Lancaster & Lancaster 1987). Likewise, Hewlett and colleagues (Hewlett et al. 2000) observed markedly different parenting strategies in three geographical settings, each pursuing a very different mode of production. For African farmers, African foragers, and upper middle class families in a Western industrialised setting, parenting strategies varied according to the work demands and social structure governing families in each context (Hewlett et al. 2000).

While the wider social environment, including resource availability, affects parental investment strategies, so too do the individual-level characteristics and circumstances of each mother. Mothers who engage in substance abuse, live in poverty, or

experience mental illness are all more likely to withhold parental care from their children (Soltis 2004). Furthermore, a mother's environment also affects the relative balance between costs and benefits associated with particular forms of investment. Hrdy (2000) has argued that maternal behaviour and emotions, as well as patterns of parental investment, do not result from biological imperatives. Rather than a universal pattern of self-sacrifice and consistent, extreme investment in offspring, mothers everywhere make strategic decisions about how balance the needs and demands of children against their own needs, resources and capacity to meet those demands. Scheper-Hughes (1992; 1985) has explored this strategic allocation of limited maternal resources in the context of shantytowns of northeast Brazil. She detailed the withdrawal or withholding of maternal investment for infants who were viewed as unlikely to survive the harsh conditions prevalent in the shantytowns. Maternal detachment and indifference operated in a context of severe resource restriction and high rates of child mortality, serving as a meaningful link between material and emotional scarcity that synergistically impacted child survival (Scheper-Hughes 1992; Scheper-Hughes 1985).

Other studies have examined the role of alloparents, especially during the late stages of pregnancy and throughout lactation, who can act as a means of reducing the costs of reproduction and child rearing (Borgerhoff Mulder 1992). Flinn (1989) examined the effects of co-resident female kin on parenting strategies in a Trinidadian village. He found that female kin managed reproduction so that only one female in a household reproduced at a given time, and that non-reproducing women contributed substantially to each other's reproductive success by sharing childcare and other household duties. He argued that evolutionary models of cooperative breeding systems helped explain the communal reproductive strategy he observed, and that household composition and residential patterns have important effects on female reproductive and parenting strategies (Flinn 1989). Similarly, Quinlan and colleagues used breastfeeding as a measure of parental investment and examined the impact of the mother's environment, including the presence of paternal support, on breastfeeding duration. They predicted that weaning "should occur when the fitness costs of continued breastfeeding exceed the benefits" (Quinlan, Quinlan & Flinn 2003: 2). They found that father absence was associated with early cessation of breastfeeding, but were not able to establish an association between age at weaning and other environmental variables suggested by parental investment theory.

While the presence of alloparents is almost always advantageous to a mother, acting as a supportive resource base which bolsters both child survival and ultimate

reproductive success, the presence of some co-resident adults can actually effect a decrease in parental investment, an increase in poor outcomes for offspring, and in some instances an increase in child mortality. While maternal grandmothers almost always have a beneficial effect on children, the contributions of paternal grandmothers show somewhat more variability, revealing little benefit for child nutritional status (Sear, Mace & McGregor 2000) and at times even a negative impact on child survival (Sear & Mace 2008). Additionally, parental figures are far less likely to invest in offspring to whom they are not biologically related. Lancaster and Kaplan (2000) found that women who raised their children with men who were not the genetic father produced children with lower educational attainment than children who were raised with both biological parents (Lancaster & Kaplan 2000). Daly and Wilson (1997) also found that individuals parenting unrelated children showed increased lapses in parental solicitude, and children being cared for by non-relatives such as stepfathers were forty times more likely to be abused. They documented a decline in abuse risk with increasing maternal age, which they interpreted as resulting from a tendency to maintain higher levels of care for existing offspring as a mother's reproductive value diminishes (Daly & Wilson 1997).

In addition to maternal characteristics and circumstances, parental investment is uniquely calibrated according to the qualities and reproductive potential of a particular offspring. Where substantial investment in a given offspring is unlikely to "pay-off" in terms of offspring survival and/or enhanced reproductive fitness, a decrease or withdrawal of parental care is more likely. For example, mothers of extremely sick infants have been shown to withhold parental care (Soltis 2004). Similarly, researchers have documented systematic reductions in parental investment among mothers of low birth weight babies, whose survival is far more precarious than that of full-term, healthy infants (Bereczkei 2001).

Under particular circumstances, one gender may represent a more assured investment and be granted an increased level of parental investment relative to the other gender. The Trivers-Willard hypothesis (Trivers 2002) suggests that parents will invest more in the gender that offers the best return, in the form of reproductive pay-off, on investment of resources. Parents in better condition are thus expected to invest more substantially in sons, while parents in poor condition are expected to bias investment towards daughters (Trivers 2002). Evidence supporting the Trivers-Willard hypothesis has been found by Irons (2000), who documented increased parental investment in sons relative to daughters, where sons had greater reproductive potential within a polygynous

mating system. Cronk (2000) also found evidence of gender-biased parental investment among the Mukogodo of Kenya. However, because females in that context had better marital and reproductive prospects than males, investment was heavily biased towards daughters. Daughters were held and nursed more, provided with better medical care, and showed better growth performance than sons (Cronk 2000).

The above studies represent some of the few attempts to empirically measure parenting behaviour and test concrete evolutionary hypotheses about parental investment. Other studies have used an evolutionary framework to discuss aspects of parental strategies without employing scientific methods. Burton (1990) argued that adolescent childbearing in African American families was a rational strategy designed to maximise reproductive fitness as part of an accelerated life-course timetable in which women work together to distribute childcare responsibilities across multiple, age-condensed and frequently cohabiting generations. Given a lowered expectation of longevity, a perception of diminished availability of quality and quantity of marriageable men, and a marked need for an available pool of alloparents, adolescent childbearing functions as an alternative and viable reproductive strategy designed to maximise inclusive fitness under a particular set of environmental constraints (Burton 1990). Adolescent parenting may serve to alter the timing of specific life-history stages to bring childbearing in line with the peak physical and reproductive capacity of mothers. This strategy has particular implications for child outcomes since "children may fare best if their birth and preschool years coincide with their mother's peak health and access to social and practical support provided by relatively healthy kin" (Geronimus 2003: 885).

2.2 Nighttime Parenting and Infant Sleep Research

There is no shortage of studies devoted to parenting behaviour, some of which employ an evolutionary perspective and many of which explore parenting in terms of its social, biological, and especially psychological aspects. However, very few studies have been devoted to parenting at night. Only in the last two decades has relatively limited attention been given to nighttime parenting, particularly focusing on infant sleep location and routines. This body of knowledge stems from a growing concern about "sleep problems" among infants and children in Western, post-industrial societies and the corresponding negative effects on parents (Anders & Taylor 1994), as well as a particular

concern about sleep-related risks with implications for infant morbidity and mortality, most notably Sudden Infant Death Syndrome (SIDS) (see McKenna, Ball & Gettler 2007).

It is important that discussions of infant sleep be informed by an awareness of the evolved biology of infancy, and anthropological perspectives provide a particularly useful groundwork for studies of infant sleep and nighttime parenting behaviour. Infant sleep patterns have been discussed within an evolutionary framework in which sleep-wake adaptations function differently depending on whether a species follows a "cache" or "carry" strategy of parenting. Unlike caching species of mammals, where mothers deposit infants in a secure location while they forage for food for extended periods of time, humans more closely follow a carrying strategy in which they are physiologically adapted to be in continuous contact with a caregiver. Among humans, the carrying strategy is marked by the need to feed at frequent intervals. This is necessary because, relative to the milk of non-primates, human milk has a low-fat, low-protein, and high-carbohydrate composition. Furthermore, human infants are able to void their bladder and bowels without assistance, a process requiring parental stimulation among cache species. Finally, the presence of startle and grasp reflexes, and the absence of developed thermoregulatory control among human infants all suggest that "the environment to which newborns genetically are the most likely to be adapted appears to be one of constant early contact, day and night, with a caregiver" (Anders & Taylor 1994: 69). Thus, the species-wide template for infant sleep is characterised by a large percentage of time spent asleep through the first years of life, frequent awakenings to feed throughout the night, and the need for sensory input from a caregiver to regulate physiological processes such as body temperature.

This evolutionary perspective is reinforced by studies of extant hunter-gatherer populations, who offer the best approximation of the environment of evolutionary adaptedness within which infant sleep evolved. These studies document patterns of continuous contact between caregivers and infants, regular opportunities to nurse throughout the day and night, a high level of maternal responsiveness to infant cues, and mother-infant contact during sleep (Small 1998). Cross-cultural data on contemporary societies have expanded our knowledge of practices related to infant sleep, but the majority of cultures continue to engage in nighttime caregiving behaviours that are in line with the evolved biology of infant sleep. Cross-cultural studies reveal a breadth of practices related to infant sleep, including use of various furniture and sleep surfaces such as cradles, slings, and hammocks (see Ball 2007b). However, close proximity between mothers and infants

is the most normative pattern worldwide, with a majority of cultures engaging in direct contact between infants and mothers during sleep (Small 1998).

Cross-cultural comparisons also suggest that culturally-influenced parenting behaviour regulates key aspects of infant sleep physiology, such as the consolidation of sleep into periods of increasing duration across the first years of life. Clinical standards for infants in the United States note a normative progression from four-hour sleep episodes at one month of age to eight hours at four months, while infants in African cultures average sleep episodes of three hours duration and maintain this pattern for the first eight months of life (Harkness 1980). Although the African pattern differs from the American indices for physiological maturation of the brain, the difference is not indicative of developmental delays or sleep pathology, but rather differences in parent-infant contact, opportunities for nighttime breastfeeding, and cultural perceptions of night wakings. The African pattern likely represents sleep-wake states that more closely resemble our evolutionary past, and the Western standards for increases in maximum infant sleep episodes may only represent normative development in the context of sleep environments and nighttime parenting strategies that promote rapid consolidation of sleep episodes.

In spite of the adaptive fit between infant physiology and parent-infant sleep contact (Ball 2007b), Western cultural norms in the past century have departed significantly from evolved behaviours related to infant sleep and feeding. A wide variety of cultural trends produced this shift, including the shift towards larger living spaces with separate sleeping quarters, changing notions about personal privacy, the use of cradles and other infant-care devices, childrearing goals based on cultural constructs such as independence and autonomy, and the influence of Freudian theory, among others (see Ball 2007b). This shift away from evolved patterns of behaviour may have increased the costs of nighttime care because of increased expenditures required to prepare separate sleep spaces for infants, promote early settling behaviours (e.g. 'Ferberizing' infants by letting them 'cry it out', see Ferber 2006; see also Hiscock & Wake 2002), and tend to infants that are at greater distances during the night. The use of artificial milk and extended periods of separation between infant and caregiver (which may represent efforts to reduce parental investment), especially at night, became a standard component of parenting strategies. As a result, clinical studies of infant sleep were conducted using samples of solitary-sleeping, bottle-fed infants based on the assumption that such a scenario represented a "normal" condition for human infants. The entire discourse related to infant sleep and its associated

pathologies has been based on these studies, and the absence of an evolutionary consideration represents a failure of the Western research paradigm (Mosko et al. 1997).

In the last two decades, anthropologists have attempted to re-introduce an evolutionary perspective into research related to infant sleep and nighttime parenting based on the idea that some caregiving strategies may be better aligned with evolved infant biology than others (Anders & Taylor 1994). Existing data indicate that there are significant physiological and behavioural differences associated with particular infant sleep environments. Anders & Taylor (1994) suggest that infant sleep environments should be classified based on distance between parent and infant sleep locations, as well as by the type of material items used in conjunction with the sleep environments. In comparing bedsharing and cot-sleeping infants, Baddock and colleagues (2006) found a number of behavioural differences between infants in the two environments. Although the total sleep time was the same for infants in each condition, bedsharing infants fed significantly more often than infants sleeping in a cot. Furthermore, bedsharers slept in a lateral position more frequently, whereas cot-sleepers spent the majority of the time in the supine position. The unsafe prone position was rare for infants in both groups, but when it was observed it lasted for short intervals in the bedsharing environment but lasted the entire sleep period for infants in cots. Key aspects of maternal nighttime parenting behaviour were also different depending on sleeping arrangement. Mothers in both situations spent a comparable amount of time checking on their infants, but this took the form of intense soothing behaviours among mothers of cot-sleepers (such as rocking and bouncing) while it involved affectionate interactions for bedsharing mothers (Barone 2002). Other studies have documented an increased number of transient arousals in bedsharing infants along with an increased number of feeding episodes and total nightly duration of breastfeeding in bedsharing dyads (McKenna, Mosko & Richard 1999), and an increase in full and prolonged arousals in solitary sleeping infants (Barone 2002). These studies suggest that meaningful differences exist in parents and infants who bedshare compared to those who sleep on separate surfaces, a finding which is particularly interesting since such differences exist even when a cot is placed in close proximity to the parental bed (Baddock et al. 2006). These findings suggest greater parental effort is required in nighttime parenting for cot-sleeping compared to bedsharing infants.

In recent years, there has been an upsurge in the amount of parent-infant sleep contact in western societies. Because sleep and feeding behaviours are intricately related, this may be a result of changing practices with regard to infant feeding. As a growing

awareness of the importance of breastfeeding for women and infants has been translated into public health campaigns (Centers for Disease Control and Prevention 2009), the increase in bedsharing may be tied to increased proportions of breastfeeding mothers since breastfeeding tends to promote bedsharing even among parents who do not initially intend to sleep with their infants (Ball, Hooker & Kelly 1999). Recent studies have found that bedsharing functions as a nocturnal parenting strategy that allows mothers to increase breastfeeding and reduce sleep disruption (Ball & Klingaman 2008). However, breastfeeding alone cannot account for the entire population of bedsharing families. Bedsharing is prevalent in several populations where breastfeeding is rare, and far less is known about why parents choose to sleep with their infants in these contexts. The increase in bedsharing has fuelled an intense debate among social scientists, epidemiologists and medical practitioners because, while sleep contact would have been standard practice over the course of human evolution and continues to be the normal arrangement for most families cross-culturally, parent-infant sleep contact appears to be associated with an increased risk of infant mortality in some contemporary populations, especially those living in an urban, socioeconomically disadvantaged context.

Since clinical and epidemiological paradigms have not fully accounted for the parental motivations that inform choice of infant sleep location, the significant variation in sleep-related parenting practices, and the differential outcomes associated with bedsharing and other specific sleep locations, evolutionary perspectives on infant sleep and nighttime parenting routines offer a meaningful expansion of existing discourse, and suggest new and alternate hypotheses and avenues of study. The intertwined relationship of nocturnal feeding practices and proximity between mothers and infants during sleep "offers a compelling arena for the application of evolutionary perspectives" (Ball & Klingaman 2008: 227).

CHAPTER 3
ADOLESCENT PARENTING, NIGHTTIME PARENTING, AND INFANT SLEEP OUTCOMES

3.1 Adolescent Parenting as a Social Problem

Both existing literature and popular perceptions generally frame teen childbearing as a social problem with significant consequences both for maternal and child outcomes as well as for larger societal costs. There is an extensive literature detailing the factors that predispose individual youth to becoming adolescent parents (e.g. Lancaster & Hamburg 2008; Hoier 2003; Maestripieri et al. 2004; Johns 2003). A variety of environmental cues experienced early in life such as father absence (Maestripieri et al. 2004), sexual abuse (Butler & Burton 1990), or poor gender relations and domestic stress (see Worthman 1999) may trigger "a developmental trajectory characterised by earlier readiness for reproduction and parenting" (Maestripieri et al. 2004). This discussion is ultimately beyond the scope of the present study since the focus here is on the actual behaviour of teen and adult mothers. Once adolescents become parents, both the existing literature and conventional wisdom hold that adolescents are at a particular disadvantage when they arrive at parenting since they must cope with the stress of pregnancy and childrearing as well as the routine stressors of adolescence, all at a time when their personal coping mechanisms are still developing (Passino et al. 1993).

Adolescent mothers are often viewed as psychologically, emotionally, and even physiologically ill-prepared to provide optimal care for their children (Borkowski et al. 2002; Roth et al. 1998), and must balance their own physical and socio-emotional developmental needs with those of their infants. Scholl and colleagues (1990) have shown that some teen reproduction occurs prior to mothers completing their own physical growth, creating significant physical stress for their offspring. Maternal growth during pregnancy, particularly for subsequent adolescent pregnancies, creates competition between mother and foetus for nutritional resources and results in significantly decreased birth weight for infants (Scholl, Hediger & Ances 1990). Overall, teen mothers are more likely to experience adverse birth outcomes (Roth et al. 1998), are two times more likely than adults to deliver pre-term or low birth-weight infants (Branum 2006), and economically they are the poorest of all maternal age groups (Roth et al. 1998). There appear to be both

physiological and lifestyle factors associated with these adverse outcomes. Incomplete maturation of the reproductive system, coupled with normative adolescent behaviours such as dieting, substance use, and other lifestyle factors, can promote low birth weight among infants of teen mothers (Roth et al. 1998).

Because of the different life stages at which teen and adult mothers reproduce, their parenting styles across multiple domains are extremely divergent, with serious implications for child development. Compared to adults, the psychological literature has shown that teenage mothers are typically less accepting of their infants, are less sensitive, display less positive affect, and engage in fewer interactions with infants (Nath et al. 1991). Furthermore, teen mothers experience heightened levels of parenting stress, and their children are at higher risk for child abuse, receive less verbal stimulation, less emotional and verbal support, and end up being less securely attached than the children of adult mothers (Borkowski et al. 2002). These apparent parenting deficits may stem from the fact that teen mothers have an egocentric orientation and are more interested in their own identity and development than in newfound parenting responsibilities (Borkowski et al. 2002). It is argued that they are particularly in need of social support, although there appears to be a fine line between helpful and harmful forms of social support where such support should ideally assist a teen mother in her parenting efforts, but not usurp her parental role and responsibilities (Borkowski et al. 2002). Support provided by a teen parent's own mother appears to be particularly important, and grandmothers make key decisions about how their teen daughters should parent, including decisions related to how infants are fed (Bentley et al. 1999). Furthermore, criticism received by a teen mother from her own mother is one of the factors most strongly related to the degree of parenting stress she will experience (Larson 2004).

Breastfeeding rates also remain extremely low among teenage mothers; indeed, adolescents have the very lowest rates of breastfeeding of all age groups (Feldman-Winter & Shaikh 2007), leaving their children at a nutritional and immunologic disadvantage with serious implications for health and developmental outcomes. Infants of African American teens are at the highest risk for premature introduction of non-milk solid foods, with the normative pattern involving feeding cereal in a bottle to infants within the first month of life (Bentley et al. 1999). There are a number of barriers to breastfeeding that are unique to adolescents (Volpe & Bear 2000). Additionally, sexually abused young women, who have higher rates of teenage pregnancy, are also less likely to breastfeed their infants (Bowman 2007). Improving breastfeeding duration and initiation rates among teen mothers is

complicated by the fact that physicians and other practitioners have the least amount of impact on infant feeding decisions among teen mothers, while their own mothers and their babies' fathers have the greatest influence (Robinson et al. 1993).

Given the numerous and severe consequences of teenage childbearing, public policy generally recognises preventing teen pregnancies as a critically important societal goal (National Campaign to Prevent Teen and Unplanned Pregnancy 2009a). Above and beyond improving individual child outcomes, this goal is largely driven by a desire to decrease the collective burden presumed to result from teen parenting (National Campaign to Prevent Teen and Unplanned Pregnancy 2009b). The conventional wisdom, simply put, "continues to hold teen childbearing to be, in all cases and in every aspect, an antisocial act and an important public health problem" (Geronimus 2003: 881). This approach guides much of the current research agenda about teen parenting, as well as public policies pertaining to teen parents and their children.

3.2 Adolescent Parenting as a Life-History Strategy

In contrast to the above perspectives and conclusions, recent studies have suggested an entirely different way to approach the phenomenon of adolescent childbirth and parenting, one that frames the discussion by recognising that adolescent reproduction is confounded by a socioenvironmental context that produces poor outcomes. Furthermore, this alternate view suggests that poor outcomes would result for the populations in question regardless of whether individual women postponed childbearing into adulthood. This perspective calls on policy makers to recognise "the prior socioeconomic disadvantage of women who become teen parents. Within that disadvantage, teen parenting may not be deviant or "off-time", but responsive to socio-structural constraints and opportunities" (Geronimus, Korenman & Hillemeier 1994: 586; see also Johns 2003). This fundamentally alters the discourse on the causes and correlates of teenage childbearing, since teen parenting is not understood as a cause of adverse outcomes, but rather as a functional strategy undertaken by some individuals within a context in which adverse outcomes are already probable. Thus, policy makers concerned about child development must recognise that "the same processes (from social inequality) contribute to both selection into teen motherhood and impaired early childhood development" (Geronimus, Korenman & Hillemeier 1994: 587).

Recent research on the outcomes associated with teenage motherhood further supports this view. While the economic disadvantage of the majority of teenage mothers is indeed a pressing concern, evidence suggests that teen pregnancy is correlated with but does not cause socioeconomic disadvantage (Bissell 2000). In fact, a study by Hotz and colleagues measured annual hours of paid employment and overall earnings, and found that teen mothers would have had lower levels of each at older ages had they delayed childbearing (Hotz et al. 2005). Existing data do not automatically support the idea that teenage parenting is a problem. Rather, it can be understood not as a sign of failure or dysfunction but instead as an alternative series of life choices that happen to be at variance with white, middle-class norms (Schultz 2001). Many of the negative consequences associated with adolescent parenting appear to be much smaller than previously found, and many of the negative outcomes that are observed are typically short-lived (Hotz et al. 2005).

Although it strongly contradicts conventional wisdom, evidence suggests that teenage childbearing can actually involve certain advantages under a particular set of circumstances. Although teenage pregnancies more often result in low birth weight infants, there are actually fewer low birth weight infants born to socioeconomically disadvantaged African American teen mothers compared to older African American mothers (Geronimus 2003). The ratio of low birth weight in African American and European American infants is smaller in the teen years than for older age groups since, in low SES categories, the incidence of low birth weight increases with age for African American mothers (Roth et al. 1998). Additionally, childbearing during adolescence often secures higher levels of social support for teen mothers than would be granted to them at older ages, since older mothers are seen as more autonomous and responsible and therefore less in need of expanded support (Rosengard et al. 2006). However, rather than promoting dependency, the transition to motherhood in adolescence often leads to a heightened sense of purpose and an increase in safety-conscious behaviours in the teenage mother (Shanok & Miller 2007). Furthermore, sharing responsibility for child rearing across multiple generations of relatives distributes risk and provides a form of "social insurance" that a disadvantaged woman might not otherwise be able to secure for herself (Geronimus 1997).

Recognising the context within which teen childbearing exists as a viable and practical strategy has far-reaching implications for policy formulation. Discussions of teen pregnancy and parenting are too often based on narrow stereotypes displayed in popular media that portray teen mothers as irresponsible and neglectful (Schultz 2001). Indeed,

"the failure to recognise that variations in population parameters may reflect adaptive cultural responses to socioeconomic and environmental exigencies may have constrained policy development so that a focus on altering fertility timing may not alter the conditions that affect child well-being" (Geronimus, Korenman & Hillemeier 1994).

3.3 Infant Sleep Environments and Sleep Safety

Despite a wealth of studies devoted to the differences in parenting skills and resultant child outcomes of teen and adult mothers, the specific behaviours associated with teen and adult parenting strategies remain poorly documented and the consequences of the teenage strategy in particular remain contested (Geronimus, Korenman & Hillemeier 1994). Furthermore, very little is known about nighttime parenting styles in general and virtually nothing is known about whether teens and adults differ in any meaningful way in their approach to providing nighttime care for infants. This represents a significant gap in the literature, since differential sleep-related outcomes exist for the infants of teens and adults and since it remains unclear which specific behaviour or suite of behaviours is responsible for those differences. Given the reality that infant survival, development and physiological regulation are all dependent upon the actions of a caregiver, it is important and clinically relevant to understand health and safety issues in light of parental caretaking behaviours. This is especially significant for nighttime parenting behaviours. Examining infant sleep environments alone, in the absence of the caregiving context within which sleep environments are chosen, constructed, and used, fails to adequately capture the true picture of infant sleep which creates either protection or risk for individual infants.

3.3.1 Clinical Literature on Infant Sleep

Although there is substantial variation in infant sleep patterns during the early months of life, several studies, based primarily on western populations, have established normative trends in sleep development during infancy. The first six months of life are typically characterised by a consolidation of sleep and wake episodes over time, with these periods subsequently becoming organised around a 24 hour day/night cycle (Coons & Guilleminault 2008). By six months of age, infants typically sleep 14.2 hours per day on average, with a decreasing amount of daytime sleep and an increase in nocturnal sleeping periods (Iglowstein et al. 2003). During the six months after birth, infants' longest sleep period progressively becomes organised around the darkest period of the 24-hour cycle

(Coons & Guilleminault 2008). Sustained waking periods are normally present in infants by 6 weeks of age (Coons & Guilleminault 1982). Polysomnographic recordings obtained in a laboratory setting by Hoppenbrouwers and colleagues (1988) have documented a normative decrease in active sleep and an increase in quiet sleep during the first six months, with an increase in sustained episodes of these states. Furthermore, they note that the considerable variability that exists in infant sleep patterns moves toward reduced variability between 3 and 4 months of age. REM sleep accounts for a higher proportion of total sleep during the night in infancy (Coons & Guilleminault 1982), and as infants mature REM periods become less likely at sleep onset (Coons & Guilleminault 2008).

Although data on normative sleep development is used to identify sleep pathology, there is some question about the appropriateness of clinical standards for infant sleep. In particular, several researchers have questioned the accuracy of these standards, noting that they are based on data collected under a very specific, and not altogether natural, set of experimental conditions. McKenna and McDade (2005) note that when studying formula-fed, solitary sleeping infants in a laboratory setting, data on infant sleep patterns should not be used to conclude what infant sleep looks like under other conditions. The sleep behaviour of infants under other circumstances appears to be profoundly different, such as when breastfed infants sleep in their normal setting which may include close proximity to the mother (Ball 2003). There is also evidence that sleep development shows remarkable variation cross-culturally and intra-culturally, and that such variation may be explained by the physical and behavioural environment within which infant sleep occurs (Ball 2007b; Harkness 1980). Cross-cultural data on children's sleep behaviour have been reviewed elsewhere (see Jenni & O'Connor 2005); a full discussion of the cultural variability of infant sleep is beyond the scope of this thesis.

3.3.2 Sudden Infant Death Syndrome

The existing clinical literature on infant sleep has largely been driven by concern about sleep-related causes of infant mortality, particularly with regard to sudden infant death syndrome (SIDS) risk. This concern has produced an extensive body of research designed to elucidate individual risk factors. Despite numerous explanatory theories, the true cause of SIDS remains unclear; in fact, many experts doubt a single cause exists. A SIDS death is a diagnosis of exclusion, where a post-mortem autopsy fails to determine a specific cause of death (Willinger, James & Catz 1991). The greatest reduction in the incidence of SIDS to date stemmed from research conducted in Australia, New Zealand

and the United Kingdom that demonstrated an elevated risk for infants placed in the prone position for sleep (see Fleming 1994). The data were sufficiently compelling for numerous public health campaigns to be developed in a variety of countries, and in all areas such campaigns were followed by a dramatic reduction in SIDS cases. In the United States, the American Academy of Pediatrics initiated the "Back to Sleep" campaign in 1992, advocating the supine position for infant sleep. In the years after the campaign was initiated, the U.S. SIDS rate fell from 1.2 per 1000 live births in 1992 to 0.53 per 1000 live births in 2000 (Rasinski et al. 2003); the majority of this decline can be attributed directly to changes in infant sleep position (Willinger et al. 1998).

In addition to the risks associated with the prone sleeping position (Vennemann et al. 2005; Fleming et al. 2003), a number of additional risk factors have been identified for SIDS. These include a peak risk at 4-16 weeks of age, a higher incidence among male infants, low birth weight (LBW), shorter gestation, and neonatal problems at delivery (Leach et al. 1999). Since the major drop in SIDS following recommendations to place infants supine, there has been a shift towards a higher proportion of SIDS cases occurring in socially-deprived groups (Leach et al. 1999). In the United States, African American, Alaskan Native, and Native American communities continue to be disproportionately affected (NICHD 2001). Epidemiological studies following the large reduction in SIDS have identified key risk factors including smoking during pregnancy, breastfeeding for less than two weeks, and cosleeping (Vennemann et al. 2005), soft bedding, soft sleep surfaces, and overheating (Moon, Horne & Hauck 2007). There is some evidence that over-the-counter cough and cold medications may be implicated in some SIDS cases (Rimsza & Newberry 2008). Furthermore, a markedly higher incidence of SIDS occurs in child care settings (Kiechl-Kohlendorfer & Moon 2008; Moon, Calabrese & Aird 2008). Sleep position, head covering, overwrapping, and infant illness are also consistently cited as risk factors (Fleming et al. 2003; Fleming et al. 1996). For reasons that remain unclear, the risk of death attributed to SIDS is greatly increased for infants who sleep with parents on a sofa (Blair et al. 1999). Parental smoking, and in particular maternal smoking during pregnancy and following birth, has been found to be a very strong predictor of SIDS risk in multiple studies (Blair et al. 1996; Fleming et al. 1996; Leach et al. 1999; Vennemann et al. 2005; Fleming et al. 2003; Fleming & Blair 2007). There is some evidence that pacifier use during sleep has a protective effect (Moon, Horne & Hauck 2007; Vennemann et al. 2005), although it is unclear whether this has a direct effect or is related to other variables that themselves confer protection. The risk for SIDS infants who routinely used a pacifier but

did not do so for their last sleep has been shown to be non-significant when socio-economic status (SES) is controlled (Fleming et al. 1999).

Blair and colleagues (2006b) have shown that risk factors for SIDS are fairly uniform between daytime and nighttime sleep, although the lateral sleep position is a more pronounced risk factor for SIDS during the day and paternal smoking is a more pronounced risk for nighttime deaths. Regardless of time of day, unsupervised sleep increases risk to infants. When infants were unobserved during the sleep period, they were more likely to be found with bedding over their heads compared to those infants where a parent was present in the room with the sleeping infant (Blair et al. 2006a). Indeed, separation from a caregiver is a significant risk factor across the board. Infants who sleep in a separate room from their parents are at increased risk for SIDS compared to infants who sleep in the same bedroom (Blair et al. 1999).

3.3.3 Other Causes of Infant Sleep-Related Mortality

While SIDS remains a prevalent type of infant mortality, there are other sudden but ultimately explainable forms of infant death, referred to collectively as sudden unexpected death in infancy (SUDI). The clinical characteristics of SIDS and explained SUDI cases are similar (Ward-Platt et al. 2000), and many of the underlying factors for infants who die of either cause are the same (Leach et al. 1999). Infants in both groups have generally poorer health, a higher frequency of symptoms, and most importantly, a history of apparent life-threatening events (ALTE) (Ward-Platt et al. 2000). However, although rates of maternal smoking during pregnancy are high for infants who die of SUDI, the rates are still significantly higher among SIDS infants, so this risk factor appears to be particularly relevant to the aetiology of SIDS (Leach et al. 1999). Additional aspects of the infant sleep environment are also implicated in infant suffocation deaths. Various lethal sleeping environments have been identified and described in detail. In a review of death scene investigations in Australia, Byard, Beal and Bourne (1994) identified a variety of risky scenarios that caused accidental asphyxia in infants and young children. Materials in the sleep environment were implicated in deaths due to suffocation, strangulation, entrapment, and other causes of asphyxiation and upper airway occlusion on a variety of different sleep surfaces. Additional dangerous scenarios identified "involved infant car seat restraints, seats with loose harnesses, cots with movable sides or projecting pieces, thin plastic mattress/pillow coverings, and beds with spaces between the mattress and cot side or wall"

(Byard, Beal & Bourne 1994: 497). Regardless of the particular materials involved, lack of supervision was identified as a factor in each of the cases reviewed in their study.

3.3.4 Parent-Infant Bedsharing

Perhaps the most controversial aspect of infant sleep safety pertains to the risks and benefits that have alternately been attributed to parent-infant cosleeping, especially in the form of bedsharing. Although bedsharing has been shown to regulate infant physiology in important ways, to facilitate breastfeeding, to promote attachment and bonding, and to lead to positive developmental outcomes (see Ball & Klingaman 2008; McKenna 2002; McKenna & McDade 2005; McKenna, Ball & Gettler 2007), it has also been cited as a significant risk factor for SIDS, and is believed to place infants at risk of suffocation through entrapment, overlying, or other airway restriction (Scheers, Rutherford & Kemp 2003; Kemp et al. 2000). The fact that such highly divergent child outcomes have been associated with the same sleeping environment highlights methodological problems involving the identification of discrete risk factors, use of standardised definitions about sleeping arrangements, and collection of appropriate information during death-scene investigations (Ball 2007a; Rigda, McMillen & Buckley 2000; McKenna 2002).

The studies that have contributed to concerns about the safety of bedsharing cite numerous dangers and poor outcomes associated with the practice of bedsharing. Some have suggested that bedsharing inhibits the development of independence and autonomy in infants, and that it impedes proper sleep, including consolidation of infant sleep episodes (see discussion in Ball 2007b; McKenna, Ball & Gettler 2007). Others suggest that it promotes behavioural and emotional problems for infants and children, and elevated levels of psychological stress for parents (Cortesi et al. 2008). Additionally, safety concerns about bedsharing grew out of studies like the New Zealand Cot Death Study, which attributed elevated risk of SIDS to bedsharing with parents who were smokers (e.g. Mitchell et al. 1997; Scragg & Mitchell 1998). Bedsharing has been cited as a SIDS risk factor in U.S. studies as well (Knight, Hunsaker & Corey 2005). Other studies in the U.S. have also documented numerous safety concerns, including risk of suffocation (Scheers, Rutherford & Kemp 2003), risk of overlying, especially among overweight parents (Carroll-Pankhurst & Mortimer 2001), and increased risk of head covering (Kemp et al. 2000). Byard (1998) argued that falling asleep while breastfeeding in bed had the potential to create a very specific form of parental overlay wherein the maternal breast caused airway occlusion. This risk was potentially greatest for mothers suffering from excessive

levels of fatigue. Research has also found that the risks created by bedsharing are greatest for very young infants, especially those less than 20 weeks of age (McGarvey et al. 2006). Additional studies suggest that some percentage of deaths diagnosed as SIDS cases that occur in the bedsharing environment may actually be deaths caused by mechanical asphyxia involving an adult body and/or compressible bedding materials (Person, Lavezzi & Wolf 2002).

Drago and Dannenberg (1999) documented specific sleep-related risks to infants including entrapment, suffocation, overlying and strangulation. Their study found that cots, beds, or bedding were involved in more than half of the suffocation deaths they reviewed, and that beds were particularly dangerous when located near a wall, when pillows and other soft bedding were present, or when bedsharing occurred. In a retrospective review of data on deaths of children under the age of two spanning the years 1990-1997, Nakamura and colleagues (1999) found 515 deaths that occurred among children placed to sleep on adult beds. They found that cause of death for 121 cases was overlying by a parent, other adult, or sibling. The cause of death for the other 394 cases was due to entrapment, suffocation, and strangulation involving the physical structures of the various types of beds, which included waterbeds. They recommended that children under the age of two years always be placed to sleep in cots meeting established safety guidelines, and that they not be put to sleep in waterbeds or other adult beds that pose a risk of entrapment, wedging, or strangulation (Nakamura, Wind & Danello 1999).

Despite the above studies addressing the dangers associated with infants sleeping in adult beds, an equally rigorous body of work has documented the ways that bedsharing offers the most appropriate and potentially the safest sleep environment for infants. These studies argue that bedsharing is beneficial, protective, and can even reduce the risk of SIDS, especially when practised in conjunction with breastfeeding. These studies have been extensively reviewed and summarised (see McKenna, Ball & Gettler 2007; Horsley et al. 2007); they enumerate specific benefits of bedsharing including routine adoption of the supine position for bedsharing infants, an increase in transient arousals, the ability of expired maternal CO_2 to stimulate infant breathing, more frequent nocturnal breastfeeding, and opportunities for affectionate interactions and bonding. Furthermore, many mothers report that proximity to infants during bedsharing allowed them to detect and respond to infant health crises, and ethnographic reports in contemporary western populations suggest that many parents believe that bedsharing allowed them to save their infant's life (McKenna & Volpe 2007). Rather than impeding independence among bedsharing

children, studies reviewing long-term child outcomes suggest that preschool-age children of parents who adopted bedsharing early on were more self-reliant and socially independent (Keller & Goldberg 2004). Furthermore, Schluter and colleagues (Schluter, Paterson & Percival 2007) found that bedsharing and roomsharing were protective factors among Pacific Island populations, even though bedsharing was often practised in conjunction with parental smoking. Pacific Islanders have an increased incidence of health problems generally but a low rate of SIDS. The authors concluded that bedsharing helped explained the low incidence of SIDS, and surmised that Pacific mothers may be engaging in some bedsharing arrangement that helps mitigate the harmful effects of smoking for their infants. Other studies have also called into question sweeping statements about the dangers of bedsharing among ethnic groups in the U.S. In a study of infant sleep-related deaths in Alaska, which has one of the highest SIDS rates in the country, Gessner and colleagues (2001) found that bedsharing posed an elevated risk to infants only when additional risk factors were present. Notably, "of the 40 infants who slept with a parent at the time of death, only 1 infant who slept supine with a non-drug using parent on an adult nonwater mattress was identified" (Gessner, Ives & Perham-Hester 2001: 923). Their study could not support a recommendation against bedsharing across the board, and found that when other risk factors were absent SIDS deaths during bedsharing were rare. Lahr and colleagues (2007) also found reason to question uniform recommendations against bedsharing based on the variable outcomes associated with its practice among different ethnic groups in the U.S. They found that "given the high prevalence of frequent bedsharing in blacks and Hispanics with widely differing SIDS rates, it is hard to see how bedsharing alone—without other modifying factors—is contributing substantially to SIDS rates, adding further doubts about the hypothesised dangers of bedsharing in and of itself" (Lahr, Rosenberg & Lapidus 2007).

Recently, several studies have tried to reconcile the existence of divergent outcomes associated with bedsharing by employing more stringent methodological approaches and by controlling for a range of variables. These studies indicate that a particularly complex relationship exists between individual risk factors and key behavioural aspects of the bedsharing environment. For example, inhibited thermoregulatory control caused by prenatal cigarette exposure can interact with the higher environmental temperatures to which bedsharing infants are exposed (Baddock 2005), thus increasing risk of overheating and succumbing to SIDS for vulnerable infants. This interaction illustrates the way in which physiological factors combine with behavioural

factors and parenting practices to increase or decrease risk for individual infants. Other factors that appear to interact negatively with the bedsharing environment include high tog value of clothing and bedding and low weight for gestation at birth (McGarvey et al. 2005). Similarly, infants display a number of cues throughout the night that elicit maternal responses, and they are capable of managing potentially risky situations such as head covering by either removing blankets on their own or alerting the mother to do so (Baddock et al. 2007). Any factors that decrease the ability of the caregiver to detect and respond to these cues may constitute a risk to the infant. Such factors may include smoking, alcohol or drug-use, and excessive overtiredness. However, it may be that airway covering itself does not necessarily create an undue risk for infants, contrary to what researchers have typically assumed. Ball (2009) reported that while babies did experience more airway covering from bedding when bedsharing compared to sleeping in a cot, they were able to maintain normal oxygen saturation, even when airway covering was prolonged, and they did not exhibit any increase in heart rate as a sign of physiological stress.

Researchers have also called into question interpretations of epidemiological data that purport to show an elevated risk from bedsharing (see McKenna, Ball & Gettler 2007; McKenna & McDade 2005; Morgan, Groer & Smith 2006; Donohue-Carey 2002). Blair and colleagues (2006a) examined data on SIDS deaths and found that, while the proportion of SIDS deaths that occur during bedsharing has risen in recent years, the actual number of such cases has reduced by half. Thus, it appears that this proportional shift has resulted from fewer deaths occurring in solitary sleep environments following campaigns advocating supine positioning rather than from a rise in bedsharing deaths, and that some increase in bedsharing deaths is accounted for by the increase in deaths occurring when parents sleep with their infants on a sofa. This finding reinforces the need to employ more tightly defined categories, such that risks from sleeping in a bed and risks from sleeping on a sofa are not combined into one category (Ball 2007a; Rigda, McMillen & Buckley 2000; McKenna 2002).

Where proper controls are employed, it is possible to separate specific risk factors from the practice of bedsharing *per se*. After post-matching for social deprivation, Fleming and colleagues found that bedsharing no longer remained a significant risk factor in a multi-variable context, although other independent risk factors such as sleep position, overwrapping, and infant illness did remain significant (Fleming et al. 2003). Likewise, the risks associated with being found in a parental bed were not significant for older infants

or infants of non-smoking parents, and became non-significant after adjusting for maternal alcohol consumption, presence of duvets, parental tiredness and overcrowded living conditions (Blair et al. 1999). Thus, identified risk factors may all pose a safety threat to bedsharing infants, but bedsharing itself does not increase risk to infants without the presence of these additional factors (Fleming 2002).

3.3.5 Infant 'Sleep Problems' and Developmental Outcomes

Although not necessarily driven by a concern for potential mortality among infants, a parallel vein of research into infant sleep has grown from an increasing concern, especially in western nations, about infant 'sleep problems'. The worry that infants are not 'learning' how to sleep appropriately or that they are not consolidating sleep episodes rapidly enough, and the consequent distress that parents experience, has spurred studies related to all facets of infant sleep including settling behaviours, sleep consolidation, infant signalling, and separation from caregivers. St. James-Roberts and colleagues (2006) found that differences in caregiving behaviour affected frequency of night wakings and infant crying bouts. Such research supports the idea that there is a complex but meaningful relationship between patterns of infant care and infant sleep and crying behaviour, but the popular literature available to parents typically promotes a much more simplistic view of infant sleep and advocates a particular 'preferred' strategy that parents should use to produce optimal outcomes for themselves and/or their children (e.g. Ferber 2006; Sears et al. 2005; Ezzo 2006; Pantley 2002). Unfortunately, much of contemporary sleep advice is at odds with infant biology, including attachment systems. The discourse on infant sleep and nighttime parenting has generally lacked a sense of continuity in how it conceptualises daytime and nighttime parenting. While sustained physical contact and interaction are generally understood as positive aspects of daytime parenting, it has largely been assumed that the benefits of such contact do not apply to the nighttime context and that moreover, nighttime contact can be especially harmful (e.g. Ford 2006). Recent studies suggest instead that "attachment as a behavioural system operates 24 hours per day and does not deactivate during sleep, where infants can spend up to 60% of their time" (Barone 2002) and that affection and bonding affect infant neurobiology in highly significant ways (Gerhardt 2004).

Parents are often advised to adopt solitary sleeping practices for their infants and encourage infants to 'self-soothe' during nocturnal awakenings by limiting or eliminating interaction with infants during such awakenings (e.g. Ferber 2006; Ezzo 2006). A review

of 40 parenting advice books currently available in the U.S., conducted by Ramos and Youngclarke (2006), found that 40% of books opposed bedsharing and 61% supported letting infants 'cry it out'. Recommendations of this sort are usually informed by the belief that solitary sleep is the most appropriate way to instil independence and autonomy in offspring (see Hardyment 1983). However, other physicians and researchers question this philosophy, arguing that prompt responsivity and close proximity during daytime and nighttime routines is best for infants (Higley & Dozier 2009). Research indicates that solitary sleeping arrangements relate only to sleep independence, but that other aspects of independence such as social competence are actually facilitated by secure attachment relationships and close proximity to caregivers during sleep (Ramos, Youngclarke & Anderson 2007). Although longitudinal data on socioemotional outcomes associated with various sleeping arrangements are few, it appears that secure attachment including proximity to caregivers during sleep promotes independence, self-esteem, and autonomy in adolescence and beyond (see McKenna 2002; Crawford 1994; Lewis & Janda 1988; Forbes et al. 1992; Okami, Weisner & Olmstead 2002). The perceived relationship between autonomous sleep behaviour in infancy and independence later in life is a culturally-derived belief, as is the desire to instil autonomy in offspring as quickly and efficiently as possible (see Ball 2007b; Hardyment 1983).

Ultimately, the presence or absence of infant sleep 'problems' may have more to do with parental beliefs, perceptions and values than any intrinsic infant characteristics or behavioural patterns. Clinicians have found that bedsharing can be disruptive to infant sleep based on parental reports of infant sleeping behaviour in solitary and bedsharing contexts. However, Ramos and colleagues note that bedsharing parents are necessarily more informed about their child's actual behaviours during the night, and that solitary sleeping infants should not be considered 'better' sleepers simply because their parents are unaware that their infants are waking during the night (Ramos, Youngclarke & Anderson 2007). Other studies have also corroborated the finding that parental factors affect whether or not sleep problems are thought to exist for an individual infant. O'Connor and colleagues (2007) found that mood disturbance in pregnancy, characterised by prenatal stress, anxiety and depression, had persisting effects on sleep problems in infancy and toddlerhood. Similarly, infant sleep patterns have been shown to be intricately intertwined with other aspects of family life, such as marital quality and parenting styles of mothers and fathers (Ramos, Youngclarke & Anderson 2007).

Some parenting advice related to infant sleep can increase parent-infant conflict, possibly resulting in increased parental expenditure, by creating struggles over where, when and how an infant should sleep. In contrast, attachment theory suggests an alternative view of infant sleep behaviour with different implications for nighttime caregiving. Higley and Dozier (2009) present a view of infant nighttime waking, particularly those episodes that involve crying and demands for contact, as an evolutionary response that happens to be considered inconvenient to caregivers in some contemporary contexts. Their study reviewed infant attachment classification alongside behavioural recordings of sleep time spent in the cot. They concluded that the interactions characteristic of secure dyads included infants signalling their awakenings and mothers responding quickly by picking-up and soothing their infants. Furthermore, mothers of securely and insecurely attached infants did not differ in the frequency of their responses; however, when they did respond, securely attached mothers were more likely to respond sensitively and securely. The authors conclude that "consistent, sensitive responses to infant signals of distress relate to attachment security, even at night" (Higley & Dozier 2009: 357). This study offers important insight into the adaptive significance of nighttime parenting strategies, and points to the clinical significance of evolutionary concepts including attachment and parent-infant conflict.

3.3.6 Risks Associated with Young Maternal Age

Given the multitude of variables that appear to relate to infant sleep safety, and the complicated way in which these variables are inherently intertwined in different contexts, attempting to pinpoint risk factors for an individual infant remains a highly complex task which defies simple categorisation. This picture of infant sleep safety is further complicated by the influence of maternal age, which has also been associated with increased risk to infants. A study by L'Hoir and colleagues in the Netherlands identified young age at first birth as a significant risk factor (L'Hoir et al. 1998). Other studies have found that infants of mothers who are younger than age 20 at first birth have the highest risk of SIDS, and that this risk is compounded by the fact that young mothers are also more likely to expose infants to other identified risk factors, such as smoking, drug and alcohol use, lack of prenatal care, low birth weight and premature birth (National Center for Cultural Competence (NCCC) 2007). In the UK, the Foundation for the Study of Infant Deaths (FSID) advises that deaths attributed to SIDS are six times more likely among infants of teenage mothers (FSID 2009).

While young maternal age helps identify infants who are at heightened risk for poor outcomes, there is some question as to whether maternal age is causally related to these negative outcomes. Fleming and colleagues (2003) have found that, although young maternal age and being an unsupported mother have been identified as risk factors, these may simply be markers for social deprivation which is itself the real risk factor. After post-matching SIDS cases for social deprivation, they found that both young maternal age and being an unsupported mother were no longer statistically significant, while other risk factors such as smoking remained significant regardless of social deprivation (Fleming et al. 2003). As discussed above, teen motherhood may represent a reproductive strategy that is beneficial within a social context that involves a high degree of risk (Geronimus, Korenman & Hillemeier 1994), and it is possible that this level of risk includes sleep-related threats to infant health and safety. Furthermore, since teen mothers generally have a higher incidence of low birth weight and shorter gestation (Branum 2006), both of which are associated with increased risk to infants, it may be that the trajectory that leads to teen motherhood also leads to infants who are physically compromised to some degree and who are therefore at increased risk for a variety of negative outcomes, including sleep-related outcomes.

It is also important to note that, as discussed in the previous chapter, the biology of infant sleep is fundamentally different from adult sleep and may therefore be incompatible to varying degrees with maternal needs during the night. This conflict may be greater for adolescents, for whom sleep disruption is more problematic than it is for adults. Wolfson and Carskadon (1998) have shown that adolescents in general are sleep-deprived, and that loss of sleep for this age group interferes significantly with daytime functioning. In their study, teens who slept less than six hours and 45 minutes on average experienced increased daytime sleepiness, depressive mood, and sleep/wake behavioural problems compared to those teens who got an adequate amount of sleep (Wolfson & Carskadon 1998). It is possible that parental strategies designed to maximise maternal sleep and minimise sleep disruption may be implicated in the elevated risk to which infants of adolescent mothers are exposed, but existing research has thus far lacked detailed behavioural data on the sleep routines and nighttime caregiving practices of teen mothers.

Fu and colleagues have shown that bedsharing is more common among adolescent mothers, compared to adult mothers who more often opt to roomshare without bedsharing (Fu et al. 2008). Although it remains unclear whether teen mothers practise bedsharing in a manner that is fundamentally different from adults, it is possible that increased risk to

infants of teen mothers happens as a result of the convergence of risk factors that may occur during bedsharing. They identify bedsharing as common among teens, African Americans, and mothers with less educational attainment, and note that while bedsharing itself may not increase risks without the presence of hazardous conditions, bedsharing under some circumstances can increase risk to infants based on overheating, rebreathing, and exposure to cigarette smoke (Fu et al. 2008).

3.4 Public Health Messages

Although substantial data are still needed to more accurately understand infant sleep and its associated risk and protective factors, and although several health and safety-related topics pertaining to infant sleep remain controversial, public health agencies and medical groups follow certain established guidelines in counselling parents on how best to approach their children's sleep environments. The most well-established guideline for parents advises against prone positioning of infants during sleep and recommends the supine position as the safest body position for all infants. The 'Back to Sleep' Campaign in the U.S., initiated in 1992, has been refined over the years in several important ways. Specifically, the American Academy of Pediatrics (AAP) no longer recommends the lateral sleep position because of the possibility that infants lying on their sides will roll into the prone position (AAP 2005b; Pike & Moon 2008). Parents are also advised against placing soft or loose bedding in their infants' immediate sleep environment, since such materials have been cited as a contributing factor in sleep-related deaths (Pike & Moon 2008). In the U.K., parents are instructed in the practice of 'Feet to Foot', wherein infants are placed with their feet towards the foot of the cot with blankets and bedding securely tucked in and placed no higher than the infant's shoulders (FSID 2008). Additionally, while no diagnostic tool exists to pinpoint SIDS risk, some clinical tools have been established to help physicians identify infants who may be at heightened risk of negative outcomes. For example, the Baby Check scoring system allows clinicians to quantify acute illnesses and allows for an assessment of infant health status that is not reliant upon parents' subjective impressions of their infants' health, thereby identifying sick infants whose illnesses might have otherwise put them at risk for SIDS, ALTE, or other poor health outcomes (Ward-Platt et al. 2000).

Public health policy is also unequivocal in its advice to parents not to smoke, particularly during pregnancy and while in the vicinity of their infants (AAP 1997). When

parents do smoke, they are advised never to bedshare since the physiological effects of exposure to tobacco smoke seem to interact in potentially lethal ways with the bedsharing environment (Blair et al. 1996; Baddock 2005). However, public health agencies in many western countries recommend against bedsharing under any circumstances, even for parents who do not smoke. The official policy of the AAP is that infants should share a room with their parents in order to protect against the dangers of solitary sleep, but that they should sleep on a separate surface, such as a cot or bassinet, and should never be allowed to bedshare (AAP 2005b). This policy may be at odds with parental values, instincts and even with infant and maternal physiology (McKenna, Ball & Gettler 2007; Ball 2007b; McKenna & McDade 2005; Morgan, Groer & Smith 2006); furthermore, it may be at odds with national public health goals related to breastfeeding as well as the breastfeeding policies of the AAP itself. In its Healthy People 2010 public health initiative, the U.S. identified a goal of 75% of mothers initiating breastfeeding and 50% continuing to breastfeed at six months (U.S. Department of Health and Human Services (USDHHS) 2000), while the AAP advises mothers to breastfeed exclusively for the first six months of life with continued breastfeeding to one year of age and for as long thereafter as mother and baby choose (AAP 2005a). While these breastfeeding targets may indeed be appropriate and useful, they may contradict messages about the dangers of bedsharing since breastfeeding tends to promote bedsharing even among families who do not initially intend to bedshare (Ball, Hooker & Kelly 1999). As more research is conducted, public health policy related to bedsharing will likely be further refined or revised. The evidence that is currently available suggests that bedsharing may not be dangerous when identified risk factors are absent (Morgan, Groer & Smith 2006; McKenna, Ball & Gettler 2007; Blair et al. 1999), and therefore that parents who choose to bedshare for any number of reasons should be taught how to do so safely (Ramos, Youngclarke & Anderson 2007) and should be adequately educated in order to make their own informed choices (Lahr, Rosenberg & Lapidus 2007).

3.4.1 Public Health Strategies for Adolescents

Although the factors that predispose infants to elevated risk for poor outcomes, including sleep-related threats to health and safety, pose a risk to infants across the board, public health campaigns often employ different outreach and communication tactics depending on the population being targeted. Adolescents form one such population which has been identified as requiring targeted strategies specifically tailored to their needs,

norms and expectations. Strategies aimed specifically at adolescents have proven to be useful in improving health outcomes generally, especially where such efforts include the opportunity for teens to develop long-term relationships with providers who are viewed as caring and sympathetic (Bensussen-Walls & Saewyc 2001). Breastfeeding promotion campaigns have long employed special tactics for reaching teen audiences. For example, the 'Breastfeeding Educated and Supported Teen (BEST) Club' programme showed a significant increase in breastfeeding initiation among adolescent mothers who attended a high school adolescent pregnancy programme compared to those who received no special breastfeeding education (Volpe & Bear 2000). Following these models for targeted outreach for adolescents, specific SIDS risk-reduction campaigns have been designed for teenage mothers, especially because this population has been identified as particularly at risk for SIDS deaths (FSID 2009; NCCC 2007). For example, the Medical and Health Research Association of New York City, Inc. (MHRA), in conjunction with the NYC Department of Health and Mental Hygiene, created a SIDS-awareness campaign called 'Always Right' to disseminate messages about SIDS risk and safe practices related to infant sleep to adolescent mothers attending schools for pregnant and parenting teens (NCCC 2007). Always Right attempted to reach teen mothers by addressing their unique "developmental issues, their need for nurturing, and their desire for autonomy and the rights of adulthood" (NCCC 2007: 2). Similarly, the FSID in the U.K. also uses specifically designed tactics to reach teenage parents. In 2009, they designed a DVD entitled 'Losing Leah—Don't Let it Happen to You' to be used to educate teen parents, highlighting the dangers associated with drinking, smoking, and sharing a bed with a baby (FSID 2009). The Canadian Foundation for the Study of Infant Deaths (CFSID) has its own teen-focused approach (STEPS: Special Teen Education Project- SIDS; CFSID 2009). Since teens are often seen as an exceptionally vulnerable population whose infants are at increased risk of negative outcomes (FSID 2009), it is sensible to design campaigns suited to their particular needs and challenges. Existing programmes have found that successful programming ultimately depends on understanding and addressing the underlying motives for their behaviours and practices, supporting their parental authority, and acknowledging that teenage mothers are responsible parents who want to do what is best for their infants (NCCC 2007).

3.5 Future Directions for Policy Related to Infant Sleep Environments

As the above programmes designed specifically for teen mothers attest, public health campaigns tend to be less successful when constrained by a one-size-fits-all approach. Unfortunately, much of existing policy related to infant sleep and its associated risks is hindered by exactly this type of approach. Even those recommendations which relate to relatively straightforward behaviours are not uniformly adopted. While data on the dangers of prone positioning are clear, Back to Sleep recommendations are not universally adopted, perhaps because parents rightly perceive that their infants sleep more soundly in the prone position (Ottolini et al. 1999; McKenna, Ball & Gettler 2007). Similarly, recommendations that relate to the way parents care for and interact with their infants require a nuanced approach for disseminating safety advice to diverse populations. For example, advocating roomsharing without bedsharing may conflict with familial goals and values, with the realities of breastfeeding, and with other culturally-influenced priorities and choices which remain poorly understood. Indeed, the AAP and other such agencies may need to refine their existing policy statements related to bedsharing, since they currently advocate solitary sleep surfaces (AAP 2005b) as the only acceptable practice for a species whose evolutionary history has primed them for exactly the opposite (McKenna, Ball & Gettler 2007; McKenna & McDade 2005). Furthermore, while great strides have been made in reducing the incidence of SIDS and other forms of SUDI, certain populations remain disproportionately affected (e.g. African Americans; see Volpe & Wetherall 2006). Clearly, cultural norms and beliefs affect how some groups receive, understand and apply public health messages. The challenges that persist in reducing infant mortality for these populations suggests that some aspects of these normative values and beliefs have not been adequately understood, and it is likely that ongoing efforts will not ultimately be successful until further understanding is achieved. This may require an expanded paradigm going forward, especially where capturing parental motivations and documenting caregiving behaviours is required. Where medical discourse has not fully considered the complexities of human behaviour, anthropological approaches may prove useful and indeed clinically relevant for informing empirical studies and suggesting new avenues of inquiry. Certainly, in the area of infant sleep and nighttime parenting, several existing studies have already proven the utility of anthropological perspectives and methods (e.g. Ball 2002; Ball, Hooker & Kelly 1999; McKenna, Mosko & Richard 1999). In light of this evolutionary perspective, "conflict between maternal and infant needs is a

reality that has important implications for maternal and infant behaviour and health" (McDade 2001: 20).

CHAPTER 4
HYPOTHESES

The data included in the present study were initially collected as part of a longitudinal developmental psychology project on transition to parenting and early child neglect (see Chapter 5). The analysis of these data through the lens of evolutionary and life-history theory involves a novel test of these data separate from the psychological framework within which they were collected, and offers a useful opportunity to explore a novel application of evolutionary theory to observable, measurable behavioural patterns among a group of first-time mothers. The hypotheses presented here were generated after data collection was complete, but before any data analysis had taken place.

The literature reviewed in Chapters 2 and 3 informs different ways of viewing the nighttime parenting practices of adolescent and adult mothers. In this chapter, two specific paradigms will be used to develop hypotheses and predictions related to the specific behavioural practices of the two groups of mothers. The two paradigms generate different sets of predictions, but have some degree of overlap. However, the underlying rationale informing the predictions is different, with divergent implications for interpretation and application. It is anticipated under both paradigms that the cumulative pattern of differences in nighttime caregiving between adults and adolescents will be more informative than differences in the individual behaviours.

The two paradigms that will be assessed relate to a conventional and a life-history view of teen parenting. The first model, referred to as the conventional model, draws on the body of research that finds that teens are more poorly informed, less prepared, and less able to handle the responsibilities and demands of nighttime parenting. This body of literature suggests that differences in parenting behaviour occur because teen mothers are less experienced and/or less well-informed about the needs of their infants, therefore engaging in less 'optimal' parenting behaviours compared to more mature mothers. The second model, informed by evolutionary perspectives and life-history theory, also indicates that significant differences exist between the two groups, but suggests that these differences in parenting behaviour may result from differential trade-offs in regard to parental investment strategies and the occurrence of parent-infant conflict. Life-history theory argues that teen mothers will experience greater parent-infant conflict because they require more resources to meet their own needs for continuing growth and/or psychosocial development, and will therefore be more likely to engage in caregiving strategies that

reduce maternal costs. Because differences in the daytime parenting styles of adolescent and adult mothers have been documented, and because children born to teen and adult mothers experience differential outcomes, including health and safety outcomes directly related to sleep and nighttime parenting, both models predict that meaningful differences exist between teens and adults in their approach to nighttime infant care.

Based upon these models, the present study hypothesises that nighttime infant care will differ between teen and adult mothers. The conventional approach suggests that teens will be less attuned to their infant's sleep needs and that they will engage in inappropriate sleep-related practices in comparison with adult mothers, who will exhibit nighttime parenting behaviours that more closely adhere to public health recommendations. The life-history approach suggests that teen mothers will experience greater conflict between their own sleep needs and their infant's sleep needs due to their own incomplete maturation, and will therefore pursue strategies to minimise or resolve that conflict whereas adult mothers will have greater capacity for prioritising their infant's sleep needs over their own. The present study also hypothesises that the incidence and duration of sleep-related risks to infants may be different for teen and adult mothers. The conventional approach argues that infants of teen mothers will be exposed to more risks, again based on the presumption of diminished abilities, neglectful tendencies, or lack of information characteristic of teen mothers compared with adults. Alternatively, life-history theory suggests that sleep-related risks may occur as a result of mothers' specific parenting strategies, but that risks can occur for either group according to the benefit perceived by the mother of tolerating that risk.

These hypotheses generate specific predictions about the nighttime parenting behaviour of teen and adult mothers which can be empirically evaluated. It should be remembered that in generating predictions about contemporary human populations, the picture of parental investment is atypical compared to other mammals or primates because the major investment component of lactation is optional for humans given the availability of artificial infant milk. Therefore predictions cannot be directly extrapolated from classic life-history studies of other species or even human societies where breastfeeding is obligatory (in which, for example, proximity and suckling can be used as simple measures of investment), but must be modified appropriately (taking into account the availability of cultural and technological resources). The specific predictions of the above hypotheses are listed in Table 4.1 below.

Table 4.1 Predictions of the conventional model and the life-history model

CONVENTIONAL MODEL	LIFE-HISTORY MODEL
Hypothesis: **Compared with adult mothers, teens will engage in less direct care of their infants during the night and will exhibit fewer behaviours consistent with infant sleep guidelines. Infants of teen mothers will be exposed to more sleep-related risks than infants of adult mothers.**	**Hypothesis:** **Adults will prioritise their infant's sleep needs over their own, whereas teen mothers will care for their infants in ways that minimise conflict over maternal and infant sleep needs. Exposure to risk is not expected to be greater for either group.**
PROXIMITY	PROXIMITY
Rationale: Adult mothers will be more involved with their infants during nighttime routines than teen mothers, and adults will be more likely to follow current rooming-in guidelines about infant sleep location.	Rationale: Responding to infant needs at night requires less effort when infants are in close proximity. Here, use of separate cribs and separate rooms, and hence decreased proximity, is taken to reflect increased investment, because it leads to reduced maternal sleep.
Prediction: Adult mothers will spend more time in close proximity to their infants compared to teen mothers.	Prediction: Teens will spend more time in closer proximity to their infants than adults.
SLEEP POSITION	SLEEP POSITION
Rationale: Increased use of the prone position for infant sleep among teen mothers may result from decreased awareness about current recommendations or a greater tendency to disregard those recommendations.	Rationale: Increased use of the prone position among teen mothers compared to adults may occur because the prone position promotes prolonged infants sleep duration, hence potentially minimizing maternal costs.
Prediction: There will be more frequent use of the prone position for infant sleep among teen mothers compared to adults.	Prediction: There will be more frequent use of the prone position for infant sleep among teen mothers compared to adults.
SLEEP LOCATION	SLEEP LOCATION
Rationale: Teen mothers will be less likely to follow rooming-in guidelines compared to adult mothers.	Rationale: Teen mothers will use proximity to minimise maternal sleep disruption, and will keep their infants with them during the night more than adults.

Prediction: No one sleep location will predominate for the teen mothers.	Prediction: Infants of teen mothers will spend more time bedsharing and/or sofa sharing than infants of adult mothers.
Prediction: Infants of teen mothers will spend less time in a cot in the mother's bedroom compared with infants of adult mothers.	Prediction: Infants of teen mothers will spend less time sleeping in a cot in a separate room compared with infants of adult mothers.
Prediction: Infants of teen mothers will experience a greater number of sleep locations than infants of adult mothers.	Prediction: Infants of teen mothers will experience a greater number of sleep environments than infants of adult mothers.
AMOUNT OF SLEEP	AMOUNT OF SLEEP
Rationale: Teen mothers will be less engaged with infant care during the night than adult mothers, and this will affect their sleep duration.	Rationale: Teen mothers have greater sleep requirements than adults. Teens will reduce parent-infant conflict over sleep by synchronising their own sleep periods with those of their infants than adults.
Prediction: The sleep period of teen mothers will be longer than the sleep period of adult mothers.	Prediction: The sleep period of teen mothers will be longer than the sleep period of adult mothers.
Prediction: Teen mothers will obtain more uninterrupted sleep (fewer awakenings) than adult mothers.	Prediction: Teen mothers will experience shorter awakenings during the night than adult mothers.
	Prediction: Teen mothers will go to sleep sooner after their infants and sleep for a more similar length of time as their infants compared to adult mothers.
BEDSHARING	BEDSHARING
Rationale: Teen mothers will exhibit diminished engagement with infants during the night compared with adult mothers.	Rationale: Teen mothers will not be less engaged with infants during bedsharing.
Prediction: Teen mothers will spend less bedsharing time orientated toward their infants than adults.	Prediction: Teen mothers will not spend less time orientated toward their infants than adults.

FEEDING
Rationale: Lack of breastfeeding and involvement with infant feeding sessions among the teen mothers will result from a lack of willingness to breastfeed or a lack of knowledge about the importance of breastfeeding compared with adult mothers.
Prediction: There will be less breastfeeding in the teen group than in the adult group.
Prediction: Teens will promote infant "self-feeding" through bottle-propping more frequently than adults.
CRYING
Rationale: Increased crying among infants of teen mothers will result from teen mothers ignoring their infant's signalling and from the diminished levels of caregiving behaviour evident among teen mothers compared to adults during nighttime routines.
Prediction: Infants of teen mothers will experience longer crying bouts than infants of adult mothers.
Prediction: Teen mothers will respond more slowly to infant crying than adult mothers.
RISK
Rationale: Infants of teen mothers will experience more sleep-related risks than infants of adult mothers. Teen mothers will be less likely to safely modify sleep environments for their infants than adults, and will be less aware or less likely to implement risk reduction guidelines than adult mothers. This also suggests that when teens bedshare, they will do so less safely than adult mothers.

FEEDING
Lack of breastfeeding and involvement with infant feeding sessions reduces the costs of infant care, which will be particularly important for teen mothers.
Prediction: There will be less breastfeeding in the teen group than in the adult group.
Prediction: Teens will promote infant "self-feeding" through bottle-propping more frequently than adults.
CRYING
Rationale: Infant crying represents an increased demand on mothers that teens will attempt to minimize more than adult mothers, and teen mothers will respond more quickly than adults to infant crying in order to minimize their own sleep disturbance.
Prediction: Infants of teen mothers will experience shorter crying bouts than infants of adult mothers.
Prediction: Teen mothers will respond more quickly to infant crying than adult mothers.
RISK
Rationale: Risks are predicted to occur for both groups equally and are expected to vary in nature based on mother's choice of infant sleep location and perception of what constitutes a risk.

Prediction: Infants of teen mothers will be more likely to experience sleep-related risks than infants of adult mothers.	Prediction: Infants of teen mothers will not experience more sleep-related risks than infants of adult mothers.
Prediction: Infants of teen mothers will spend a longer time exposed to sleep-related risks than infants of adult mothers.	Prediction: Infants of teen mothers will not spend a longer time exposed to sleep-related risks than infants of adult mothers.
Prediction: Teens will exhibit different placements of infants in the bedsharing environment compared with adults.	Prediction: There will be no group differences in the placement of infants in the bedsharing environment between teen and adult mothers.
Prediction: More teen mothers will place their infants at risk for SIDS via cigarette smoking than adult mothers.	Prediction: There will be no group differences in maternal smoking between teen and adult mothers.
Prediction: Teen mothers will have more instances of infants sleeping with pillows and other items than adult mothers.	Prediction: There will be no group difference in the use of pillows or other items in the infant sleep environment for teen and adult mothers.
Prediction: Teen mothers will leave infants alone in adult beds for more substantial periods of time than adult mothers.	Prediction: There will be no group difference between teens and adults in the use of an adult bed as a substantial sleep environment for infants.

CHAPTER 5
METHODS

The present study drew a subsample of mothers from a larger longitudinal study on transition to parenting conducted by the Centers for the Prevention of Child Neglect, U.S.A. This chapter first explains the general methods of the larger study, where they are relevant to the data presented here, in order to provide the context within which the overnight sleep studies were designed and conducted. The specific methods used in the sleep studies are then described, and details of the analytical methods are provided.

5.1 Parenting for the First Time Project

The Parenting for the First Time (PFT) project was a four-site, prospective longitudinal study of a representative sample of 397 adolescent mothers and their children conducted by the Centers for the Prevention of Child Neglect. The project focused on capturing mothers' diverse social and cultural contexts, measuring a wide variety of parenting behaviours and beliefs, examining indicators of early child neglect, and evaluating the availability and likely impact of teen parenting programmes and supports in these communities. A comparison group of 285 adult mothers provided data on the parenting practices and attitudes of older mothers within diverse ethnic, cultural, and socio-economic groups, and was used to establish norms related to new measures of neglect. The adult sample enabled an examination of whether the "successful" teen mothers displayed parenting behaviours that essentially mimicked adult parenting within their culture and community, or whether they used distinctive parenting approaches to overcome the typical risks faced by young mothers in today's world. The four research sites for the PFT project were South Bend, Indiana; Kansas City, Kansas; Birmingham, Alabama; and Washington, D.C.

5.1.1 Participant Recruitment

The PFT project recruited first-time mothers who fell into one of three categories: adolescent mothers between the ages of 15-18 at childbirth; adult low-education mothers between the ages of 22-35 who had completed less than 2 years of a four-year college degree; and adult high-education mothers between the ages of 22-35 who had completed at least two years of a four-year college degree. Primiparous mothers were recruited during

the last trimester of their pregnancy and were enroled in the study until their infants turned 36 months. At each site, recruitment took place at selected prenatal clinics, health care offices, and school-age mothers programs at local schools. Each recruitment site displayed posters advertising the project, including a brief statement describing the purpose of the project and instructing mothers about how to obtain additional information. A nurse or receptionist at each site approached primiparous pregnant women who were in the appropriate age range, described the general nature of the study and provided a letter of invitation from the local PFT site. Prospective participants were asked if they would be willing to be contacted by a member of the research staff, and if they responded affirmatively, follow-up contact occurred within 48 hours. During the follow-up contact, research staff reviewed the key components of the study, the purpose of the study, and the schedule of remuneration. Potential risks, although considered minimal, were described to the mother, and the right to discontinue participation for any part or all of the study was described. For adolescent mothers under the age of 18, a parent or legal guardian was also contacted and the same information was presented.

The national sample was restricted to mothers who self-declared that they were not chronic substance users. All mothers were asked about substance use at the initial prenatal assessment, and those who responded affirmatively were probed to determine the frequency of drug use. Participants who reported frequent or daily substance use were excluded from the study and were referred to treatment providers.

The adult and adolescent participants in the PFT project were ethnically matched in order to control for possible cultural/ethnic differences in parenting practices and beliefs. However, the two groups were not matched on other demographic characteristics. By definition, adult mothers have generally completed more education, have a higher SES, are more mature, and are more frequently married or partnered than adolescent mothers.

Recruitment procedures were initially designed to produce a sample of 740 participants, and enrolment began in December 2001 and lasted until March 2004. Completion rates for the various assessments at the four sites were as follows: Prenatal n = 682; 4-month n = 478 (71%); 6-month n = 495 (73%); 8-month n = 427 (63%); 12-month n = 466 (68%); 18-month n = 417 (61%); 24-month n = 428 (63%); 30-month n = 381 (56%); and 36-month n = 376 (55%).

5.1.2 Consent

At the initial prenatal assessment, participants were provided with a consent form, and a member of the research staff reviewed the nature of the study, including the overall objective of the project, the assessment schedule, risks and benefits of participation, and a right to discontinue participation, in whole or in part, at any time. Participants were provided with a copy of the consent form for their records. For those participants younger than 18 years of age, a parent or legal guardian was included in the discussion, was given an opportunity to ask questions, and was also asked to sign a consent form. The consent form signed by the guardian included a statement acknowledging that the minor participant had granted her own consent to participate, and that information shared by the minor was considered confidential and would not be disclosed to anyone else.

There were no known risks to participants from any of the assessment instruments used in the PFT project. All data were treated according to strict confidentiality procedures, and confidentiality was protected except for situations in which the threat of harm to self or others became evident. In such instances, as required by law and ethical standards, threats of harm and suspected neglect or abuse were reported to the local Department of Families and Children or other relevant law enforcement agency. Information for all participants was entered into data files using participant identification numbers to ensure anonymity. All data were housed in a locked facility to which only select members of the research staff had access. Electronic data files were housed on a secure server maintained by the Data Management Center at the University of Notre Dame.

5.1.3 Assessments

Participants completed a total of nine assessments over a 36-month enrolment period (see Appendix IV), and assessments lasted an average of one and a half to two hours each. Assessments took place in both the home and laboratory settings, and transportation was provided to and from assessments as necessary. In addition, several phone interviews were conducted between assessments, and mothers received occasional mailings with calendars and other project materials to remind them of upcoming assessments. The assessments were designed to capture a broad range of parenting practices, and included constructs related to child well-being, maternal involvement, parenting behaviours and beliefs, maternal cognitive readiness to parent, aspects of the physical home environment, father involvement, and child developmental outcomes. All assessment instruments were translated into Spanish as needed, and assessments were read

aloud and in the preferred language whenever necessary. Data on infant feeding practices, family and/or household income, and sleeping practices in the home were not a focus of the PFT assessments. Resulting limitations and implications for this study are discussed in section 8.4.

5.1.4 Funding

The PFT project was supported by a grant from the National Institutes of Child Health and Human Development (NICHD; grant number HD-39456-05). Cosponsoring groups included the Centers for Disease Control (CDC), the National Institute on Drug Abuse (NIDA), the Department of Education (DOE), and the Robert Wood Johnson Foundation. Cellular phones used to conduct some of the assessments were provided by donations from Cingular and Centennial Wireless.

5.2 Sleep Lab Study Overview

The current project was designed in conjunction with the Principal Investigators at the South Bend, Indiana site of the PFT study. At this site only, a sub-sample of mothers was invited to participate in overnight sleep studies at the Mother-Baby Behavioral Sleep Lab at the University of Notre Dame. The sleep study was designed to capture how first-time mothers were caring for their infants at night, and to explore the relationship between parenting behaviours and child outcomes. The sleep lab study was designed to permit descriptive and exploratory analyses of behavioural observations of nighttime parenting, and to examine nighttime parenting practices within the larger framework of parenting captured by the PFT project.

All adolescent and high-education adult mothers enrolled in the PFT project at the South Bend, Indiana site were eligible to participate in the sleep study. During a 4-month in-home visit, interviewers for the PFT project introduced the sleep study, described the general purpose of the study, and asked the participants whether they were interested in completing an overnight sleep study in a laboratory setting. Interviewers explained to each participant that their decision would in no way affect their continued association with the PFT project, and that there would be no penalty should they decide not to enrol. Participants were invited to speak with the author for additional information on the sleep study, and were also given the opportunity to visit the sleep lab, alone or with additional

family members and partners, prior to deciding whether or not to enrol in the study. Transportation to and from the lab was offered to participants as necessary.

In order to coincide with direct observations of parenting behaviour that were conducted in-home when infants were four months of age, sleep studies were timed to occur during a five-week window beginning when infants were four months old and ending when infants turned five months and one week. Participants who agreed to complete a sleep study were scheduled for one overnight period spent in the sleep lab during this data-collection window on a date of their choosing. If participants cancelled their initial sleep study, every effort was made to reschedule their visit during the data collection window. Participants who were unable to reschedule prior to the close of their window were not included in the study.

Recruitment for the sleep studies was contingent on continued recruitment for the PFT study and no separate recruitment efforts were undertaken above and beyond those conducted by the larger study. However, when recruitment for the PFT study ceased, the research team decided that recruitment of adult mothers had been inadequate to allow for meaningful group comparisons, so an additional round of targeted recruitment was completed between March and June 2005 to enrol additional adult high-education participants in the study. Normal recruitment procedures, including distribution of pamphlets and outreach efforts at all primary care facilities, were followed. An electronic advertisement for the study was also distributed to a faculty and staff listserv through the University of Notre Dame. The additional ten mothers who were enrolled as a result of these targeted recruitment efforts participated in the PFT project as well as the sleep study. However, these participants followed a modified assessment schedule for the PFT project that included only a limited selection of the normal assessments in addition to the four-month sleep study. Reflections on the recruitment of teen and adult mothers for the sleep studies are presented in section 8.4.1.

5.2.1 Consent

All participants signed informed consent documents (see Appendix I) prior to beginning a sleep study. Mothers were given multiple opportunities to ask questions prior to granting consent. They were reminded of their right to discontinue participation at any point during the sleep study at no penalty, and were allowed to request that the infrared cameras be turned off for any period of time they wished during the course of the sleep study. Mothers were also given a tour of the lab, reminded that the bathroom was a private

area containing no cameras or microphones, and were shown where telephones were available in the lab for their use at any time. Mothers were also encouraged to give the phone number of the sleep lab to any family members in cases where the mother did not have a phone of her own with her during the night. Consent forms for the sleep study included consent to use images and/or short media clips in conjunction with presentations to scientific and academic audiences. The consent form covered only the participant and her infant, and in cases where participants arrived with a family member, filming was delayed until the family member departed. In situations where the participant was younger than eighteen years of age, the parent or guardian of the participant was also required to sign the consent form and was given similar opportunities to ask questions.

5.2.2 Confidentiality

The consent form was the sole document collected during the course of the sleep study containing the participant's name, and these forms were housed in separate files from those containing each mother's participant identification number. All files were maintained in a locked drawer in the sleep lab, to which only members of the research staff had access. Mothers were instructed that all information collected during the course of the sleep study was treated as confidential information. All data obtained were identified only by the participant identification number, and video tapes, questionnaires, and other data were housed in locked cabinets inside a locked facility at all times. Data were managed in conjunction with the principles set forth by the National Institutes of Health, and all members of the sleep lab staff had obtained a certificate of completion of the NIH online ethics training course, and renewed the certificate of completion on an annual basis. Participants were further informed that the entire PFT project, including the sleep study, was governed by a Certificate of Confidentiality issued by the Federal Government that prevented authorities from compelling research staff to disclose confidential information about any participant. Participants were informed that the sole exception to this confidentiality protocol involved cases where intervention was required by law. Such situations included threats of harm to self or others, and suspected cases of abuse or neglect.

5.2.3 Benefits and Risks of Participation

There were no known added risks of sleeping in the laboratory environment compared with sleeping at home. At least one member of the research staff remained in

the lab for the entire time that participants were present. A number of precautions were taken in order to maximise participant safety while in the lab. Routine modifications were made to the laboratory environment consistent with child safety standards, including covering all electrical outlets, installing child safety latches on all drawers and cabinets, removing all potentially hazardous materials, and providing a cot and other sleep-related furniture that met normal safety standards. In situations where any aspect of infant safety was in question, research staff were instructed to intervene in such a way as to confirm infant safety, and/or wake or alert the mother to modify bedding or other aspects of the infant's environment in order to remove any threats posed to the infant. In accordance with the SIDS-reduction strategies advocated by the American Academy of Pediatrics in 2000 and reaffirmed in 2005 and 2008 (AAP 2000; AAP 2005b; AAP 2008), mothers who chose to place their infants in the prone position for sleep were asked to re-position their infants and were told of the potential safety issues involved in prone sleeping. However, some mothers chose to keep their infants in the prone position even after intervention by research staff, typically because the prone position was the infant's "normal" or "preferred" sleep position. In these instances, no further attempts to modify the mother's choice of infant sleep position were pursued. Although other instances of intervention by sleep lab staff were rare, such occasions involved infants at risk of falling off the edge of a bed or sofa or where the infant's face was covered by bedding.

Mothers were not permitted to smoke inside the sleep laboratory, and were asked to smoke outside the building if necessary. In instances where the mother left her infant in the sleep lab while she went outside to smoke, the research staff remained in the lab to monitor the infant, although no direct child care practices were undertaken other than ensuring infant safety.

Although no other activities occurred at night in the building where the sleep lab was located, both the building and the lab were kept locked from the outside at all times. Smoke detectors, fire alarms, and standard patrols by campus police also preserved participant safety while in the lab. Whenever transportation was provided to a participant and her infant, no member of the research staff drove the mother to or from the lab unless the mother could provide an infant car seat that had been properly installed, and unless the mother was also wearing a seatbelt.

Participants were unlikely to benefit directly from the behavioural data collected during the course of the study. On the few occasions when participants expressed an interest in learning the outcomes of the study, they were informed about how to maintain

contact with the directors of the project in order to view any manuscripts or materials that may have been produced by the research team. All participants were provided with a $50 gift-certificate to Wal-Mart stores for participating in the sleep study. On the rare occasion where a participant began but was unable to complete the entire overnight sleep study, the gift certificate was still provided.

The Human Subjects Institutional Review Board of the University of Notre Dame reviewed the sleep study protocol as an addendum to the complete PFT protocol and granted full ethics approval (Protocol Number 04-085).

5.3 Overnight Sleep Studies

Overnight sleep studies were conducted at the Mother-Baby Behavioral Sleep Lab between July 2002 and May 2005. Participants were instructed to arrive at the sleep lab shortly before they would normally begin preparing their infants for sleep, and remained for a short period of time after final awakening the following day. Although other anthropology-based studies of infant sleep have included a habituation night (McKenna & Mosko 1993; Ball 2006a), the present study was designed without this feature in order to be more conducive to the needs and logistical considerations of the participants. Because the study was designed to include high-risk participants and those whose home lives were relatively less stable and predictable, a decision was made that a habituation night might constitute an undue barrier to participation for some mothers and was therefore not included in the study design. This issue is discussed further in section 8.4.1.

The lab was designed to resemble a home environment, with two bedrooms, a bathroom with shower, and a small living room with television. The layout of the lab enabled a variety of sleeping arrangements, including use of a standard double mattress with box springs for mothers or for mothers who bedshared with their infants, a freestanding bed-side bassinette for room-sharing, and a standard cot positioned in an adjacent room for those who slept separately from their infants. Infra-red cameras were mounted in the ceilings of each room, enabling the collection of direct observations of nighttime parenting behaviour using continuous video and audio recording. Participants were encouraged to maintain their normal home sleeping arrangement, sleep schedule, and parenting routines, and they performed all caregiving behaviour for their infants at will. Participants had minimal interaction with researchers while in the sleep lab, but were

encouraged to approach the researchers at any point in order to address questions or concerns.

Figure 5.1 Pictures of the Mother-Baby Behavioral Sleep Lab

A set of standard sheets, a blanket, two pillows, and a thin bedspread were provided on the double bed. A fitted sheet covered the mattress of the cot, and two small baby blankets were placed in the room with the cot for participant use. Curtains and minimal decor in each room were appropriate for an adult and an infant bedroom. The door to the infant bedroom was approximately 90 centimetres (3 feet) away from the door to the adult bedroom, well within auditory range. A selection of snacks and soft drinks was provided for the mothers, but all infant food, clothing, toys, or other personal items required to care for the infant at night were brought to the lab by the mother. A changing table, a small refrigerator, coffee maker, infant bottle warmer, bath towels, and adult shampoos and soaps were also provided to participants. There was a wall-mounted thermostat in each

room, and the mother was instructed to adjust the temperature as she pleased at any time during the course of the sleep study.

Research staff remained in the lab with the participant throughout the entire study, although they were located behind a partition in a work area within the lab, outside the three rooms available for participant use. Participants were recorded and monitored at all times during the sleep study, and when infants and mothers were in separate rooms they were recorded simultaneously using a split-screen format with a digital mixer (Panasonic Digital AV Mixer WJ-MX20). Participants were allowed to retire for the night and awaken the next morning at will. Participants typically departed from the lab shortly after awakening in the morning. When necessary, participants were driven to and from the lab by a member of the research staff.

Immediately prior to departing the sleep lab at the conclusion of each study, research staff administered a Post-Sleep Questionnaire to participants (see Appendix II). The questionnaire gathered data on whether the amount of sleep for both mother and infant differed from a typical night at home, and asked mothers how many times she and her infant had awakened during the night and how many times and for how long the infant fed during the night. The form also asked participants to rate their level of satisfaction with the experience of completing a sleep study.

5.4 Data Coding Procedures

Analogue SVHS tapes were used to capture the continuous behavioural recordings collected in the sleep lab. Infrared cameras were wired to a Panasonic VHS machine and were recorded in SVHS format using EP (extended play) settings. All video tapes were kept in a locked cabinet separate from the consent forms, and were labelled only with the date of the sleep study and the participant identification number.

A taxonomy was developed by the author, in consultation with faculty advisers and other postgraduate colleagues. The taxonomy was designed to capture all aspects of nighttime parenting, and represents a significant expansion upon previous infant sleep-related behavioural taxonomies that focused more narrowly on key aspects of infant sleep behaviour and physiology. The taxonomy was designed specifically for this study but was based on the taxonomy used in hospital-based randomised controlled trials at the Parent-Infant Sleep Lab directed by Dr. Helen Ball (Ball, personal communication, February 2004), and on a taxonomy used by Dr. James McKenna and Dr. Sarah Mosko at the

University of California-Irvine (McKenna, Mosko & Richard 1999; McKenna, personal communication, September 2002). The taxonomy (see Appendix III) consisted of 16 behavioural classes and 15 modifier classes. Selected behaviours focused on the timing, duration, and patterning of maternal and infant sleep, where and how infants slept, infant feeding sessions including how and what infants were fed, proximity between mothers and infants at all times while in the lab, the amount of physical contact between mother-infant dyads, affectionate interactions, the presence of sleep-related risks, and potential neglect issues.

All research staff completed an iterative process of comparing coding results with each other until no major discrepancies were found. Definitions of behavioural classes were repeatedly refined and clarified in order to standardise coding procedures. Once the taxonomy was considered finalised, two sleep studies were coded by each member of the research team, and the coding procedure for each was automatically compared for sequence and occurrence of behavioural classes using the Noldus Observer 5.0 software. Because of the thoroughness of the taxonomy and the length of the behavioural observations, every video tape collected in the study was coded by a pair of researchers working together in order to maintain a high degree of accuracy. Throughout the coding process, any unusual or atypical events (such as novel behaviours, technical difficulties, or procedural issues) were discussed by the full research team, and consensus was reached about the most appropriate code for each scenario.

The behavioural taxonomy was entered into the Noldus Observer 5.0 behavioural coding software, and all videotapes were reviewed in real time in their entirety. The specific behaviour, and the start and end time of each behaviour, were logged using mouse controls within the Observer. The videos were viewed at a work station within the sleep lab that contained a Gateway PC with the Noldus Observer software installed, a black and white television monitor, and a VHS recorder connected to the computer. Segments of the videotapes were frequently viewed multiple times in order to clearly determine the exact nature of each behaviour. On average, coding a single sleep study took approximately 6 hours. Reflections on the behavioural taxonomy and the use of the Observer software, as well as recommendations for future research, are presented in section 8.4.5.

5.5 Analysis

All data files were housed on the password-protected Gateway PC in the Sleep Lab, and were backed up on a secure server managed by the Data Management Center at the University of Notre Dame. Only researchers on the PFT project had access to both the PC and the secure server. When all data coding was complete, the entire data set was exported from the Observer software into Microsoft Excel. A period of data cleaning followed, which primarily involved deleting meaningless combinations of behaviours and modifiers that did not represent behaviours that were actually coded. Each unique behaviour was given a distinct variable name, and the data file was then imported into SPSS version 12.0 for analysis.

Demographic data, including items such as mother's age, ethnicity, and child's birth date, were extracted from the Microsoft Access PFT Participant Tracking Database. This database was housed on a secure server maintained by the Data Management Center at the University of Notre Dame.

5.5.1 Computer Programming

In order to capture the relationship between different behavioural states (i.e. what was happening in one behavioural class when a second behaviour occurred) a computer programmer was hired at Durham University to produce an additional set of data files that extracted certain variables under particular conditions (e.g. infant behaviours that occurred while the mother was coded as asleep). The computer programmer was provided with a list of eight research questions, and the author worked closely with the programmer to specify the exact codes that corresponded with each research question. The author exported the raw data files from the Observer into Excel format, and the programmer read these files into the program that was written using Apache HSSF Library. The data were then organised into separate observations for each participant, identified by the participant number and formatted with the time stamp for each behaviour organised sequentially. The programmer conducted manual testing to confirm that the program was written and executed accurately. The manual testing included checking the input and output functions as the software was written, as well as systematic testing of the output data once the software was complete. For each research question, three randomly chosen observations were manually processed, and verified against the output of the program. Whenever errors were discovered, the program was refined and re-run, and manual testing was again

completed. The output data were written from the program into Excel using Apache HSSF Library.

5.5.2 Analysis with SPSS

Once all data had been imported into SPSS, new variables were created to express each behaviour of interest in terms of the length of the sleep study for each participant. Behaviours were expressed as either rate-per-hour variables, or as a percentage of the sleep study spent engaged in a particular behaviour. Descriptive analyses of all behavioural categories were generated using SPSS. Non-parametric statistics were used given the non-normal distribution of the variables. Group difference testing was conducted using Mann-Whitney U (MWU) and chi-square tests. MWU is an appropriate non-parametric t-test equivalent, and chi-square is the appropriate non-parametric test for two categorical variables. When chi-square tests involved cells with an expected count less than 5, SPSS 12.0 calculated Fisher's exact probability. All tests were two-tailed and a 95% confidence level was used. This is consistent with other behavioural studies, and has been the standard for similar research conducted on nighttime parenting behaviour and infant sleep, including studies with small samples (e.g. Ball, Hooker & Kelly 1999; Ball 2002; Ball 2007a; Baddock et al. 2006; Baddock 2004; Baddock 2005). At the initial stage of data analysis, a decision was made to focus on simple group difference tests which were most appropriate to the data involved, given the non-normative distribution and the small number of participants that prohibited the further partitioning of data beyond the dichotomous comparison of teens and adults. No initial power calculations were performed prior to conducting the sleep study. Although this is a routine procedure in most studies involving quantitative analysis, it was not possible given the exploratory nature of the present study. At the outset of this study, it was unclear what behaviours might occur and therefore it was not possible to define the main outcome variables.

5.5.3 Case Studies of High-Risk Nighttime Parenting Practices

Six overnight sleep studies that included key behavioural variables related to infant risk were selected for further descriptive analysis, and are presented as case studies in Chapter 7. The selected risk factors included those identified in the literature as being associated with significant threats to infant safety, even though the exact mechanisms by which some of these risk factors affect infant outcomes have not previously been identified. The quantitative data were then examined, and the participant who best

represented that behaviour was chosen. For example, the literature has identified sleeping with an infant on a sofa or recliner as being a sleep-related risk factor (see Chapter 3). The mother-infant dyad that spent the largest percentage of the overnight study in this sleeping arrangement was selected for the case study. The tapes chosen for inclusion in the case studies were reviewed again in their entirety for a qualitative description of the participant's nighttime parenting behaviour with a particular focus on the relevant risk topics.

CHAPTER 6
SAMPLE DESCRIPTION AND NIGHTTIME PARENTING BEHAVIOUR OF TEEN AND ADULT MOTHERS

6.1 Study Site

Participants in the present study were recruited between 2002 and 2005, and all were inhabitants of South Bend, Indiana, U.S.A. South Bend is located approximately 5 miles (8 km) south of the Michigan border, and 93 miles (150 km) east of Chicago, Illinois (see Figures 6.1 and 6.2 below). The greater metropolitan area of South Bend includes a population of 316,663, and the racial composition of the area is primarily European American (66%) and African American (25%) (FedStats 2008). South Bend is a somewhat economically depressed area, particularly since the decline of heavy industry in the region. The primary economic sectors in South Bend include health care, education, small business, and tourism. The median household income in 1999 was $32,439 (U.S. Census Bureau 2000c), below the national average of $42,000 (U.S. Census Bureau 2000a).

Some demographic data are unavailable at the local level, but South Bend is generally reflective of the state of Indiana as a whole, for which census data are available. As of the most recent census, among those 25 years of age and over in Indiana, 12% held a bachelor's degree, and more than a third of the population (37%) left school after completing a high school diploma or equivalency (U.S. Census Bureau 2000d). In general, 14% of families were below the poverty level, and an even greater percentage (35%) of households headed by single women were below the poverty level (U.S. Census Bureau 2000c). 56% of residents 15 years of age and older were married, 25% had never married, and the remainder were separated, widowed, or divorced (U.S. Census Bureau 2000d). More than half (60%) of the female population over age 16 was currently employed (U.S. Census Bureau 2000b).

In 2000, Indiana ranked 32nd in the nation for teen births, with 13% of babies born to women under the age of 20 (Annie E. Casey Foundation 2008). This resulted in 9,595 births to teen mothers in 2004 (National Campaign to Prevent Teen Pregnancy 2006). The most recent national census indicates that grandparents carry a significant responsibility for

child rearing. Census data from 2000 reveal that 50% of grandparents in Indiana were responsible for grandchildren under the age of 18 (U.S. Census Bureau 2000d).

Figure 6.1 Map of South Bend, Indiana (National)

Source: Google Maps 2009

Figure 6.2 Map of South Bend, Indiana (Regional)

Source: Google Maps 2009

6.2 Participants

Demographic data for the study participants are presented in Table 6.1 and described in sections 6.2.1 to 6.2.6 below.

Table 6.1 Maternal demographic characteristics

	Teens (n=23)			Adults (n=22)	
	n	*%*		*n*	*%*
Ethnicity					
Non-Latino White	9	39		14	64
African American	8	35		7	32
Latina	2	9		1	5
Other	4	17		0	0
Infant Gender					
Female Infants	15	65		10	46
Marital Status					
Married	0	0		13	59
Partnered	6	26		2	9
Single	17	74		7	32
Household Composition					
Reside with no other adults	0	0		1	5
Reside with 1 other adult	7	30		15	68
Reside with 2 other adults	13	56		2	9
Reside with 3 or more other adults	3	13		4	18
Reside with 1 or more children	18	78		5	23
Employment/School Enrolment*					
Employed at time they found out they were pregnant	10	44		20	91
Employed at prenatal interview	4	17		10	46
Stopped attending school due to pregnancy	4	17		2	9
Pregnancy Intendedness					
Planned pregnancy	3	13		12	55
Pregnancy "just happened"	20	87		10	46
Father Involvement					
At 4-month interview, father is not part of child's life	6	26		3	14
At four-month interview, child's father involved daily	11	48		17	77
At 4-month interview, child's father involved less than daily	6	26		2	9
Substance Use					
Ever used drugs in last 6 months	2	9		2	9
At prenatal interview, still using drugs	0	0		0	0
Ever consumed alcohol in last 6 months	3	13		3	14
At prenatal interview, still consuming alcohol	2	9		3	14
Ever smoked cigarettes in last 6 months	8	35		5	23
At prenatal interview, still smoking cigarettes	3	13		3	14

* School enrolment data include both high school and university attendance.

6.2.1 Adolescent and Adult Participants

45 primiparous mothers and their infants participated in overnight sleep studies. Approximately half of the participants (n=23) were adolescent mothers, ranging in age

from 15-19 years at childbirth with a mean age of 17.5 years. There was a roughly even proportion of non-Latino whites and African Americans, with the remainder identified as either Latina or other race. The median personal annual income of the adolescent mothers was $12,516.00 (the limitations of this variable are discussed in section 8.4). The majority of infants of adolescent mothers were female, and the average age of infants at the time of the sleep study was 20 weeks.

An additional 22 adult mothers completed overnight sleep studies. These mothers ranged in age from 22-36 years at childbirth, with an average age of 27.2 years. Minority ethnic groups were somewhat underrepresented in the adult sample. The majority of adults were non-Latino whites, just under a third were African American, and a small percentage were Latina. The adult sample had a slightly higher SES compared to the teen mothers, with a median personal annual income of $15,006.00. There was a higher percentage of male infants in the adult sample, and the average age of infants in this group was 21.3 weeks at the time of the sleep study.

6.2.2 Partner Status and Household Composition

Marital status differed between the adolescent and adult sample. At the prenatal interview, none of the adolescent mothers were married. The majority reported being single, and just over a quarter reported being partnered. This contrasted with the adult mothers, the majority of whom were married or partnered, with less than a third reporting being single. Similarly, the residential arrangements of teens and adults were different. During the last trimester of pregnancy, all of the teen mothers lived with at least one other adult. The majority of teens lived in a house with 2 other adults, predominantly involving at least one of the respondent's own parents, with some teens living with a grandparent, step-parent, or other adult relative. Most teen mothers also lived in homes with one or more children present other than their own child, whereas the majority of adult mothers resided in homes with no other children. The majority of adult mothers lived with only one other adult who was typically the participant's husband or partner, although several adult mothers lived with multiple other adults.

6.2.3 Employment and School Enrolment Status

The adolescent mothers were typically unemployed, with less than half reporting some level of employment at the time they found out they were pregnant and very few who continued to be employed during the last trimester of their pregnancy. Almost all of the

adults were employed at the time they found out they were pregnant, but the majority had stopped working by the time of the prenatal interview. Pregnancy did not seem to greatly affect participants' decisions related to enrolment in high school or at university. Only a small number of teens and adults reported that they stopped attending school after they knew they were pregnant. The remainder had either already stopped attending school, or continued to be enrolled.

6.2.4 Pregnancy Intendedness

Self-reports of pregnancy intendedness also differed between the teen and adult participants. Almost none of the teen mothers reported that their pregnancy was planned. The vast majority reported instead that the pregnancy "just happened." In contrast, more than half of the adult mothers reported planning their pregnancies.

6.2.5 Father Involvement

Regardless of pregnancy intendedness, the majority of mothers in both groups reported that they were still "in touch", at minimum, with their baby's father at the time of the prenatal interview. By the time their infants were four months old, none of the adolescent mothers were married to their child's father, but just over half were still partnered with him. At the same time point, the majority of adult mothers were married to or partnered with their child's father. The level of involvement these fathers had in the child's life was variable, however, and differed between the teen and adult groups. At the 4-month interview, just under half of the teen mothers reported that their child's father was involved on a daily basis, approximately a quarter reported having no contact with their child's father, and the remainder reported less than daily levels of involvement. The majority of adults indicated that fathers were involved with their children on a daily basis, a few reported less frequent levels of involvement, and only 3 mothers reported having no contact with their child's father.

6.2.6 Substance Use

Substance use was not common for the majority of mothers in both groups. At the prenatal interview, 2 mothers in each group reported that they had ever used drugs, but none of the mothers in the sample reported continued drug use during the last trimester of pregnancy. A small number of mothers in each group reported consuming some alcohol in the 6 months preceding the prenatal interview. Of these, 1 teen mother stopped drinking

during pregnancy, and the remainder in both groups decreased but did not stop consuming alcohol. Cigarette smoking was similar for teen and adult mothers. Slightly more teens reported ever smoking, but only a few teens and adults reported that they currently smoked during the last trimester of pregnancy.

6.3 Representativeness of the Sample

Participants in the present study were largely representative of the South Bend metropolitan area (see Table 6.2 below). They generally reflected the ethnic composition of the area, which for both the city and the study sample was predominantly non-Latino white and African American. The sample did not differ in any meaningful way from the South Bend area in terms of educational attainment, income, or marital status.

Table 6.2 Comparison of study site and sample on select characteristics for which comparison data are available

	South Bend/Indiana, USA		Study Sample
Median household income	$32,439 (1999)†		$ 12,516††
Ethnic Composition†			
% European American	66%		51%
% African American	25%		33%
% Other	9%		16%
15 years +, % Married	56%*†		47%
15 years +, % Single	44%**†		53%**
16 years +, % of Female Population Currently Employed	60%		67%

† Census data include male respondents.
* The census data includes only those legally married; for the study sample, those who declared themselves "partnered" are also included in the married category
** Those who are single includes those categorised as "never married", "widowed", "separated", and "divorced"; in the study sample the data include all those not currently married or partnered.
†† The mothers in the study sample were asked about their personal annual income. This does not include income from spouses, other co-resident adults, or other sources. Few mothers in either group reported receiving government assistance in the form of food stamps or TANF (Temporary Assistance for Needy Families) funding.

The adolescent and adult mothers included in the study also were generally representative of adolescent and adult mothers in the area. The two groups were similar in background, and differed from each other in precisely the areas that they would be predicted to differ based on their varying life circumstances at time of first reproduction. The adolescent mothers were approximately 9.6 years younger than the adult mothers on average. As expected, the adults were more likely to be married or partnered, and had more planned pregnancies than mothers in the teen group. Father involvement was typical for both the teen and adult mothers in this study, but was still more common and involved more frequent contact among the adults. There was a larger proportion of African American mothers in the teen group, although this is also consistent with local and national rates of teen pregnancy which are higher among African American teens (National Campaign to Prevent Teen and Unplanned Pregnancy 2008).

6.4 Overnight Sleep Studies

Of the eligible participants at the South Bend site, just over a third (34.6%) chose to enrol and successfully completed an overnight sleep study when their infants were approximately 4 months old. There was no significant difference in acceptance rate between the adolescent and adult groups (χ^2=0.13, p=.72). The subsample was similar to the entire sample of eligible mothers, and did not differ significantly from those who did not participate in sleep studies in terms of mother's age (t=0.67, p = 0.50), marital/partner status (χ^2=1.05, p=.59), educational attainment (t=0.04, p=0.97), employment status (χ^2=0.60, p=0.44), or ethnic minority status (χ^2=0.90, p=0.34).

Sleep study participants were first introduced to the sleep study during an in-home interview that took place when infants were 4 months old. Participants were scheduled for sleep studies on the date and time of their choosing during the data collection window outlined in Chapter 5. On multiple occasions, participants cancelled scheduled sleep studies or did not arrive for a scheduled sleep study, and in such instances every effort was made to reschedule these participants during the data collection window. When participants were unavailable to reschedule their sleep study before the data collection window closed, they were not included in the study. There were three instances in which participants withdrew participation after sleep studies began. Two withdrew because their infants were ill or had soiled clothing, and the participants chose to return home to care for their infants. One participant discontinued participation because mechanical problems

with one of the overhead cameras caused too much noise for the participant to sleep. No serious adverse incidents occurred for any participants during a sleep study. Additionally, a single sleep study was excluded from analysis because equipment problems caused a recording failure for a portion of the sleep study. Because it was not possible to determine the start time (and therefore the duration) for that participant's sleep period as well as that of her infant, the study was not included in the analyses presented here.

The arrival time for sleep studies was self-selected by each participant according to her own scheduling preferences. The earliest sleep study began at 6:10 pm, and the latest began at 11:00 pm. There was no group difference in start times between teens and adults (MWU=152.50, p=0.45). The duration of the sleep study was also determined by each participant, and sleep studies lasted an average of 11 hours (SD=1.5 hours). There were no differences in length of sleep study between teens and adults (MWU=221.00, p=0.47). A total of 5 infants (4 in the adult group and 1 in the teen group) arrived at the sleep study already asleep, but this did not represent a significant group difference (Fisher's exact probability=0.19).

On a subset of sleep studies, equipment problems interrupted all or some of the audio capture. One study with an adolescent participant and 2 studies with adult participants had no sound, 3 studies (2 in the teen group and 1 in the adult group) had low but audible sound, and 3 studies (1 in the teen group and 2 in the adult group) had missing audio capture for only a portion of the sleep study. There were no differences between teens and adults in the presence of missing audio data (Fisher's exact probability =0.41). In cases where audio data were compromised, visual cues were used to code for the two behavioural categories that involved sound, infant crying and maternal response to crying. Visual cues indicative of infant crying and maternal vocalisations in response to infant crying are described in the behavioural taxonomy, Appendix III.

The majority of sleep studies took place on weeknights for both groups. Fifteen of the 23 teen mothers and 16 of the 22 adult mothers spent the night in the lab on a weeknight. There were no differences in likelihood of completing a sleep study on weeknights versus weekends between the two groups (χ^2=0.30, p=0.59). Sleep studies involving teens took place primarily in the summer (35%, n=8) and autumn (35%, n=8), with fewer in the spring (17%, n=4) and winter (14%, n=3). Sleep studies involving adults were concentrated in the spring (36%, n=8) and winter (27%, n=6), with 4 studies (18%) conducted during the summer months and 4 (18%) in the autumn. Two aspects of sleep studies which were potentially related to seasonality were temperature and sleep study

duration due to day length. Temperature variation was unlikely to impact study participants because the sleep lab was heated through a central heating system, with wall-mounted thermostats in each room which the mothers were able to control. Study duration was tested for seasonal effects in order to determine whether studies that took place on the shortest days of the winter season were longer than studies that were scheduled in spring, summer, or autumn. The duration of sleep studies that occurred in the winter was not significantly different from studies that took place in warmer months (MWU=152.00, p=0.78).

Upon completion of overnight sleep studies, mothers were asked to evaluate the amount of their own and their infant's sleep compared to a typical night at home, and were asked to rate the quality of their experience in the sleep lab. The majority of participants in both groups (13 teens and 13 adults) reported that the amount of their infant's sleep was "about the same as usual" on the night of the sleep study. Mothers reported that the overnight sleep study was slightly more disruptive to their own sleep, with 11 teens and 9 adults indicating that they got less sleep than usual. The process of completing a sleep study did not appear to be a burden for most participants, and the majority of mothers (16 teens and 15 adults) indicated that they were "very satisfied" with their experience in the sleep lab. There were no significant group differences in whether the mothers felt their infant's sleep (χ^2=0.71, p=0.40) or their own sleep (χ^2=0.11, p=0.74) had been less than usual on the study night, or whether the mothers were satisfied or unsatisfied (Fisher's exact probability =0.70) with their experience in the sleep lab.

6.5 Descriptive Data on Nighttime Parenting

In the following section, descriptive data are presented to characterise the behaviour of both groups during the overnight sleep studies. Statistical comparisons are presented in section 6.6 concerning hypothesis testing.

6.5.1 Sleep Durations

For both mothers and infants, the majority of the overnight study period was spent asleep. Teen mothers spent an average of 7.2 hours asleep. The sleep period of adult mothers was slightly shorter, with an average of 6.8 hours spent asleep. The duration of infant sleep was roughly equal for both groups. Infants of teen mothers spent an average of 8.3 hours asleep, and infants of adult mothers spent an average of 8.5 hours asleep. This meant that infants of teens slept 1.1 hours longer than their mothers on average, and infants

of adults slept 1.7 hours longer than their mothers. Teen mothers typically went to sleep 1 hour after their infants, and adult mothers went to sleep 1.7 hours after their infants began sleeping. The length of infant sleep bouts was similar for both groups, with infants of teens sleeping for 2.3 hours between awakenings and infants of adults sleeping for 2 hours at a time, on average.

6.5.2 Sleep Locations

Bedsharing was the predominant sleeping arrangement in the teen group. For this group, infants spent an average of 61% of their sleep time bedsharing, followed by 23% of sleep time in a bedside bassinette. The other possible sleep locations, including being in a cot in a separate room, alone in an adult bed, held in the mother's arms, in a car seat, or on the sofa, accounted for the remainder of the sleep period, although none of the infants of teens spent a significant amount of time in these locations and none of these locations accounted for more than 5% of the infant's sleep period individually. The sleeping arrangements experienced by infants of adult mothers were somewhat different. Among this group, the predominant arrangement was to have the infant sleeping in a crib in a separate room. An average of 39% of infant sleep time was spent in this location, followed by 32% spent bedsharing, and 18% spent sleeping in a bedside bassinette. The remainder was also distributed across the other possible sleep locations. As with the teen group, these other sleep locations did not constitute a substantial portion of the infant's sleep period, and no other location accounted for more than 6% of the infant's sleep period individually.

6.5.3 Infant Sleep Position

For both groups, infants slept primarily in the supine position. This sleep position accounted for 39% of infant sleep time in the teen group, followed by 20% of sleep time in the lateral position, 19% in the prone position, 17% in the CUPI position ('curled up protecting infant'; see Appendix III for a description), and 5% held in the mother's arms. For infants of adult mothers, 59% of sleep time was spent in the supine position, followed by 12% in the prone position, 11% in the lateral position, 10% in the CUPI position, and 8% held in the mother's arms. It should be noted that, for both groups, the percent of time spent in the prone position is an underestimate of actual behavioural practices because sleep lab staff intervened when mothers selected this position for their infants as described in Chapter 5. Therefore, the typical incidence and duration of prone sleeping among infants of both groups was potentially higher at home.

6.5.4 Infant Crying

The majority of infants in both groups cried at some point during the sleep studies. Infants of teens spent an average of 0.5% of the overnight study crying, and infants of adults spent 0.7% of the study crying. Crying bouts lasted 40 seconds on average for infants in the teen group, and 89.2 seconds on average for infants in the adult group. The teen mothers most frequently (32% of the time) responded to infant crying by holding or picking up their infants, followed by vocalising to infants (30%), touching their infants (20%), giving an object to the infant (9%), and feeding the infant (8%). Adult mothers responded to their infants' cries primarily by vocalising (32%), followed by touching the infant (27%), holding or picking up the infant (15%), feeding the infant (13%), and giving an object to the infant (12%).

6.5.5 Infant Feeding

A similar amount of time was spent feeding infants during the course of the sleep studies for both groups. Infants in the teen group spent an average of 4.5% of the sleep study feeding, and infants in the adult group spent 4.6% of the sleep study feeding, on average. The feeding methods of the two groups were markedly different, however. Breastfeeding was not as common among the teen mothers. Only 4 of the 23 teen mothers breastfed their infants, and 16 mothers exclusively bottle fed their infants. 8 of the adult mothers exclusively breastfed their infants. Another 4 followed a mixed feeding strategy that included both breastfeeding and bottle feeding, whereas none of the teen mothers engaged in a mixed feeding strategy. 10 adult mothers exclusively bottle fed their infants. There were also 3 teen mothers who never fed their infants during the course of the overnight sleep study, and their sleep studies were not significantly shorter in duration than the rest of the sample (MWU=42.00, p=0.34). None of the adult mothers completed an overnight sleep study without feeding their infants. Teen mothers were also more likely to structure bottle feeding sessions that did not require them to hold the bottle for their infant. 16 of the 23 teen mothers and 14 of the 22 adult mothers had their infant self-feeding at some point, but the duration of these episodes was higher among the teens. Self-feeding represented more than a quarter (28%) of time spent bottle-feeding among infants in the teen group, compared to 7% of time spent bottle feeding among the adult group.

6.6 Hypothesis Testing

In order to test the hypotheses outlined in Chapter 4, a number of behavioural variables were examined. These included physical proximity of mother and infant, infant crying, infant sleep location, infant sleep position, sleep routines specific to bedsharing, infant feeding practices, and sleep patterns of mothers and infants. All behaviours were tested for group differences between teens and adults in order to assess whether the predictions derived from the theoretical approaches fit the behavioural data. For each behavioural category, the conventional approach essentially suggests that teens approach parenting with less information, less maturity, less skill development, and less involvement in nighttime infant care. Therefore, teens are predicted to display more sub-optimal parenting behaviours, in relation to infant health and safety, compared to adults. Alternatively, life-history theory suggests a more complex picture wherein adolescent mothers face greater levels of parent-infant conflict and must find ways to decrease maternal costs in comparison to adults, since teens must meet their own needs for continued growth and/or psychosocial development while providing care to their infants.

6.6.1 Physical Proximity

6.6.1.1 Physical Proximity: Rationale

Physical proximity was coded continuously during the overnight sleep studies, and was separated into proximity during the infant's sleep period and proximity during awake periods. The amount of physical contact and the degree of physical proximity between mothers and infants was considered to be a measure of parenting effort, and was hypothesised to be different for the two groups. The conventional approach predicts that teens will be less involved in nighttime care and will maintain greater distances from their infants compared with adults, both during awake periods and when the infant is asleep. In contrast, life-history theory predicts that teens will remain closer to their infants while awake and asleep than adults. Greater proximity will be a key part of the teen strategy because it may allow the teen mothers to respond quickly to their infants with less cost and/or impact on maternal sleep when infants are immediately next to them throughout the night.

6.6.1.2 Physical Proximity: Results

Teen mothers spent the vast majority of their time in contact with or within arm's reach of their infants. While the infant was awake, teens spent 67% of their time in contact with infants and another 24% of their time within arm's reach. A small percentage of their time (8%) was spent in a different room from their infants while awake, but when teen mothers and infants were in the same room together virtually none of their time (1%) was spent beyond arm's reach of each other. A different pattern emerged for the adult mothers. In the adult group, mothers also spent the majority (55%) of infant awake time in contact, and also like the teens, they spent virtually no time in the same room with their infants at distances greater than the mother's arm's reach. Unlike the teens, however, the adult mothers spent significantly less time in the same room within arm's reach (9%), and spent a significantly greater portion of the infant's awake time in a different room from their infants (36%).

The physical proximity between mothers and infants during the infant sleep period also showed several significant group differences. For the teen group, just over half (51%) of the infant's sleep period was spent in contact with the mother. Just under a third (31%) of the infant sleep period was spent within arm's reach of the mother. Very little time was spent far away from the mother, however. Only 13% of the infant sleep period was spent in the same room beyond arm's reach of the mother, and even less time (5%) was spent in a different room. Sleeping arrangements in the adult group involved different levels of maternal-infant proximity. Adult mothers spent less than half (41%) of their infant's sleep period in contact with their infants, and spent significantly less time (13%) in the same room within arm's reach of their infants. Adults spent an additional 10% of the infant sleep period in the same room beyond arm's reach. A significantly greater portion of the infant's sleep period was spent in a different room from the mother among the adult group, and this arrangement accounted for 36% of the sleep period.

Table 6.3 Physical proximity between mothers and infants while awake and asleep

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% infant awake time spent in contact	63.7	6.0-98.7		68.2	1.6-97.0		202.00	ns
% infant asleep time spent in contact	56.4	4.8-86.5		34.3	0.0-98.6		206.00	ns
% infant awake time spent within arm's reach	18.6	1.2-94.0		7.1	0.2-35.9		132.00	>**0.01**
% infant asleep time spent within arm's reach	27.7	0.8-81.3		1.5	0.0-90.1		111.00	>**0.01**
% infant awake time spent beyond arm's reach	0.01	0.0-7.6		0.01	0.0-1.5		244.00	ns
% infant asleep time spent beyond arm's reach	1.7	0.0-83.1		1.1	0.0-84.0		228.50	ns
% infant awake time spent in different room	2.8	0.0-35.2		16.9	0.2-98.2		127.00	>**0.01**
% infant asleep time spent in different room	3.6	0.0-20.7		15.9	0.0-99.9		148.50	>**0.05**

6.6.2 Infant Crying

6.6.2.1 Infant Crying: Rationale

Crying represents an overt signal of infant needs designed to elicit a maternal response. The occurrence of nocturnal crying may also significantly disrupt maternal sleep, and thus represents an instance of maternal-infant conflict whose resolution is likely to differ depending on the particular nighttime parenting strategy that mothers employ. For the present study, crying bouts that occurred during the maternal sleep period were analysed for group differences to determine whether teen and adult nighttime parenting strategies were marked by a differential response to infant crying. The conventional approach holds that teens will ignore infant demands during the maternal sleep period and will respond less frequently to infant crying than adult mothers. Furthermore, the conventional approach predicts that when mothers do respond the teen group will take longer to respond than the adult group. Life-history theory predicts that teens will minimise the costs of nighttime interactions, but will not ignore infant crying any more than adult mothers. The maternal strategy for responding to infant crying may be

inherently bound to other aspects of a mother's nighttime parenting strategy, such as physical distance. While it might be possible to ignore infant crying as a way to decrease maternal costs when mothers and infants are separated from each other, it is likely that efforts to minimise costs will include prompt responsiveness when infants are sleeping in close physical proximity to the mother. Although ignoring the cries of an infant in a separate room might serve some purpose for mothers, it is unlikely that maternal costs would be minimised by ignoring the sustained cries of a baby sleeping close to the mother. Therefore, life-history theory predicts that when teens are sleeping in close proximity to their infants they will not ignore infant crying bouts, and they will be just as responsive as adults in order to attend quickly to infant crying and minimise the length of an awakening initiated by infant crying.

6.6.2.2 Infant Crying: Results

Although crying bouts lasted almost twice as long for infants of adult mothers compared to infants of teen mothers (89.2 seconds and 49.0 seconds, respectively), the difference was not statistically significant. Physical contact played a key role in the adolescent response to crying, and teen mothers picked-up and held their infants in response to crying significantly more than adult mothers. None of the other forms of maternal response to crying showed a significant group difference.

During the maternal sleep period, infant crying bouts that resolved without the mother attending to or responding to the infant were extremely rare for both groups. Almost all infant crying bouts that occurred during the maternal sleep period elicited a response from the mother. These crying bouts occurred at a rate of 0.1 times per hour for teens and 0.2 times per hour for adults, and there was no significant difference between the two groups.

The response time of mothers to infant crying bouts during the maternal sleep period in both groups was similar for teen and adult mothers. The mean lag time between the start of infant crying and the first maternal response was 32 seconds for teens and 36 seconds for adults. There was no significant group difference in response time between teens and adults.

Table 6.4 Maternal response to infant crying (not mutually exclusive categories)

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% maternal response to crying that involved contact	18.5	0.0-75.0		19.8	0.0-67.0		103.00	ns
% maternal response to crying that involved feeding	4.8	0.0-50.0		3.4	0.0-67.0		112.00	ns
% maternal response to crying that involved giving an object to infant	0.0	0.0-40.0		9.6	0.0-50.0		103.00	ns
% maternal responses to crying that involved holding or picking up infant	26.8	0.0-100.0		10.8	0.0-43.0		65.00	>**0.05**
% maternal responses to crying that involved vocalising	25.0	0.0-88.0		32.2	0.0-78.0		118.00	ns
% maternal responses to crying that involved a passive response	0.0	0.0-23.0		0.0	0.0-14.0		123.00	ns

Table 6.5 Infant crying

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% of sleep study infant spent crying	0.2	0.0-2.5		0.3	0.0-4.3		245.50	ns
Mean length of crying bouts (seconds)	41.0	9.6-102.1		50.9	12.2-255.7		105.00	ns
Rate per hour of crying bouts where mother did respond (during maternal sleep period)	0.0	0.0-0.7		0.0	0.0-1.1		248.00	ns
Mean lag time between infant crying and first maternal response in seconds (during maternal sleep period)	14.3	3.0-167.2		7.6	1.7-238.6		37.00	ns

6.6.3 Sleep Location

6.6.3.1 Sleep Location: Rationale

Choice of infant sleep location is perhaps one of the most fundamental aspects of nighttime parenting, particularly when sleep time is important for the growth and development of both mother and infant. The present study examines the sleep locations experienced by infants in both groups and hypothesises that the teen and adult parenting strategies will be characterised by different sleeping arrangements. The conventional approach predicts that teens will be more likely than adults to separate from their infants at night by placing infants to sleep in a separate room, based on the assumption that teens will pursue such separation as a means of prioritising maternal sleep quality and minimising involvement in nighttime infant care. Life-history theory, however, predicts that teens will be more likely than adults to select a sleep location for their infants that allows them to minimise maternal costs while engaging in infant care. This aspect of nighttime parenting is likely to be inherently related to other aspects of a mother's nighttime caregiving strategy, such as proximity and response to infant crying.

The present study also examines the total number of locations in which infants spent any portion of their sleep period, and examines differences between teens and adults. The conventional approach predicts that infants of teen mothers will experience a greater number of sleep locations on a given night because of a more chaotic lifestyle that involves less structure and less focus on routine in terms of infant sleeping habits. Life-history theory also predicts that infants of teen mothers will spend their sleep period in a greater number of locations than infants of adult mothers, but posits that the greater number of sleeping environments results from a strategy in which the mother keeps her baby with her wherever she is, pursuing a more fluid and less structured approach to infant sleep.

6.6.3.2 Sleep Location: Results

The pattern of infant sleep locations revealed that bedsharing was the predominant sleeping arrangement for teen mother-infant dyads and was significantly greater among teens than adults. Bedsharing accounted for 61% of the infant's sleep period in the teen group. Teen sleeping arrangements overall showed less variation, with bedsharing and roomsharing (in the form of a bedside bassinette) accounting for 84% of the sleep locations for infants of teen mothers. Out of all the remaining sleep locations, none of them accounted for more than 5% of infant sleep time for the teen group. Overall, the least amount of infant sleep time was spent in a cot in a separate bedroom.

The pattern of infant sleep locations among infants of adult mothers showed a different arrangement. Placing infants in a cot in a separate bedroom was the primary sleeping arrangement for this group and was significantly greater for adults than for teens. Separate room sleeping accounted for 39% of infant sleep time in the adult group, but the percentage of infant sleep time spent bedsharing (32%) was a close second. Unlike teens, half (50%) of infant sleep time was spent in the same room as the mother (either in the form of bedsharing or roomsharing). The remaining sleep locations also were not substantial in terms of the percentage of the sleep study spent in these locations.

Mothers in the teen group also had their infants spend a significantly larger percentage of the sleep period alone in an adult bed compared to adults. However, this appeared to be a function of the higher rates of bedsharing in this group, rather than being a deliberate infant sleep environment *per se*. Most sleep that occurred alone in an adult bed lasted only a few minutes, usually when the mother left the bed for short periods of time during the night. However, neither infants of teen nor adult mothers spent extended periods of time alone in the adult bed. Teen mothers tended to keep their babies with them wherever they were in the sleep lab, and when teens were in the living room watching television they typically kept their sleeping infants next to them. Therefore, there was a trend toward a higher percentage of infant sleep time being spent on a sofa while the mother was awake among the teen group. No significant group difference was found for infant sleep time spent on the sofa while the mother was also asleep, although one mother in the adult group spent the majority of the sleep period in this arrangement. This scenario is described in more detail in Chapter 7.

Table 6.6 Time spent with infants alone in adult bed

	Teens			Adults				
	n	*%*		*n*	*%*		χ^2	*P-value*
Alone adult bed: more than 10 minutes	9	39		3	14		3.74	>0.10
Alone adult bed: more than 15 minutes	6	26		2	9		*	ns
Alone adult bed: more than 30 minutes	4	17		2	9		*	ns

* Probability calculated using Fisher's exact test.

Table 6.7 Infant sleep location

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% infant sleep period spent bedsharing	76.6	0.0-99.1		0.0	0.0-28.4		146.00	>**0.05**
% infant sleep period spent in bassinette, same room	0.0	0.0-99.6		0.0	0.0-98.7		214.00	ns
% infant sleep period spent in cot, separate room	0.0	0.0-10.4		0.0	0.0-100.0		169.00	>**0.05**
% infant sleep period spent in car seat	0.0	0.0-56.4		0.0	0.0-16.9		235.00	ns
% infant sleep period spent on sofa	0.0	0.0-22.0		0.0	0.0-13.7		193.00	>0.10
% infant sleep period spent on sofa with mother also asleep on sofa	0.0	0.0-22.8		0.0	0.0-79.8		238.50	ns
% infant sleep period spent in mother's arms	1.3	0.0-23.5		1.3	0.0-10.8		227.50	ns
% infant sleep period spent alone in adult bed	0.7	0.0-49.6		0.0	0.0-28.4		161.00	>**0.05**

There was a significant difference in the total number of sleep environments experienced by infants of teen mothers compared to infants of adults. Infants of teen mothers experienced a significantly greater number of relocations during the night, sleeping in 4 locations on average compared to 3 for infants of adult mothers.

Table 6.8 Number of infant sleep environments

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
Number of sleep environments	4.0	1.0-6.0		3.0	1.0-5.0		133.50	>**0.01**

6.6.4 Bedsharing

6.6.4.1 Bedsharing: Rationale

The factors that motivate mothers to bedshare with their infants can affect how bedsharing is practised (see Chapter 3), and ultimately determine the relative risk and/or protective factors associated with bedsharing for individual infants. The present study examined how mothers orientated their bodies in relation to their infants during bedsharing, how infants orientated their bodies towards their mothers, and where the infant was located in the bed in relation to the mother's body (with their heads placed at the level of the mother's face, shoulder, breasts, waist, or other position). The conventional approach holds that teen mothers will engage in more unsafe bedsharing compared to adults, and therefore predicts that teen mothers will be less orientated towards their infants, and will either have their infants sleeping higher in bed in relation to the mother's body or at other unusual levels that indicate a lack of engagement between the mother and infant during bedsharing. Life-history theory predicts that teens will bedshare and will have the same degree of engagement with their infants during bedsharing as adult mothers.

6.6.4.2 Bedsharing: Results

As reported in section 6.6.3, the adolescent mothers did bedshare significantly more than the adult mothers. However, no significant group differences were found in the ways in which teens and adults practiced bedsharing. While sleeping next to their mothers, infants of teens spent 34% of their time with their heads positioned at the mother's breast level, 28% at the mother's face level, 38% at the mother's shoulder level, and virtually no time at other positions in relation to the mother's body. Among the adult group, infants spent 22% of the time at the mother's breast level, 24% at the mother's face level, 38% at the mother's shoulder level, and 16% at other positions in relation to the mother's body. None of the infants in either group were ever coded as sleeping at the mother's waist level.

Similarly, no significant group differences were found in the amount of bedsharing time mothers were orientated towards their infants or infants orientated towards their mothers. Teen mothers spent 70% of bedsharing time orientated towards their infants, and adults spent 78% of their time orientated towards their infants. For the infants, those in the teen group spent 60% of the time orientated towards their mothers. Infants in the adult group were orientated towards their mothers 61% of the time.

Table 6.9 Infant head position and mother-infant orientation during bedsharing

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% infant bedsharing time with head at breast level	22.7	0.0-100.0		0.2	0.0-100.0		105.00	ns
% infant bedsharing time spent at face level	15.1	0.0-99.9		0.0	0.0-99.1		109.00	ns
% infant bedsharing time spent at shoulder level	34.6	0.0-100.0		23.3	0.0-100.0		137.00	ns
% infant bedsharing time spent at other level	0.0	0.0-1.1		0.0	0.0-100.0		104.00	ns
% infant bedsharing time mother orientated toward infant	70.7	18.3-100.0		84.3	19.2-100.0		80.00	ns
% infant bedsharing time infant orientated toward mother	60.1	0.0-100.0		72.1	0.0-100.0		126.00	ns

6.6.5 Sleep Position

6.6.5.1 Sleep Position: Rationale

The position in which a mother places her infant to sleep has significant implications for infant health and safety outcomes. As discussed in Chapter 3, medical recommendations state that infants should be placed supine for sleep, and that the prone position is the least safe position for sleep and the position associated with the highest risk of SIDS. Despite the pervasive recommendations about the dangers of prone positioning, noncompliance rates remain high in certain populations and lack of message exposure does not appear to be the reason for the noncompliance. However, existing research documents that infants sleep more soundly and have fewer limb movements when sleeping prone (Ottolini et al. 1999; McKenna, Ball & Gettler 2007). Since the infants of adolescent mothers experience more negative outcomes associated with sleep safety, the present study hypothesises that teen mothers in the sample will be more likely to place infants in the prone position for sleep. The conventional approach assumes that this will occur because teens engage in higher risk behaviours with their infants across the board and because teen mothers will be more likely to disregard health and safety recommendations. Life-history theory assumes the increased incidence of prone positioning among teen mothers will occur as the result of the mother's desire to enhance infant sleep quality and duration and thereby minimise maternal sleep disruption.

It is important to note that when prone positioning occurred during the overnight sleep studies, research staff intervened to alert the mother to the dangers of this sleep position and request that she reposition her infant for sleep. Therefore, mothers who might have placed their infants prone on more than one occasion were less likely to do so, and the duration of sleep spent in the prone position cannot be calculated. Thus, all data on prone positioning are somewhat limited and likely represent an underestimate of the actual practices of the mothers included in the present sample. Results are presented on whether mothers placed their infants in the prone position for sleep at any point during the overnight sleep study.

6.6.5.2 Sleep Position: Results

The supine and lateral positions were the predominant sleep positions for infants in both groups, although there was slightly more lateral positioning for infants in the teen group and slightly more supine positioning for infants in the adult group. None of the group differences in infant sleep position was statistically significant. However, although not overly common for either group, there was a trend towards more teen mothers placing their infants in the prone position.

Table 6.10 Infant sleep position

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% infant sleep time in supine position	31.2	0.0-95.6		70.5	0.0-100.0		171.00	>0.10
% infant sleep time in prone position	0.6	0.0-99.0		0.0	0.0-98.3		184.00	>0.10
% infant sleep time in lateral position	4.9	0.0-94.0		0.4	0.0-57.0		199.00	ns
% infant sleep time in CUPI position	9.2	0.0-75.5		0.0	0.0-85.1		181.00	>0.10
% infant sleep time held in mother's arms	2.0	0.0-24.8		1.3	0.0-46.0		240.00	ns
% bedsharing time in prone position	0.0	0.0-55.4		0.0	0.0-0.5		95.00	ns

Table 6.11 Number of mothers in each group who placed infants prone

	Teens			Adults				
	n	*%*		*n*	*%*		χ^2	*P-value*
Number of mothers who placed infant in prone position at some point	11	48		5	23		3.09	>0.10

6.6.6 Infant Feeding

6.6.6.1 Infant Feeding: Rationale

Infant feeding represents a significant form of maternal parenting effort, and breastfeeding in particular involves a high level of energetic expenditure. Since infant sleep and feeding practices are inherently related (e.g. Ball, Hooker & Kelly 1999; McKenna & Bernshaw 1995), the present study hypothesises that maternal choices about how to feed infants will form a significant portion of each mother's nighttime parenting strategy. Feeding practices are thus expected to differ between the two groups in accordance with the particular strategy being pursued by each. The conventional approach predicts that fewer teens will breastfeed their infants than adults based on myriad perceived social and physical barriers to breastfeeding and based on a decreased level of maternal effort across the board. Life-history theory also predicts that fewer teens will breastfeed than adults, based on the assumption that teen mothers need to continue to invest in their own physical growth and maturation (and that they are destined to spread their reproductive effort over a greater number of offspring, hence investing less in each one). Furthermore, life-history theory suggests that the decreased frequency of feedings associated with formula consumption may limit the frequency and/or duration of maternal sleep disruptions, thereby minimising parent-infant conflict concerning sleep needs.

In addition to preserving maternal sleep, the choice to formula feed infants may be essential to the teen nighttime parenting strategy because it allows mothers to transfer some degree of management of a bottle feeding session from the mother to the infant. The present study therefore predicts that the amount of infant self-feeding accomplished by bottle propping will be different between the teens and adults. Both the conventional approach and life-history theory predict that bottle feeding sessions will more often involve infant self-feeding among the teen mothers as a way to decrease the amount of maternal involvement in infant feeding sessions in comparison with adult mothers.

6.6.6.2 Infant Feeding: Results

There were no significant differences in the amount of time spent feeding infants (including all feeding methods) between the teens and adults, although as noted above 3 of the 23 teen mothers never fed their infants during the course of the overnight sleep study. Significantly fewer teens engaged in breastfeeding compared to adult mothers. Significantly more adults than teens followed a mixed feeding strategy that included both bottle and breastfeeding. Of the time that was spent feeding infants, teen mothers spent significantly less time breastfeeding and significantly more time bottle feeding than adult mothers. Additionally, a greater number of teen mothers had their infants self-feed at some point compared with adult mothers, and a greater percentage of feeding time was spent with infants self-feeding among the teen group, although these differences just failed to reach significance.

Table 6.12 Feeding strategies

	Teens			Adults				
	n	*%*		*n*	*%*		χ^2	*P-value*
Number of mothers who exclusively breastfed	4	17		8	36		2.07	ns
Number of mothers who exclusively bottle fed	16	70		10	46		2.68	ns
Number of mothers who followed a mixed feeding strategy	0	0		4	18		*	**>0.05**
Number of mothers who did not feed their infants during sleep study	3	13		0	0		*	ns
Number of mothers who engaged in any breastfeeding	4	17		12	55		6.77	**>0.01**
Number of mothers who had their infant self-feed during the sleep study	9	39		3	14		3.74	>0.10

* Probability calculated using Fisher's exact test.

Table 6.13 Percent of sleep study infants spent feeding, with percent of feeding time spent breastfeeding, bottle feeding and self-feeding

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% sleep study spent feeding infants	3.4	0.0-14.6		4.2	0.8-11.8		219.00	ns
% infant feeding time spent breastfeeding	0.0	0.0-100.0		78.8	0.0-100.0		152.00	**>0.05**
% infant feeding time spent bottle feeding	100.0	0.00-100.00		21.2	0.0-100.0		152.00	**>0.05**
% infant bottle feeding time spent self-feeding	12.6	0.0-98.8		0.0	0.0-47.8		70.50	>0.10

6.6.7 Sleep Duration

6.6.7.1 Sleep Duration: Rationale

The way in which mothers structure their own and their infants' sleep periods forms the crux of an individual's nighttime parenting strategy. Because maternal and infant sleep needs are not always compatible, the sleep period potentially represents a peak period of parent-infant conflict. Given the detrimental effects of inadequate sleep, it is logical to expect that all mothers will engage in strategies that promote the best possible sleep for mother and infant without causing undue neglect of infant needs. The present study hypothesises that the different nighttime parenting strategies pursued by teens and adults will have different implications for maternal and infant sleep patterns. Specifically, the study assumes that the timing and duration of maternal and infant sleep, the frequency of awakenings, and the degree of synchronicity between maternal and infant sleep will all differ for teens and adults. The conventional approach predicts that teen mothers will be less involved with their infants during the night, decreasing caregiving efforts in order to gain more sleep and thus achieving a longer sleep period than adult mothers with fewer interruptions. In comparison with adult mothers, life-history theory also predicts that teens will find a way to minimise sleep disruptions and preserve the maternal sleep period, but suggests that their nighttime parenting strategies will be constructed so that mothers obtain as much sleep as possible while still providing nighttime care to infants.

6.6.7.2 Sleep Duration: Results

There were no group differences in the amount of sleep experienced by mothers and infants, either as a percentage of the sleep study spent asleep or in terms of the total

duration of sleep, which was self-determined by the mothers. There were also no differences between teens and adults in terms of how often infants awakened during the night, nor were there any differences in whether infant awakenings were attended to by mothers or whether infants went back to sleep after an awakening without the mother ever waking up. There was a trend toward more frequent but shorter maternal awakenings in the teen group, with teen mothers waking up more often and getting back to sleep more quickly than adults.

There was more compatibility between maternal and infant sleep periods in the teen group than in the adult group. There was a significant group difference in the lag time between maternal and infant sleep onset, with mothers in the teen group going to sleep sooner after their infants went to sleep compared to adults. After their infants began their sleep periods, teen and adult mothers went to sleep 1 hour and 1.7 hours later, respectively. There was also a trend towards more compatibility between mother and infant sleep in the teen group, with the total duration of time spent asleep more similar between teen mothers and their infants compared to those in the adult group. On average, infants in the teen group slept 1.1 hours longer than their mothers, as opposed to 1.7 hours in the adult group.

Table 6.14 Maternal and infant sleep

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% sleep study mothers spent asleep	65.4	45.9-85.9		62.3	43.2-80.1		194.50	ns
% sleep study infants spent asleep	80.5	58.0-95.1		76.6	54.4-96.7		228.00	ns
Duration of maternal sleep (hours)	7.0	4.8-10.3		6.9	5.1-8.2		209.00	ns
Duration of infant sleep (hours)	8.7	6.1-10.6		8.6	6.3-10.8		235.00	ns
Lag time between infant and maternal sleep onset (hours)	0.7	0.08-3.6		1.4	0.3-3.8		152.00	**>0.05**
Difference between length of infant and maternal sleep periods (hours)	1.3	-0.6-3.2		1.6	-0.2-4.2		166.00	**>0.05**
Rate per hour of infant wakings mothers attended to	0.11	0.00-1.06		0.15	0.00-1.00		227.50	ns

Rate per hour of infant wakings mothers did not attend to	0.11	0.00-0.55		0.12	0.00-1.71		249.00	ns
Total number of maternal awakenings	15.00	2.00-34.00		10.50	1.00-28.00		173.50	>0.10
Mean duration of maternal awakenings (minutes)	2.0	0.4-18.0		4.2	0.4-32.6		169.00	>0.10

6.6.8 Sleep-Related Risks

6.6.8.1 Sleep-Related Risks: Rationale

Because sleep-related risks remain a significant threat to infant health and safety, and because these risks remain poorly understood and somewhat difficult to identify, most studies on nighttime caregiving have focused almost exclusively on risk factors associated with the sleep environment. The present study measured how mothers' nighttime parenting strategies translated into specific forms of risk for individual infants. The risk factors evaluated included the following: use of the prone sleeping position, placing infants to sleep in a separate bedroom, engaging in risky bedsharing practices, bottle propping, exposing infants to breathing, feeding or other forms of risk, lack of breastfeeding, having infants sleep on pillows or with other unsafe materials in their immediate environment, maternal smoking, and having infants sleep alone in an adult bed. The conventional approach predicts that infants of teen mothers will be exposed more often and for longer periods of time to each of these risks. Life-history theory predicts a somewhat more complex picture of nighttime parenting in which both groups of mothers tolerate certain degrees of risk to their infants in exchange for real or perceived benefits to the mother if the potential benefit outweighs the probable cost.

The specific predictions of the conventional approach are, again, that the parenting practices of teen mothers will result in more of each of the types of risks outlined above. This includes the prediction that, compared to adults, teens will be more likely to place infants to sleep in the prone position, more likely to have infants sleeping in a separate room, more likely to practise unsafe bedsharing that includes diminished orientation to the infant and more atypical placement of infants in the bed, more self-feeding through bottle propping, more time with infants exposed to breathing-related, feeding-related, or other forms of risk, more maternal smoking, less breastfeeding, more pillow use, and a greater duration of infants sleeping alone in an adult bed.

Unlike the conventional approach, life-history theory holds that risks occur in the context of nighttime parenting as the result of functional, if not always conscious, maternal strategies that benefit either the mother or the infant without causing excessive harm to the infant. Maternal perception of what constitutes excessive harm, then, depends on how necessary the perceived benefit and how likely it is that the potential risk will result in actual harm to the infant. Life-history theory predicts that teen mothers will be more likely to tolerate the risks that decrease maternal costs, as well as those which help resolve parent-infant conflict at night. This means that teen mothers will be more likely to place infants in the prone position, which may result in more sound sleep for infants and therefore for mothers. Life-history theory also predicts that teens will be less likely to breastfeed their infants, and more likely to have infants self-feeding during the night. However, unlike the conventional approach, life-history theory does not predict that infants in the teen group will spend more time exposed to breathing-related, feeding-related, or other forms of risk compared to those in the adult group. Instead, such risks may occur for either group, and in any sleep location. Life-history theory also predicts that teens will maintain greater proximity to their infants at night as discussed in the previous section, and therefore posits that teen mothers will be less likely to place infants to sleep in a separate room and will be more likely to bedshare. Life-history theory does not suggest the teens will be less attuned to their infants while bedsharing, nor that teen mothers will expose their infants to pillows and other items more than adults. Life-history theory also does not predict that teens will be more likely to leave their infants sleeping alone in an adult bed, nor does it generate a specific prediction about maternal smoking in comparison with adults.

6.6.8.2 Sleep-Related Risks: Results

As discussed above, several of the nighttime parenting behaviours that may impact the presence and degree of sleep-related risks to infants showed significant differences between teens and adults. Infants of teen mothers breastfed significantly less, and self-fed from a propped bottle more than infants of adult mothers (see Tables 6.12 and 6.13). Teen and adult strategies also involved different sleeping locations for infants, with those in the teen group bedsharing significantly more, and infants in the adult group spending significantly more time sleeping alone in a separate bedroom (see Table 6.6). Other risk-related topics showed no significant group differences. There were no differences in maternal and infant orientation or infant head position while bedsharing. Similarly, there

were no group differences in infant sleep position (see Table 6.9), although the more frequent occurrence of prone positioning among the teen group was approaching significance. Although not statistically significant, descriptive data suggest that there may be an elevated occurrence of prone positioning during bedsharing among the teen group.

Pillow use was another aspect of the infant's sleep environment that differed between teens and adults (see Table 6.15 below). Infants of teens spent significantly more time with their heads on pillows than infants of adults. This primarily occurred in the context of bedsharing, where infants of teen mothers spent nearly a third (31%) of their bedsharing time with their heads on a pillow, compared to only 2% of bedsharing time for adults. Pillow use in any of the other possible sleep locations was not common for either group. However, although there was no significant group difference, pillows were introduced into the other sleeping environments by both groups. Adult mothers but not teen mothers placed pillows in the cot, and teen mothers but not adult mothers placed pillows in the bedside bassinette. Sleeping on a pillow accounted for an average of 11% of time spent sleeping in the cot among the adult group, and 10% of time spent sleeping in a bassinette among the teens.

Table 6.15 Infant sleep surface

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% infant sleep time spent with head on pillow across all sleep locations	0.0	0.0-95.8		0.0	0.0-88.0		168.00	**>0.05**
% infant sleep time spent with body only on mattress across all sleep locations	67.6	0.0-99.6		96.9	0.0-100.0		160.50	**>0.05**
% time bedsharing with infant head on pillow	0.1	0.0-100.0		0.0	0.0-27.3		67.00	**>0.05**
% time in cot with infant head on pillow	0.0	0.0-0.0		0.0	0.0-100.0		12.00	ns
% time in bassinette with infant head on pillow	0.0	0.0-100.0		0.0	0.0-0.0		22.50	ns

Specific risks that occurred during the overnight sleep studies were coded and categorised as being either breathing-related, feeding-related, or related to other forms of risk to infants (for detailed definitions, see Appendix III). There were no significant

differences between teens and adults in the incidence or duration of each of the three risk categories individually, or in the overall incidence of the combined risk situations. Infants of teen and adult mothers spent an average of 19% and 18% of the sleep study exposed to some type of risk situation, respectively. For both groups, the predominant threat to infant safety occurred in the form of breathing risks. Feeding risks and other forms of risk, which included risk of entrapment, falling or overheating, were not common for the entire sample. It should be noted that the duration of each risk is potentially an underestimate of actual behavioural practices since sleep lab staff intervened whenever an infant was exposed to immediate harm or in any circumstances in which the safety of the infant was in question (see section 8.4 for further discussion).

Table 6.16 Sleep-related risks to infants

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
% of sleep study infant exposed to breathing risk	6.2	0.0-89.7		0.0	0.0-61.2		193.50	ns
% of sleep study infant exposed to feeding risk	0.0	0.0-54.0*		0.0	0.0-2.1		233.00	ns
% of sleep study infant exposed to other risk	0.0	0.0-26.2		0.0	0.0-73.3		218.50	ns

* The upper range for the teen group was represented by one mother whose sleep study was somewhat anomalous in that her infant slept with a bottle propped in her mouth for the majority of the sleep night. The risk was coded as a breathing (choking) risk, but was secondarily coded as a feeding risk because the bottle contained water, which was the main liquid consumed by the infant during the night. This was an exceptional case and is detailed in the third case study in Chapter 7. Without the data from this participant, the upper range for the teen sample would have been 17.6.

Table 6.17. Number of infants ever exposed to sleep-related risks

	Teens			Adults				
	n	*%*		*n*	*%*		χ^2	*P-value*
Number of infants ever exposed to any of the 3 risks	14	61		14	64		0.04	ns
Number of infants ever exposed to breathing risk	14	61		10	46		1.07	ns
Number of infants ever exposed to feeding risk	5	22		4	18		*	ns
Number of infants ever exposed to other risk	5	22		7	32		0.58	ns
Number of infants exposed to all 3 risks	2	9		1	5		*	ns

* Probability calculated using Fisher's exact test.

Potential breathing risks caused by items placed in the infant's sleep environment were more common among adults. Adult mothers placed significantly more items, such as stuffed animals, toys, and blankets, in the cot environment than teens. Items placed in the other sleep environments were less common for both groups, and there were no significant differences between teens and adults in the placement of objects in any of the other infant sleep locations. There are some limitations associated with this variable; see section 8.4.5 for further discussion.

Table 6.18 Items added to infant sleep locations at any point during the infant sleep period

	Teens			Adults				
	Median	*Range*		*Median*	*Range*		MWU	*P-value*
Number items added to cot	0.0	0.0-7.0		0.0	0.0-11.0		182.00	**>0.05**
Number of items added to adult bed	1.0	0.0-5.0		1.0	0.0-5.0		218.50	ns
Number of items added to bassinette	0.0	0.0-8.0		0.0	0.0-6.0		220.50	ns
Number of items added to sofa	0.0	0.0-3.0		0.0	0.0-5.0		218.50	ns
Number of items added to mother's arms	1.0	0.0-6.0		0.0	0.0-9.0		195.50	ns
Number of items added to other sleep location	0.0	0.0-4.0		0.0	0.0-4.0		243.00	ns

There were no significant group differences found in the rates of cigarette smoking between teens and adults. The majority of mothers in both groups reported that they did not smoke, and of those who did smoke all but three mothers in each group had ceased using cigarettes since becoming pregnant.

Table 6.19 Maternal smoking

	Teens			Adults				
	n	*%*		*n*	*%*		χ^2	*P-value*
Number of mothers who ever smoked	8	35		5	23		0.81	ns
Number of mothers who were current smokers during last trimester of pregnancy	3	13		3	14		*	ns

* Probability calculated using Fisher's exact test.

6.6.9 Summary

The behavioural data presented here suggest that teen and adult nighttime parenting strategies are not identical, and that meaningful differences exist in how the two groups of mothers approach infant care at night. Furthermore, the data indicate that nighttime parenting behaviours function interdependently. The above data illustrate that nighttime parenting strategies are not defined by a collection of discrete behaviours, but rather by a behavioural complex wherein multiple caregiving practices operate synergistically. For example, proximity, sleep location, feeding method, and maternal response time to infant crying are all mutually reinforcing elements of a mother's nighttime parenting strategy.

For the teen mothers in this sample, the cornerstone of their nighttime parenting strategy was physical proximity. This involved close proximity both while infants were awake and while they were asleep, and translated into a pattern of predominant bedsharing. Furthermore, infants of teen mothers had a higher number of sleep locations, since infants generally moved between different sleep locations as their mothers went about their nighttime routines. The adult nighttime parenting strategy for this sample was more heterogeneous. Bedsharing and physical contact during sleep was common among adult mothers, but the predominant parenting strategy for these mothers involved physical distance and separation during the night. Adult mothers spent a larger portion of the night

in separate rooms from their infants, including time the infant was awake and asleep, and had a more structured approach to infant sleep that primarily involved having infants sleeping alone in their own bedroom.

The nighttime parenting strategy undertaken by teen mothers served to promote synchrony of maternal and infant sleep to a much greater extent than was observed for the adults. Teen mothers started their sleep period sooner after their infants fell asleep, whereas adults spent a longer period of time awake while their infants slept. The sleep period of teen mothers and their infants was more similar in length than the sleep period of dyads in the adult group. Furthermore, there was a trend toward a greater frequency but shorter duration of night wakings for teen mothers, which supports the idea that teen mothers were matching their own and their infant's sleep routines and reducing costs by synchronising their sleep with their infant's sleep. This finding suggests that the teen strategy buffers maternal costs by reducing parent-infant conflict over sleep.

Teen and adult nighttime parenting strategies were also marked by significant differences in infant feeding methods. Adults were more likely than teens to breastfeed their infants whereas teen mothers were almost always exclusively using formula. In addition to the energetic costs which teen mothers avoided by formula-feeding their infants, bottle feeding also allowed them to reduce their involvement in infant feedings by enabling infants to self-feed during the night.

Despite other differences between the teen and adult strategies, the occurrence of sleep-related risks to infants was not polarised. Teen mothers were more likely to have their infants sleeping on pillows, and there was a trend towards a great incidence of prone sleeping among infants in the teen group compared to adults. Otherwise, infants of teen mothers did not spend more time exposed to potential risks than did infants in the adult group, and risks occurred for both groups of mothers and across sleep locations. Given the incidence of negative sleep-related health and safety outcomes in general, it might have been unusual to see frequent and acute risks to infants in a sample of this size. Instead, the study suggests that high-risk practices are not overly common for mothers regardless of maternal age, and that a sub-set of mothers engage in particularly risky practices that may pose a more substantial threat to the safety of their infants. These specific risk factors, and information on the behavioural context in which they occurred for mothers in this study, are explored in greater detail in the following chapter.

The picture of nighttime parenting captured by the present study supports the idea that caring for infants during the night represents a substantial cost to mothers. The

number of night wakings observed for mothers in both groups illustrates how much is required to care for infants during the sleep period. It is therefore not surprising that the sleep period represents a significant instance of parent-infant conflict, and that maternal strategies would develop to help mothers cope with these high costs. It is possible, of course, that fathers and other relatives or caregivers figure in to the cost-reduction strategies of mothers in both groups, but this aspect of nighttime parenting strategies was beyond the scope of the present study. The issue is discussed further in section 8.4.

CHAPTER 7
CASE STUDIES OF SLEEP-RELATED RISKS TO INFANTS DURING NIGHTTIME CAREGIVING ROUTINES

This chapter presents case studies of risk-related parenting practices observed for six mother-infant dyads during the course of the study. The cases focus on specific aspects of maternal behaviour that have been identified as risk factors in the literature (see Chapter 3). Many sleep-related risks to infants have been identified by large-scale epidemiological research. These cases are offered as a supplement to these studies, presenting a detailed description of the focal behaviours as well as a broader description of the context in which they occurred. For each case, a brief description of the mother and infant is presented, followed by a detailed account of the overnight sleep studies.

All of the case studies presented below illustrate the complex nature of nighttime parenting, and reinforce the challenges involved in trying to identify discrete risk factors within a varied and multifaceted behavioural context. Overall, the case studies collectively suggest that the behind-the-scenes stories of each dyad are significant to understanding the occurrence of sleep-related risks. Moreover, it is possible that this underlying information is potentially as clinically relevant as the identified risk factors themselves. Although Reduce the Risk guidelines and other public health messages focus on eliminating discrete risk factors, such as prone positioning, sofa sleeping, and bedsharing, as if they were directly and uniformly lethal, the fact is that the majority of instances in which any one of these risk factors is present is unlikely to result in actual infant mortality. Mothers are therefore assessing potential costs and benefits within margins of risk which are not acknowledged or addressed by public health campaigns. This approach may be akin to treating the symptoms of an illness rather than the cause. The important point of these case studies is that the context in which particular nighttime parenting behaviours are being used is as important as the occurrence of the behaviour itself. The case studies all provide unique examples of mothers who were engaged in the strategic management of nighttime parenting costs, and all were making compromises in infant care which were expressed in different ways depending on their individual circumstances. Addressing why each mother

chose to manage maternal costs in that particular way may hold the key to uncovering how risks actually impact individual infants, and why the same behaviour might result in poor outcomes for one infant but not for another.

7.1 Case Study 1: Infant Was Never Fed During the Overnight Sleep Study

The first case study illustrates a lack of feeding episodes during the night, including during the immediate pre- and post-sleep periods. It is possible that this does not constitute a specific risk for the infant, but it may be of concern and is presented here as an opportunity for discussion of potential implications, if any. The lack of nocturnal feeding episodes occurred for three mothers in this study, and all of them were teen mothers. While the clinical implications of this lack of feeding are open for discussion, the fact that the behaviour occurred for only one group of mothers suggested that it was worthy of inclusion in this chapter since it relates to the issue of how the nighttime parenting practices of teen and adult mothers might be different and how the practices of either group might relate to infant risk during the sleep period. The mother's nearly continual use of a pacifier for her infant in this case may be related to a desire or need to keep the infant quiet, since virtually every vocalization of any type prompted the mother to reach for a pacifier. The mother's lack of feeding and nappy changing hint at early signs of child neglect, yet they occurred alongside displays of affection, sensitivity, and other very attentive parenting behaviours. This case study suggests that neglect is not an all-or-nothing behaviour, and that neglectful practices can exist even for mothers who are very devoted to their infants.

7.1.1 Participant Description

Participant 4070 was an 18 year old of Native American ethnicity, and her son was 22.6 weeks old at the time of the sleep study. She was partnered and living with the child's father. At the sleep study, the infant appeared healthy, active, and of adequate body weight, and had very visible fat rolls on his arms and legs. The mother was morbidly obese, and a notable body odour was present. The mother wore jeans and a t-shirt for the entire sleep study, including the sleep period. She displayed some difficulty sleeping, snoring frequently and appearing to have some sleep apnoea-like episodes.

7.1.2 The Overnight Sleep Study

The sleep study began at 9:33 p.m. on 3 May, 2003, with the mother and baby together on the sofa watching television before bed. The mother held the infant in her arms or on her lap for the vast majority of this time, and engaged in a number of affectionate interactions with her infant. The mother had several toys nearby, which she frequently offered to the infant in order to keep him entertained, including a teething rattle which the baby spent time chewing. A pacifier was attached to the baby's clothes with a cord and a clip, and the mother offered the pacifier to him frequently. The baby was very content, and vocalised but did not engage in any fussing or crying. When the baby did vocalise, the mother was quick to insert the pacifier into his mouth, which the baby accepted each time even if the pacifier did not remain in his mouth for a long period of time. At about 45 minutes (10:18 p.m.) into the sleep study, the mother opened a bag of crisps and a can of soda which she consumed while watching television. The baby watched the mother consume the crisps with interest, and whenever the mother lifted the can of soda to her mouth the infant reached for it as well, but the infant did not engage in any fussing or crying, and did very little vocalising, during this time. Each time the infant reached for the can of soda, the mother said "no" and moved the can just beyond his reach.

At approximately 57 minutes into the sleep study (10:30 p.m.), the mother felt the baby's neck and forehead several times, and went into the bedroom to retrieve a thermometer she brought with her to the overnight study. She began taking the infant's temperature underarm (see Figure 7.1), but because the baby was squirming she was unable to get a proper reading and proceeded to take his temperature rectally instead. Following the rectal temperature reading, the mother put the same nappy back onto the baby that he had been wearing previously. The mother removed all of the baby's clothes except for his nappy, presumably because she felt that he was hot but not feverish. Fourteen minutes after the first temperature reading, the mother took the infant's temperature again, this time completing an underarm temperature reading. The mother and baby continued sitting together on the couch while the mother watched television, again holding the baby on her lap (see Figure 7.2). The baby continued to move frequently and engage with toys, and did some vocalising but no extended fussing or crying.

1 hour and 22 minutes into the study (11:18 p.m.), the baby fell asleep in the mother's arms while she sat upright on the sofa watching television. The mother noticed that the infant was asleep, and repositioned him numerous times in an attempt to wake him up. She tried to lift his head in order to wake him, and said, "wake up, wake up" several

times. The baby continued to nod off into sleep, so the mother placed the infant supine on the sofa right next to her and kept her hand on his torso continuously. The baby's face was turned to the side towards the edge of the sofa, and there was nothing near his face. Four minutes later, the mother picked the baby up and carried him to the cot in a separate room, where she placed him supine on the cot mattress with no bedding or additional items in the cot. The baby continued to wear only a nappy. The mother inserted the pacifier into the baby's mouth at this time, which the baby accepted without waking up. The mother left the room briefly to retrieve a musical toy from her belongings, which she then attached to the cot and secured. The toy began to play a lullaby and light up, but the baby remained asleep throughout. The mother then returned to the other room to continue watching television.

1 hour and 47 minutes into the sleep study (11:43 p.m.), the mother returned to the room where her infant was sleeping, and the baby began to wake. She picked the infant up and moved him to the second bedroom containing a bedside bassinette and a standard adult bed. The mother placed the infant supine in the bassinette, and again inserted the pacifier into his mouth. She began to place a baby blanket over the infant, but this action caused the baby to stir so she removed the blanket. The mother then picked the infant up, who was now awake, and held him while she sat on the edge of the bed, rubbing his back as she did so. At 1 hour and 50 minutes (11:46 p.m.), mother and baby both lay down in bed together. The mother placed the infant with his head on a full-sized pillow next to her, and covered her own body with blankets but did not cover the infant. Mother and baby held hands and engaged in affectionate interactions with each other, including the baby chewing on the mother's fingers and sucking on her hand. The baby engaged in a small amount of vocalising during this time, but did not do any fussing or crying. Whenever the pacifier fell out of the baby's mouth, the mother promptly reinserted it. The baby continued to squirm and move, and the mother readjusted the bed covers so they were partially covering the baby's body, as well. After a few minutes, both mother and baby fell asleep, with the pacifier in the baby's mouth (see Figure 7.3). At two hours and 25 minutes (11:58 p.m.), the mother woke up briefly, visually inspected the infant, repositioned herself so she was sleeping prone with her head turned away from the infant, and promptly fell back asleep. She had another short waking at three hours and 14 minutes (12:47 a.m.), including another visual inspection of infant, and again fell right back to sleep. Throughout this time, the baby slept soundly, with very little covers over his body, and his head continuously on the pillow. The mother woke up again briefly at 3 hours and 29 minutes

(1:02 a.m.), at 3 hours and 49 minutes (1:22 a.m.), and at 4 hours (1:33 a.m.). The pacifier fell out of the baby's mouth at 4 hours and 57 minutes (2:30 a.m.), but the baby did not wake up. At 5 hours and 27 minutes (3:00 a.m.), the mother got out of bed briefly to use the bathroom. The baby stirred as a result of her movement, but did not wake. The mother returned to bed 3 minutes later, reinserted the pacifier into the baby's mouth, and returned to sleep. The pacifier remained in the baby's mouth until 5 hours and 36 minutes (3:09 a.m.).

At 7 hours and 26 minutes (4:59 a.m.), the baby stirred and woke up, and prompted the mother to wake up as well. The mother repositioned the baby so his head was fully back on the pillow. He began fussing, so she reinserted the pacifier into his mouth, which he took and immediately stopped fussing. The baby closed his eyes, but continued moving his legs for several minutes. The pacifier fell out of his mouth two minutes later, and the mother immediately reinserted it into his mouth. The baby's eyes opened, and he began fussing, which the mother dealt with by repeatedly putting the pacifier in his mouth whenever the fussing occurred. She also made some soothing noises and affectionately touched the infant. Since the infant was still wide awake, she repositioned him onto her chest and rubbed his back, again continuing to reinsert the pacifier whenever it fell out of the baby's mouth. At 7 hours and 30 minutes (5:03 a.m.), she repositioned the baby onto his back on top of the mattress, with her arms encircling him, and reinserted the pacifier again (see Figure 7.4). Within two minutes, both mother and baby had fallen back asleep. They slept until 9 hours and 17 minutes (6:50 a.m.), when the baby had a very brief awakening with fussing, although he never opened his eyes, which prompted the mother to once again reinsert the pacifier into his mouth. The pacifier immediately settled the baby, and both fell back to sleep. At 10 hours and 15 minutes (7:48 a.m.), the mother woke up, visually inspected the baby, and got out of bed. Her movement caused the infant to stir, but he did not wake up. When the mother returned to bed two minutes later, the baby fussed slightly, so the mother reinserted the pacifier into his mouth and the baby settled immediately. Both returned to sleep. The pacifier fell out of the baby's mouth at 10 hours and 38 minutes (8:11 a.m.) and the baby began fussing, causing the mother to wake up and quickly put the pacifier back into his mouth. Both fell back asleep.

At 10 hours and 54 minutes (8:27 a.m.), mother and baby both began to stir, and the baby opened his eyes. At this point, both mother and baby were awake for the day. He began fussing, so the mother reinserted the pacifier into his mouth, and he settled immediately although he remained awake. The baby engaged in some vocalisations with

the pacifier still in his mouth, but there was no crying. The mother picked up the infant, cradled him and rubbed his back. At 10 hours and 57 minutes (8:30 a.m.), she carried him into the lounge, and put his clothes on without first changing his nappy. Whenever the baby began fussing or engaging in any amount of vocalising, the mother again inserted the pacifier into his mouth and the vocalisations immediately ceased. The sleep study ended at 8:39 a.m.

At the end of the sleep study, the mother accurately reported that the baby fed zero times during the night, although she did not answer the question to report how this nighttime feeding frequency compared to her normal routine at home. She also reported that both she and her infant had slept less than usual on the night of the sleep study, but that she was very satisfied with her experience in the sleep laboratory.

Figure 7.1 Participant 4070 – picture 1

Figure 7.2 Participant 4070 – picture 2

Figure 7.3 Participant 4070 – picture 3

Figure 7.4 Participant 4070 – picture 4

7.1.3 Notable Features of the Overnight Sleep Study

- No feeding episodes occurred during this sleep study, which lasted just under 11 hours.
- There was nearly continuous use of a pacifier during both pre-sleep interactions and during the sleep period.
- Infant vocalisations served as an immediate prompt for the mother to insert the pacifier into the infant's mouth, even when the vocalisations did not include fussing or crying.
- The infant wore only one nappy during the entirety of the sleep study.
- The infant did not engage in any crying episodes during the entirety of the sleep study.
- Two temperature readings of the infant were taken using a thermometer the mother brought with her to the sleep study.
- The infant slept for long periods of time, and only two very brief awakenings were recorded for the infant during the sleep period.

7.2 Case Study 2: Infant and Mother Asleep on a Sofa

The second case study presents a view of mother-infant shared sleep on a sofa. Although there were interesting points about the sleep period of this particular dyad, the case study is largely remarkable for its lack of acute risk scenarios or other overt indicators

of sleep-related risk to the infant. It remains unclear how any specific aspect of the sofa itself could pose a substantial threat to infant safety. Rather than offering firm conclusions on why sofa sleeping has been identified as an important risk factor, this case study instead generates additional questions. It seems that the nature of mother-infant interactions on a sofa are not so wildly different from those which occur during bedsharing as to explain the disproportionate risk posed to infants sleeping on sofas. Perhaps some combination of maternal and infant characteristics might cause a mother to adopt such a sleeping arrangement, and these characteristics may affect the degree of sleep-related risk to which an infant is exposed. It seems curious that any mother would have selected this arrangement in the sleep lab, given the particularly small size of the sofa in the lab and the availability of a full-sized adult bed in the adjacent room, not to mention the other possible infant sleeping locations provided. The case study suggests that it will be clinically useful to further explore why a mother might choose to sleep on a sofa with her infant. For some mothers, sleeping on a sofa may simply be a function of poverty and/or lack of available alternatives. But where alternative sleeping locations exist, it is possible that some aspect of maternal condition, such as depression, sleep problems, psychological reasons for avoiding a bed, or the nature of relationships with other household members, might cause a mother to select a sofa for her own and her infant's sleep. Furthermore, infant characteristics may influence mother's choice of sleeping location, and it is possible that infant temperament, sub-clinical or acute illness, or other infant characteristics that themselves confer risk may prompt mothers to select a sofa for sleep. The factors motivating mothers to select this location, either routinely or on a given night, may hold some additional clues as to the mechanism by which sofa sleeping negatively affects infant health and safety.

7.2.1 Participant Description

Participant 4133 was a 22 year old adult mother of African American ethnicity. Her son was 22.3 weeks old at the time of the sleep study. She reported being partnered with but not married to her child's father. During this sleep study, the mother and infant spent their sleep period together on a sofa in the living room area of the sleep laboratory. The sofa was very small, of a size typically referred to as a 'two-seater', and was not long enough to enable an adult person to recline fully.

7.2.2 The Overnight Sleep Study

The sleep study began at 10:40 p.m. on 12 February, 2004. At the start of the study, the mother and baby were seated on the sofa. The mother changed her infant's clothes and offered him toys to play with, and their interaction was marked by substantial affection and maternal conversation with the infant. The mother arranged the baby so he was lying down on the sofa with his body touching the back of the sofa, keeping him as far from the edge of the sofa as possible. The baby remained in this position as the mother arranged the items she brought with her, and she periodically left the room to retrieve or arrange other belongings. During this time, the baby remained awake, alert, and engaged in some vocalisations. At 8 minutes into the study (10:48 p.m.), the mother handed the baby a bottle which was basically empty. The infant was able to grasp the bottle and hold it, and he sucked on the nipple although he did not appear to be receiving any liquid. The mother selected a snack of crisps and biscuits for herself, and sat down on the sofa next to her infant to watch television. After several minutes she offered the baby a rattle to play with, and then placed a call on her personal mobile phone which lasted for several minutes. At 18 minutes (10:58 p.m.), the mother held the baby on her lap while feeding him a bottle of formula. The feeding session lasted until 30 minutes (11:10 p.m.), at which time the mother gave a pacifier to her infant, who was still awake. The mother set him down in a supine position on the sofa next to her, placing him on top of a baby blanket covering the sofa cushions, and then covered his body with a second baby blanket. She picked the infant up again at 33 minutes (11:13 p.m.) and held him for several minutes until he fell asleep. Once asleep, the mother laid him back down in a supine position on the sofa next to her with the same arrangement of blankets (see Figure 7.5). She left the room to retrieve a large blanket from another area of the sleep laboratory, and returned to the sofa where she sat next to the infant and covered herself with the large blanket. She continued watching television while the baby slept next to her.

At 1 hour and 19 minutes (11:59 p.m.), the baby woke up, moving and fussing, so the mother picked him up and held him on her chest. She covered both of their bodies with the large blanket, and the baby settled back to sleep while the mother continued watching television. At 12:02 a.m., she shifted position so that her legs were up on the couch and she was lying with her body lengthwise, still holding the baby on her chest with his body balanced in her right arm which was along the outside edge of the sofa. She proceeded to shift the baby's body position so that he was lying in her lap, and then removed a scarf and comb from her overnight bag. After combing her hair in preparation for sleep, she tied the

scarf around her head. After the scarf was in place, she settled back into the sofa and brought the baby back up to her chest, again holding him in the arm closest to the edge of the sofa. She covered both of their bodies with the large blanket, and resumed watching television. The baby remained asleep throughout this time. The mother eventually fell asleep as well, at 1 hour 42 minutes (12:22 a.m.), and by the time she was asleep the baby was centred on her chest (see Figure 7.6). At 2 hours and 6 minutes (12:46 a.m.), the mother stood up while holding the baby, turned off the overhead lights in the room, and returned to the sofa. She lay down on the sofa with the infant cuddled in the crook of her arm lying next to her, with his body along the outside edge of the sofa (see Figure 7.7). The baby slept continuously, and the mother fell asleep again at 2 hours and 12 minutes (12:52 a.m.). At 2 hours and 34 minutes (1:24 a.m.), increasing movements by the baby promptly awakened the mother, although the baby quickly settled and never fully woke up. While awake, the mother sat up, folded a baby blanket in half and placed it on top of the sofa cushions next to her, and placed the infant on top of this blanket in a supine position. The infant was positioned in the corner of the sofa so that the side of his body was touching the back of the sofa and he was as far away from the edge as possible, and there were no materials in the immediate vicinity of his face or mouth. The mother proceeded to cover him with an additional baby blanket. The mother stood up again briefly, then returned to the sofa and lay down so that her body was reclining on the sofa while her feet were propped on the coffee table in front of the sofa (see Figure 7.8). In this position, the mother was very close to the baby but the two were not actually touching. The mother fell asleep again at 2 hours and 36 minutes (1:26 a.m.).

At 3 hours and 21 minutes (2:01 a.m.), the baby woke and his increased body movements, without any vocalising or fussing, again prompted the mother to wake up immediately and attend to the infant. She retrieved a bottle of formula, gave it to the baby without moving his body position, and held it as he fed. At 3 hours and 26 minutes (2:06 a.m.), she removed the bottle from his mouth, which caused the baby to begin squirming but he did not fuss or cry. She gave him a pacifier, which settled him immediately, and he soon fell asleep. The mother remained sitting upright and watching the television, dozing off with her head resting against the back of the sofa. At 3 hours and 32 minutes (2:12 a.m.), the baby awakened and began moving around, and the mother repositioned his blankets and repositioned herself so that she was again reclining on the sofa with her feet propped on the coffee table. One minute later, she offered the baby a bottle of formula, which he accepted and held by himself. At 3 hours and 39 minutes (2:19 a.m.), the mother

removed the bottle and put a pacifier in his mouth instead. Because the infant remained awake, the mother decided to continue the feeding session at 2:20 a.m. The feeding lasted until 2:23 a.m. Both mother and baby fell back asleep following the feeding session.

The mother and baby continued to spend their sleep period on the sofa, and the baby was either held in the mother's arms, with his body mostly on her chest, or lying next to her on the sofa, always along the outside edge of the sofa. By 5 hours and 58 minutes (4:38 a.m.), the mother and baby had settled into a position that involved the baby lying supine in the corner of the sofa, with the mother also lying mostly supine with her back along the opposite corner, with the baby's head near to and occasionally touching the mother's feet. The mother and baby remained covered with one blanket each. At 6 hours and 38 minutes (5:18 a.m.), the mother awakened, inspected the infant, and repositioned herself on her side with her knees pulled up, so that the infant was located in the L-shaped space made by her knees and legs. She quickly returned to sleep. At 6 hours and 52 minutes (5:32 a.m.), the baby began squirming, and kicked the mother's legs with his feet, but she did not immediately awaken or respond. However, as soon as the baby began vocalising one minute later, without fussing or crying, the mother immediately woke up and attended to the infant. She offered the baby a bottle of formula, which he immediately began feeding from while he held the bottle himself. At 7 hours (5:40 a.m.), the infant appeared to be asleep so the mother removed the bottle from the infant's mouth, and she lay back down on the sofa as well. Five minutes later, the baby coughed a couple of times and the mother responded instantly. He quickly stopped coughing, she checked him and adjusted his blankets slightly, and then she returned to sleep. At 7 hours and 50 minutes (6:30 a.m.), the mother shifted her position so that she was on her back with her knees bent, and her movement did cause the infant to awaken. At 9 hours (7:40 a.m.), the baby again began to wake up and increase his body movements, but the mother did not wake up until he made a tiny vocalisation, which caused her to awaken instantly. While she checked him, he quickly settled and returned to sleep, and the mother rested on the sofa again but did not fall asleep. At 7:42 a.m., the mother sat up, reached for her overnight bag and began packing up her belongings. While she did this, the infant remained asleep in a supine position, lying in the corner of the sofa. At 9 hours and 5 minutes (7:45 a.m.), she stood up, left the room, and continued arranging her things. She returned to the room at 9 hours and 12 minutes (7:52 a.m.), and began changing the infant's clothes prior to putting him in the car seat for the trip home.

At the end of the sleep study, the mother reported that she had slept less than usual, but that the amount of the baby's sleep was about the same as a typical night at home. She also reported a neutral assessment of her experience in the sleep lab, indicating that she was neither satisfied nor dissatisfied with the experience of completing a sleep study.

Figure 7.5 Participant 4133 – picture 1

Figure 7.6 Participant 4133 – picture 2

Figure 7.7 Participant 4133 – picture 3

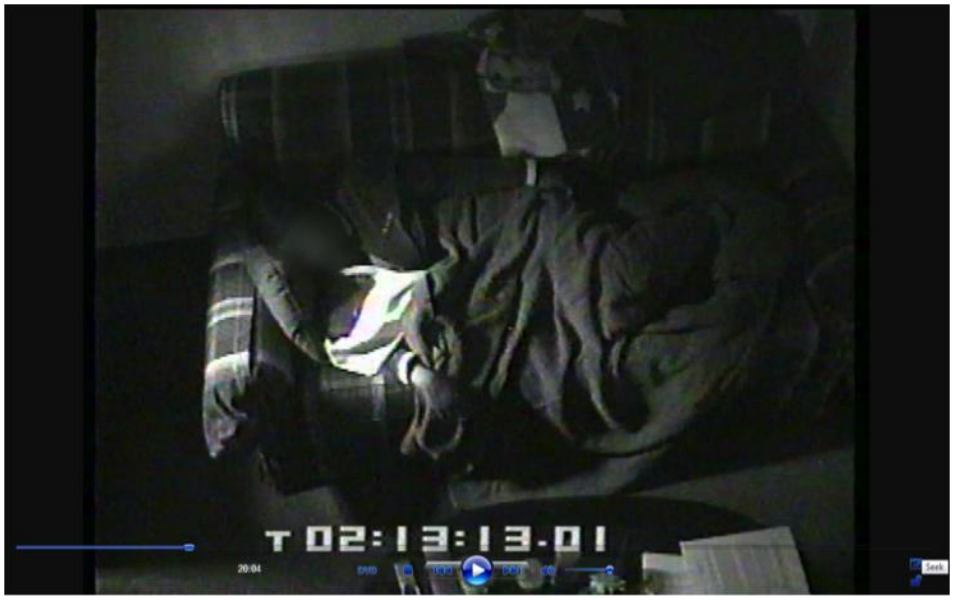

Figure 7.8 Participant 4133 – picture 4

7.2.3 Notable Features of the Overnight Sleep Study

- The mother and baby both spent their entire sleep period on the sofa.
- The infant's face was never orientated towards the back of the sofa, nor was it obscured by cushions, blankets, or the mother's body.
- While sleeping together on a sofa, a number of body positions and physical arrangements existed, including those where the infant was sleeping directly on the mother's body and those where the mother and infant were not in direct contact with each other.

- The mother was extremely sensitive to infant cues, and responded virtually immediately to every instance of nighttime awakening. However, infant vocalisations were slightly more effective in prompting the mother to awaken and respond compared to infant movement that occurred without vocalisations.

7.3 Case Study 3: Frequent Bottle Propping During Nighttime Feedings

The third case study exemplifies some of the more extreme cost-cutting measures undertaken by mothers in this study, primarily involving the construction of unsafe sleeping environments for infants that serve to minimise maternal involvement with infants during the night, especially during nocturnal feedings. This particular mother seemed to be pursuing a rather ineffective strategy at times, trading the most immediate gains in sleep quality for what might have otherwise been a less interrupted sleep night. It seemed that had the infant been fed a full bottle of formula at one of the earlier night wakings, as opposed to bottles of water and bottles tilted at such an angle that the infant actually consumed very little, some of the subsequent awakenings might not have occurred. This case study also reinforces the idea that sleeping and feeding behaviours are inherently linked, and that the use and placement of soft bedding materials may be affected by a mother's approach to nighttime feedings. The case study also provides a concrete example of why a mother might disregard seemingly simple advice about avoiding soft bedding for infants, illustrating the meaningful pay-off received by the mother for disregarding that advice in exchange. In reviewing the case study, it seems possible to understand why the benefit to this one mother on a selected night of sleep might outweigh the potential but not overly likely threat to infant safety caused by the presence of multiple items of soft bedding. It is possible that the mother did not consider the sleeping environment she constructed as posing an undue risk to the infant; otherwise, it seems unlikely that she would have so openly pursued this arrangement when she was aware she was being monitored.

7.3.1 Participant Description

Participant 4049 was an 18 year old of non-Latina white ethnicity. Her daughter was 19.6 weeks old at the time of the sleep study. She reported being "in touch" but not partnered with the father of her child. Throughout her sleep study, she positioned the infant in immediate proximity to multiple items of soft bedding, including full-sized pillows and other soft bedding, in order to settle her infant for sleep with a bottle propped

in the infant's mouth. This behaviour stands in contrast to the mother's own self-reports about what she knew about infant sleep safety. She reported that to maximise safety for her daughter during sleep she should "put her on her side and do not have anything in her cot with her." The mother also requested a cigarette lighter from the sleep lab technician during the course of the study, although she had not reported ever smoking or currently smoking when she was interviewed about cigarette use during the last trimester of her pregnancy.

7.3.2 The Overnight Sleep Study

The sleep study began at 8:31 p.m. on 8 March, 2003. The study began with the mother changing the baby's clothes, handing toys to the baby, and engaging in some verbal interactions. The mother then set the infant in the bassinette while she left the room briefly. When the mother returned, she picked up her infant and carried her into the living room, where she placed the infant in a supine position on the floor, on top of a blanket, with an arrangement of toys. The mother sat on the sofa, and turned on the television. The baby demonstrated an ability to roll from her back to her ventrum, and received praise and vocal encouragement from the mother when she did so. The baby remained content and active, engaged in a number of vocalisations, and appeared interested in the toys. When the baby fussed briefly, the mother responded promptly by picking her up, holding her on her lap, and showing affection for the baby.

After watching television for a brief period, the mother and infant together took a shower. Following the shower, the mother put lotion on the baby and then dressed her, during which time the infant appeared uncomfortable and cried. In order to stop the crying the mother picked up a baby bottle filled with water that was nearby, and offered it to the infant 49 minutes into the study (9:20 p.m.). The baby took the bottle and immediately stopped crying. The mother proceeded to carry the infant back into the living room, where she sat on the sofa with the infant and gave the infant a bottle of formula instead. The mother stayed on the sofa for only a couple of minutes before carrying the infant into the bedroom, sitting on the edge of the bed and continuing with the feeding episode. This feeding episode continued until 9:22 p.m., at which point the mother stood up, switched off the overhead lights, and placed the infant supine in the bassinette and gave the bottle of formula to the infant. The mother reached for a baby blanket that was nearby, folded it up several times, and turned the infant on her side so that the bottle was resting on the folded blanket and positioned in the baby's mouth. The infant continued feeding while the

mother left the room briefly. When she returned, she was carrying a throw pillow from the sofa which she placed behind the infant's back, between the infant's body and the cot side, so that the infant was unable to roll backward into a supine position which would have caused the bottle to fall out of her mouth. The mother removed the bottle from the infant's mouth at 53 minutes (9:24 p.m.), picking the infant up and beginning to tightly swaddle the infant with an additional baby blanket. The infant began to cry as soon as the feeding session was interrupted. Once the baby was fully swaddled, the mother returned the infant to the bassinette and established the same arrangement, with a sofa throw pillow behind the infant's back and the blanket propped onto a folded baby blanket which kept the bottle firmly in the infant's mouth. The infant settled as soon as the bottle of formula was put back into her mouth. While the infant continued feeding in this manner, the mother placed another folded baby blanket between the top of the infant's head and the top of the bassinette, which was flush with the wall. The mother walked in and out of the bedroom multiple times as she continued to arrange her belongings for the night, and visually inspected the infant in this arrangement numerous times as she did so. At 58 minutes (9:29 p.m.), the mother again visually inspected the infant and determined that the infant had fallen asleep, so the mother removed the bottle from her mouth but left the pillows and folded blankets in place. The baby remained in a lateral position throughout this time. The mother then went back into the living room, sat down on the sofa, and continued watching television. At 1 hour and 15 minutes (9:46 p.m.) she asked the sleep lab technician for a cigarette lighter and expressed some dismay when told that a lighter was not available and she would be unable to smoke.

At 1 hour and 19 minutes (9:50 p.m.), the infant woke up and began crying. The mother responded immediately and put the bottle of formula back in the infant's mouth with the same arrangement in place to prop the bottle. The baby settled as soon as she received the bottle, although she struggled with it and moved it around clumsily with her hands, eventually knocking it out of her mouth at 1 hour and 22 minutes (9:53 p.m.) and starting to cry immediately. The mother returned to the room promptly once the crying began. She picked up the infant, rearranged the blanket so that she was once again tightly swaddled, then held the swaddled infant on her lap and fed the infant the bottle of formula for one minute. At 9:54 p.m., the mother once again put the infant back into the bassinette, still swaddled. She proceeded to remove the sofa throw pillow that she had used previously, and instead placed a full-sized pillow from the adult bed into the bassinette next to the infant, who was lying in a lateral position. Again, she placed a folded baby

blanket between the top of the infant's head and the cot side which was aligned with the wall. She propped the bottle onto the pillow and left the infant to continue with the feeding session. Whenever the baby's movements altered the position of the bottle such that it was not firmly in the infant's mouth, the mother promptly attended to the infant and re-placed the bottle in the infant's mouth. At 1 hour and 25 minutes (9:56 p.m.), the mother lay down on top of the adult bed in the same room (within 60 centimetres of her infant), and the infant fell asleep (see Figure 7.10). The mother shifted her own body position frequently, resting but not sleeping, and conducted occasional visual inspections of the infant. The infant fell asleep at 1 hour and 36 minutes (10:07 p.m.) with the bottle still held in her mouth. The mother followed soon after, falling asleep at 1 hour and 42 minutes (10:13 p.m.). At 1 hour and 49 minutes (10:20 p.m.) some slight fussing from the baby due to bottle movement prompted an immediate response from the mother, who repositioned the bottle of formula back into the baby's mouth and then immediately returned to lying in bed. At 2 hours and 22 minutes (10:53 p.m.) the baby woke up, moving her arms, and resumed sucking on the bottle that was still in her mouth, but the mother did not awaken. The baby quickly returned to sleep. At 2 hours and 36 minutes (11:07 p.m.) the sleep lab technician entered the room and removed the bottle from the infant's mouth. During the next half hour of sleep, the infant did some squirming and moving, but never actually woke. The mother woke briefly to conduct another visual inspection of the infant at 2 hours and 43 minutes (11:14 p.m.), and returned to sleep immediately thereafter. At 2 hours and 48 minutes (11:19 p.m.) the infant woke, with a small amount of fussing and squirming, but returned to sleep almost instantly.

The baby woke again at 3 hours and 39 minutes (12:12 a.m.) and began fussing. The mother stirred and turned her head to the other side, but did not indicate a true awakening and did not show any response to the infant's fussing. The fussing became progressively louder, and was nearly continuous (see Figure 7.9). After several minutes of this, the mother again repositioned her body but showed no other response and did not show any signs of waking from sleep. At 3 hours and 42 minutes (12:15 a.m.), the infant's fussing subsided, but the baby remained wide awake and continued to actively move in every possible way, limited by the small and confined sleep space in which she was located in between the pillow and the cot side. The infant dozed off intermittently for a couple of minutes at a time, but woke up again each time and by 3 hours and 51 minutes (12:24 a.m.) the fussing had resumed quite loudly. The mother stirred once again and changed position, but did not wake up. The infant's fussing increased and was closer to a sustained bout of

crying, and she continued thrashing in every direction, arching her back, kicking her legs, and flailing her arms. Mother continued to shift her body position frequently, but never opened her eyes or visually inspected the infant in any way. The infant worked herself into a full, sustained cry and continued crying for several minutes. At 4 hours and 1 minute (12:34 a.m.), the mother finally lifted her head off the pillow, looked at the infant, and then sat up. She lifted the infant out of the bassinette, and the baby stopped crying as soon as she was in contact with the mother. The mother reached for the bottle of formula that had been resting on top of the pillow in the bassinette with the infant, and placed the infant next to her in bed, with the infant's head on a pillow. The mother fed the baby the bottle of formula, and covered the infant's body with the bed covers. She proceeded to bunch the covers up near the infant's head so that the bottle could rest on top of them without her having to hold the bottle (see Figure 7.11). The mother then stood up, moved another full-sized pillow close to the infant's face to keep the bottle from rolling to the side, and then left the room. The baby remained wide awake and continued sucking on the bottle, although it was tilted at such an angle that it was unlikely the infant was actually consuming any formula. One minute later, the mother returned to the room, got back in bed, and briefly held the bottle for the infant so that she could drink the formula. As soon as the mother got herself settled, however, she again propped the bottle onto the bed covers and removed her hand from the bottle, at which time the baby again was unable to consume any liquid. Each time the baby moved enough to dislodge the bottle from her mouth, the mother quickly reinserted the bottle and rested it on the bed covers. At 4 hours and 7 minutes (12:40 a.m.), the baby squirmed enough that the bottle dislodged, and the mother removed the bottle, set it down on the mattress, and then got up and left the room. The baby remained in the bed, awake but not fussing. The mother returned about 30 seconds later carrying a bag of crisps. She re-established the arrangement with the bottle propped in the infant's mouth, but the infant spat the bottle out and did not appear to want it. The mother opened her crisps and began eating, which the baby watched with interest.

At 4 hours and 17 minutes (12:46 a.m.), the baby remained fully awake and was vocalising although not fussing or crying, so the mother left the bed briefly and came back with a baby bottle filled with water. She changed the infant's nappy, re-swaddled the baby, and at 12:49 a.m. she held the infant in her arms while she fed the baby the bottle of water. The mother shifted her position slightly so that both were lying down together in bed, with the baby's head resting on a pillow and the mother curled around the infant holding the bottle of water and feeding her infant. The infant remained awake while

drinking from the bottle. The mother kissed the infant's head several times during this feeding session. At 4 hours and 25 minutes (12:54 a.m.) the infant began dozing off, so the mother repositioned her into a lateral position in the bed with the very top of her head touching a full-sized pillow but otherwise with the baby's entire body on the mattress. The mother proceeded to remove the bottle of water from the infant's mouth and replace it with the pacifier. The mother pulled the covers up to the baby's waist, while the infant was still swaddled, and the mother fell asleep also.

At 5 hours and 11 minutes (1:40 a.m.), the baby began to wake, increasing her body movements and doing some intermittent vocalising. The mother awakened a minute later and gave the infant a pacifier, but the baby continued to fuss loudly so the mother gave the infant a bottle of water instead. The mother repositioned a pillow so that it was closer to the baby's head, and rested the bottle on top of the pillow. The baby initially rejected the bottle and continued fussing, so the mother held the bottle for her and the baby proceeded to drink from it. The mother lay down in bed, propped the bottle on her own elbow, and closed her eyes. The baby remained awake, however, and continued to squirm so the mother retrieved a car seat that was nearby and placed it on the floor near the bed, and relocated the infant into the car seat. The mother then placed a folded baby blanket on top of the infant's chest, and put the bottle in the infant's mouth and rested it on top of the folded blanket. The mother then left the room to get a second, thicker baby blanket from the other room, and folded it and placed it on top of the infant's chest as well (see Figure 7.12). The blanket was partially covering the infant's face, but was tented enough that it was not in direct contact with the infant's nose or mouth. The mother returned to bed and quickly fell back to sleep. The bottle remained in the infant's mouth for at least another hour and a half, and fell out at some point although the blankets obscured the view of the infant's face and it was difficult to determine from the video footage the exact time at which the bottle of water was no longer in the infant's mouth.

The infant remained in this position in the car seat, with blankets piled on top of her and the bottle resting on her chest although no longer in her mouth, until 8 hours and 59 minutes (5:30 a.m.). The infant woke at this point, fussing, and the mother quickly awakened and reinserted the bottle of water into the infant's mouth. Receiving the bottle caused the infant to settle immediately, and the mother returned to bed. The baby continued sucking on the bottle, although again the angle was such that very little water was actually being consumed by the infant. This entire awakening episode was handled by the mother in a matter of seconds.

At 10 hours and 39 minutes (7:10 a.m.), the infant awakened, flailing her arms, and began to fuss. She still had the bottle in her hands although it was now empty, and she attempted repeatedly to get the bottle into her own mouth but was unable to coordinate the procedure. The baby continued moving vigorously, and was fussing loudly and continuously. The mother awoke at 10 hours and 42 minutes (7:13 a.m.), quickly put a bottle containing formula into the infant's mouth, re-established the bottle propping arrangement with the blankets on top of the infant's body, and then went back to sleep. The baby settled immediately as soon as the bottle was in her mouth. The bottle quickly became dislodged due to the infant's movements, however, and the baby resumed fussing. At 11 hours and 1 minute (7:32 a.m.), the mother picked the baby up and changed the baby's nappy. She then placed the baby higher in bed, with her head on a pillow, and gave her a bottle of formula. She again brought the bed covers up to the baby's chin, and the bottle rested on the mother's arm on top of the covers. The baby remained awake, encircled in the mother's arms, and the mother appeared to fall asleep. The baby fell asleep soon thereafter, with the bottle still in her mouth. The bottle remained there for 18 minutes, until the infant turned her head and dislodged the bottle. At 11 hours and 29 minutes (8:00 a.m.), the infant woke again and began squirming, and the mother repeated the procedure of offering her a bottle, propping it onto bed covers, and returning to sleep. The baby fell asleep for another 15 minutes, but awoke again when the bottle fell out of her mouth. The mother woke at 12 hours and 31 minutes (9:02 a.m.), replaced the bottle in the infant's mouth, and the infant actively sucked on the bottle although she was not actually receiving any liquid. The baby remained awake, vigorously moving in bed, although the mother was asleep and did not respond.

At 12 hours and 50 minutes (9:21 a.m.), the mother sat up in bed and took a drink of juice. She began tidying the room and packing her belongings, walking in and out of the bedroom several times while the baby remained in bed. She changed the baby's nappy and dressed the baby for the day, and engaged in some verbal and affectionate interactions with the baby. At 13 hours and 7 minutes (9:38 a.m.), the mother placed the infant in a car seat, gave a pacifier to the infant, and prepared to leave.

At the end of the sleep study, the mother reported that both she and her baby slept less than usual, and that she had a neutral experience in the sleep laboratory that was neither satisfactory nor dissatisfactory.

Figure 7.9 Participant 4049 – picture 1

Figure 7.10 Participant 4049 – picture 2

Figure 7.11 Participant 4049 – picture 3

Figure 7.12 Participant 4049 – picture 4

7.3.3 Notable Features of the Overnight Sleep Study

- Multiple episodes of bottle propping were created by the mother to settle the infant to sleep without the mother's direct involvement.
- A bottle of water was given to the infant for most of the nighttime feeding sessions.
- The presence of a bottle in her mouth while lying in each sleep environment settled the infant immediately each time, regardless of what type of liquid (formula or

water) was in the bottle, and even at times when little or no liquid was actually being consumed.

- The infant spent the entire sleep night in the presence of a large number of soft bedding items, including sofa cushions, pillows from an adult bed, and folded baby blankets.

7.4 Case Study 4: Use of Multiple Blankets and Items of Soft Bedding in the Infant's Sleep Environment

The fourth case study illustrated a unique picture of nighttime parenting that involved the use of many material items, including bedding for the infant while asleep and toys, videos and other forms of entertainment and stimulation while the infant was awake. The use of warm clothing and multiple items of soft bedding for this infant were particularly noteworthy given the lightweight clothing which the mother wore during the night. Surrounding the infant with so many items could be interpreted as a form of investment, since the mother created these arrangements for the infant's enjoyment, stimulation and care, even when those items may not have been strictly necessary or useful. For instance, it is hard to imagine how the infant could have usefully interacted with the multiple toys placed on her chest while she sat in a car seat orientated toward a video created for infants, but the mother apparently had the infant's interests in mind when she constructed this arrangement. Likewise, the bedding underneath and on top of the infant, as well as the special infant-sized pillow the mother brought to the lab, seemed inappropriate and did in fact result in head covering when the infant was awake, but it seems that the mother created this arrangement for the comfort of the infant during the sleep period. The use of a separate cloth around the front of the infant's neck was particularly unusual, and unfortunately no interview was conducted to further explore the mother's motivation for using the cloth in this manner. The neck wrapping was a phenomenon not seen in any other sleep study collected during the course of this project. This case study reveals that sleep-related risks to infants can occur even in the context of extreme concern over infant needs and preferences, and suggests that risks can result from a very high-investment strategy. This particular mother may have tolerated increased levels of risk in the form of excessive use of bedding based on a perceived benefit to the infant in terms of comfort and security rather than a perceived benefit to the mother, although the long and uninterrupted sleep period evident in this case study would likely

have been considered beneficial to the mother herself. Regardless of whether the mother approached nighttime parenting in this particular manner based on prioritising infant or maternal needs, the fact remains that cost-reduction strategies are not the only nighttime parenting behaviours that potentially result in the presence of risks to infants.

7.4.1 Participant Description

Participant 4022 was a 35 year old mother of non-Latina white ethnicity, and her daughter was 23.7 weeks at the time of the sleep study. The mother reported being single but was still in touch with her child's father. The mother was dressed in jeans and a short-sleeved t-shirt for the first portion of the sleep study, and changed into a pair of shorts and a t-shirt for sleep. The infant wore an undershirt plus warm zippered pyjamas with feet. The average temperatures for South Bend, Indiana in the month of September include a high of 23° C (74° F) and a low of 12° C (53° F) (Weather Channel 2009). The sleep lab was heated to an average temperature of 21° C (70° F), but participants were able to adjust the temperature in each of the rooms individually, and the mother in this case did so in the bedroom the infant was sleeping in, although the temperature to which she set the thermostat was not recorded.

7.4.2 The Overnight Sleep Study

The sleep study began at 8:30 p.m. on 26 September, 2002. At the start of the study, the baby was lying supine on the adult bed, surrounded by the mother's overnight bag and other personal belongings, while the mother walked in and out of the room arranging her things for the night. The baby was active and content during this time. After one minute, the mother placed the baby in a car seat, and wrapped a small cloth loosely around the front of the baby's neck. The mother carried the car seat into the living room, sat it on the sofa, and gave the baby several toys to hold. She then walked in and out of the room as she continued settling in for the night. The baby remained active and content, moving frequently and chewing on the toys, but engaging in few vocalisations. After several minutes, the mother put a videotape designed for infants (playing classical music) into the VCR. 9 minutes into the study (8:39 p.m.), the mother joined the infant on the sofa, sitting next to the car seat and affectionately touching the baby's hands. She remained there only briefly, then left the room again, and returned at 8:44 p.m. At 28 minutes (8:58 p.m.), she adjusted the cloth wrapped around the baby's neck so it was more loosely draped over the infant's neck and upper torso. At 33 minutes (9:03 p.m.), the

mother lifted the infant out of the car seat and held her on her lap, adjusting the cloth so that it was again tucked all the way up to the infant's chin. The mother cradled the infant and fed her a bottle of formula, interrupting the feeding session to burp the infant at 9:10 p.m. During this time, the mother was very affectionate with the infant and talked to her frequently. The mother stood up, still carrying the infant, to re-warm the bottle and then returned to the sofa to resume the feeding session from 9:13-9:15 p.m. The mother then carried the infant into the bedroom containing the cot and rocking chair, adjusted the wall-mounted thermostat, and then swaddled the baby tightly in a baby blanket. The mother sat down with the infant in the rocking chair and breastfed the infant beginning at 49 minutes (9:19 p.m.). The baby fell asleep during the breastfeeding session, and the mother took her off the breast at 1 hour and 2 minutes (9:32 p.m.), inserting the pacifier into the baby's mouth. The mother handled the baby very gingerly, presumably in order not to wake her, and carefully stood up and continued rocking the infant. At 1 hour and 4 minutes (9:34 p.m.), the mother placed the infant supine in the cot, on top of a baby blanket and with her head on a very small pillow that the mother had brought from home. The infant was still swaddled, with the small cloth wrapped around the front of her neck. Once the infant was in the cot, the mother then covered her with an additional baby blanket, pulling it up to the middle of the infant's torso (see Figure 7.13). The mother left the room, and returned at 1 hour and 5 minutes (9:35 p.m.) to visually inspect the infant. The baby woke while the mother was leaning over the cot, and began kicking vigorously and moving the covers with her legs, and pulled the cloth off her neck and began chewing on it. At 1 hour and 10 minutes (9:40 p.m.), the mother again inserted the pacifier into the infant's mouth and re-placed the cloth around the infant's neck, after which she left the room while the baby remained wide awake. The baby remained active and alert, but content and was making virtually no sound.

At 1 hour and 21 minutes (9:51 p.m.), the baby's movement was sufficient to move the position of the blankets higher onto her body, covering her chin. With continued kicking, the blanket periodically covered the infant's face, but the infant was able to pull it back down to her neck level on her own. Two minutes later, the mother went to speak to the sleep lab technician and while there both she and the technician observed that the infant's face had become completely obscured by the bedding. The mother returned to the infant's room and laughed, saying in an affectionate tone, "What are you doing? You're not even tired, look at you! I thought you were asleep!" The mother then lifted the infant out of the cot, changed her nappy, and then brought her to the living room and again placed

her in the car seat which was still sitting on the sofa. The mother placed a blanket over the infant's body, re-established the neck wrapping with the same cloth, and then placed multiple toys on top of the infant's body and said to her, "There you go, you can play" (see Figure 7.14). The mother reinserted the pacifier into the infant's mouth, and then sat down next to the car seat and placed a call on her personal mobile phone. The baby remained active and alert, moving vigorously, but was content. Following the phone call, the mother repositioned the car seat so that she and the baby were facing each other, and she smiled and talked to the infant, and engaged in a number of affectionate interactions. At 2 hours (10:30 p.m.), the mother positioned the car seat back to its original position on the sofa, facing the television, and she continued to reinsert the pacifier into the infant's mouth whenever it fell out or when the infant engaged in any fussing. Mother and baby sat side by side watching television while the mother ate a snack, until 2 hours and 7 minutes (10:37 p.m.) when the mother carried the infant into the bedroom containing the cot. The two sat down in the rocking chair, and the mother rocked the infant for several minutes. At 2 hours and 12 minutes (10:42 p.m.), the mother set the baby supine in the cot, with the same arrangement of blankets. Again, this included the blanket below the infant, another swaddling the infant, a cloth wrapped around the front of the infant's neck, and another blanket covering the top of the infant's body. The infant's head was again placed on top of the small pillow, and she had the pacifier in her mouth. The baby was wide awake and doing lots of kicking. The mother leaned over the cot for a moment before leaving the room, but returned at 2 hours and 15 minutes (10:45 p.m.) when the baby's fussing increased. The mother picked up the infant, returned to the rocking chair, and breastfed again. At 2 hours and 25 minutes (10:55 p.m.), the mother took the infant off the breast and put a pacifier in her mouth, and the infant appeared to be asleep. The mother re-swaddled the infant, again handling her very gingerly in order not to wake her. The mother carefully stood up, rocked her for a few seconds, and then placed the infant supine in the cot with the same arrangement of blankets (see Figure 7.15). The mother left the room briefly, then returned at 2 hours and 40 minutes (11:10 p.m.) to visually inspect the infant, touch the infant's forehead, and then left the room again.

The infant remained asleep, and the mother also got into bed in the adjacent bedroom at 2 hours and 45 minutes (11:15 p.m.) and appeared to fall asleep quickly. Both slept very soundly, with very little movement, and the baby remained in virtually the same position until 9 hours and 4 minutes (5:34 a.m.). At that point, the infant's eyes opened briefly and her movements increased, but she settled back into sleep for another 3 minutes.

At 9 hours and 7 minutes (5:37 a.m.), the baby again woke and made some small vocalisations, and her movements managed to pull the neck wrapping out of place and up over her chin. Several minutes later, a small increase in the baby's vocalisations caused the mother to wake, and she entered the baby's room shortly thereafter, picking up the infant and returning to the rocking chair where she began breastfeeding. At 9 hours and 24 minutes (5:54 a.m.), the infant appeared to be asleep and the mother took her off the breast. She continued rocking the infant for a minute before again very gingerly lifting her and placing her supine in the cot with the same arrangement of bedding. The baby woke again upon being placed in the cot, and the mother leaned over the cot and adjusted the infant's bedding but did not pick up or touch the infant. The mother left the room and returned several minutes later with a pacifier, which she gave to the infant before leaving the room again. The infant remained awake but content. At 9 hours and 29 minutes (5:59 a.m.), the mother entered the room to conduct another short visual inspection of the infant, and then she left the room and returned to bed herself. The infant was active and alert, looking around the room, kicking the blankets, and making only very small vocalisations.

At 9 hours and 36 minutes (6:06 a.m.) the infant's vocalisations became slightly louder, so the mother returned and lifted the infant out of the cot, carrying her to a nearby changing table and changing her nappy. Following the nappy change, the mother returned to the rocking chair and rocked the infant for several minutes before starting another breastfeeding session. The mother continued to show affection to the infant, stroking her hands and kissing her forehead. At 9 hours and 49 minutes (6:19 a.m.), the infant remained awake and the mother removed her from the breast, placed a pacifier in her mouth, and continued rocking. By 9 hours and 52 minutes (6:22 a.m.), the infant appeared to be asleep, so the mother placed her supine in the cot, re-swaddled the infant, and arranged all of the items of bedding in the same manner. The infant woke very briefly upon being placed in the cot, and moved the blankets up over her own nose, so the mother quickly moved the blankets off the infant's face and down to her neck level. Once the infant had settled into sleep again, the mother left the room and returned to bed at 9 hours and 56 minutes (6:26 a.m.). Both mother and baby slept again until 10 hours and 52 minutes (7:22 a.m.), when the baby awoke and her fussing woke the mother. The mother lifted the infant out of the cot and carried her into the adult bed, still swaddled, and then placed her head on one of the full-sized pillows in the adult bed. The mother lay down next to the infant, closing her eyes periodically while the infant remained awake, alert and active. At 10 hours and 57 minutes (7:27 a.m.), the mother repositioned the baby so she

was no longer on a pillow, and then lay down with her arm up over the baby's head. The mother continuously closed her eyes, but opened them again each time the infant moved or made any vocalisations. The two remained in this position, engaging in small affectionate interactions and with the mother offering the pacifier whenever the infant fussed in any way. By 11 hours and 18 minutes (7:48 a.m.), both appeared to be asleep. The infant was still swaddled, lying on the mattress, with an additional baby blanket covering her entire body up to her neck. The mother was lying on her side, turned away from the infant, covered with the adult bedding (see Figure 7.16). They slept in this position for another 40 minutes, until 12 hours and 6 minutes (8:36 a.m.), when the infant woke and the mother woke immediately thereafter. They remained in bed together for several minutes, talking and engaging in affectionate interactions, until 12 hours and 10 minutes (8:40 a.m.) when the mother got out of bed and left the room. She returned a minute later, carried the infant to the rocking chair, and breastfed from 8:42 a.m. to 8:55 a.m. Following the feeding session, the mother placed the infant supine in the cot, and the baby remained awake but content. The mother left the room to change her clothes and begin arranging her belongings, and then returned to pick up the infant at 12 hours and 35 minutes (9:05 a.m.). The mother changed the baby's clothes, and the sleep study ended as they prepared to depart the lab.

At the end of the sleep study, the mother reported that the amount of sleep for both her and her baby was about the same as usual, and she indicated that she had a neutral experience in the sleep lab that was neither satisfactory nor dissatisfactory.

Figure 7.13 Participant 4022 – picture 1

Figure 7.14 Participant 4022 – picture 2

Figure 7.15 Participant 4022 – picture 3

Figure 7.16 Participant 4022 – picture 4

7.4.3 Notable Features of the Overnight Sleep Study

- The mother used multiple items of soft bedding for her infant, including blankets below and on top of the infant's body, a swaddling blanket, and a small infant-sized pillow.
- The mother kept a small cloth around the front of the infant's neck virtually at all times during the overnight sleep study.
- In addition to the numerous items used to prepare the infant's sleep space, a large number of toys and other items were also placed on or near the infant during times she was awake.
- The mother persisted in using multiple items of soft bedding for the infant even after witnessing these items covering the infant's head and face on one of the sleep lab monitors.

7.5 Case Study 5: Unsafe Bedsharing Practices

The fifth case study presents a different picture of mother-infant bedsharing than those found by previous researchers (Baddock et al. 2007; Ball 2003; Ball 2007a; McKenna & Mosko 1993; McKenna, Mosko & Richard 1999) where adult breastfeeding mothers placed their infants at breast level in bed and spent a greater proportion of time orientated towards their infants. Previous work by Ball (2006a) has shown that adult mothers who never breastfed shared a bed with their infants in a manner that more closely resembled sleeping with another adult compared to sleeping with an infant. The teen

mother observed in the case study engaged in a similar practice, placing her infant higher in the bed, more in line with the mother's own head level, and placing her infant's head on a pillow. This case study indicates that the absence of breastfeeding characteristic of the teen parenting strategy may translate into a different bedsharing relationship for some dyads. In this particular case, the higher placement of the infant in bed and the use of pillows for the infant resulted in periods of head and face covering, and the mother's awareness of her infant seemed to vary during different portions of the sleep period. The sleep-related risks observed here also occurred alongside very affectionate and responsive parenting behaviours, reinforcing the notion that sleep-related risks do not operate on an all-or-nothing basis and that mothers can exhibit behaviours that expose infants to both protective and risk factors.

7.5.1 Participant Description

Participant 4108 was an 18 year old of non-Latina white ethnicity. Her daughter was 20.9 weeks at the time of the sleep study. The mother reported being single, and no longer had any contact with her child's father. The mother had extremely long hair which reached almost to her waist. She wore her hair tied back in a ponytail, including during sleep, and wore glasses while she was awake.

7.5.2 The Overnight Sleep Study

The sleep study began at 9:35 p.m. on 15 June, 2004 with the mother placing her infant in a baby swing that she brought from home. The swing was placed on the floor of the living room, and the mother attended to the infant, putting socks on her feet and strapping her in to the swing. The mother then turned the swing on and went to prepare food for the infant, which appeared to be baby cereal. 2 minutes into the study (9:37 p.m.) the mother returned and fed the infant with a spoon while the baby was in the swing, watching television intermittently during the feeding session. The mother interrupted the feeding session at 8 minutes (9:43 p.m.) to retrieve a bib from the other room, then returned and put the bib on the infant before resuming the feeding session. At 14 minutes (9:49 p.m.), the feeding session ended, and the mother proceeded to pick up the baby from the swing, place her supine on the sofa next to her, and change her nappy and put on her pyjamas. The mother showed some affection during these interactions, and played a brief game of peek-a-boo with the infant. The mother gazed periodically at the television, but was primarily focused on the infant. The baby remained active, awake and content, and

the mother tickled the infant and the infant smiled in return. After the dressing was finished, the mother held the infant on her lap and rocked her while feeding her a bottle of formula. The mother stood up during the feeding session, still holding the infant, and retrieved a can of soda for herself, and then returned to the sofa and continued with the feeding session. At 31 minutes (10:06 p.m.), the bottle feeding ended, and the mother sat the infant on her lap, facing the mother, and they engaged in some vocal and affectionate interactions. Two minutes later, the mother turned the infant so she was facing the television, and the infant gazed around the room while the mother watched television. The mother was periodically affectionate and remained attentive to the infant, but her focus during that time was on the television. At 39 minutes (10:14 p.m.), the mother sat the infant on the sofa, as far towards the back of the sofa as possible, and handed the infant a toy. The mother moved about the room, arranging things for the evening. 5 minutes later, the mother repositioned the infant into a more upright seated position, resting her body against the sofa pillows. The mother got herself a snack of crisps and offered one to the infant, but the infant didn't take it. The mother offered a crisp to the infant a second time, but the infant again refused to take it. The mother then continued walking around the room arranging her things, then picked up the infant at 50 minutes (10:25 p.m.), turned off the television, picked up a baby blanket, and carried the infant into the bedroom. The mother lay the infant down on the adult bed on top of all the bed covers, with the infant's head on a pillow, and covered the baby with a baby blanket from the waist down. The mother then moved the pillows so they were parallel with the infant's body on either side of her, and then left the room for two minutes. When she returned, the mother engaged in some affectionate interactions with the infant and continued arranging her belongings, walking in and out of the room. The baby remained content throughout this time.

The mother returned to the bedroom and picked up the infant at 54 minutes (10:29 p.m.), turned down the bed covers, and then placed the infant's body on the mattress, returned the pillows to their original position at the head of the bed, and then placed the infant's head on a pillow. The mother joined the infant in bed, gave a pacifier to the infant, and re-placed the baby blanket up to the infant's waist. The mother continued to drink her soda while in bed, and began reading a children's book to the infant. At 1 hour (10:35 p.m.), the infant began to fuss and refused to take her pacifier again, so the mother said to the infant, "you'll be up all night now! Want me to rock you? Want to go rock?" She then swaddled the baby in the baby blanket and carried her into the second bedroom, sitting down in the rocking chair and affectionately rubbing the infant's back while she

rocked her. The mother read her own book to herself silently, pausing frequently to kiss the infant's forehead. The baby fell asleep in the mother's arms, and at 1 hour and 6 minutes (10:41 p.m.) the mother stood up with the infant and returned to the adult bed in the other bedroom. The mother placed the baby on the mattress, still swaddled, with her head on a pillow. While the baby slept, the mother left the room briefly, then returned to bed and un-swaddled the baby, which caused the infant to stir but not fully wake. The mother pulled the bed covers up to her own waist and up to the infant's neck, and continued reading a book, kissing the infant's forehead occasionally. The mother continued to sip her soda while in bed. She took a last drink at 1 hour and 23 minutes (10:58 p.m.) before turning off the lights, and settling in to bed curled around the infant, with her arm under the infant's head, and the blankets pulled up to both of their chins. She kissed the infant's head again, and quickly fell asleep.

Both mother and infant slept until 2 hours and 25 minutes (12:00 a.m.), when they both stirred but did not fully wake. At 2 hours and 31 minutes (12:06 a.m.), they both moved position slightly, and the mother kissed the infant's head although her eyes never opened. The mother engaged in some scratching and fidgeting, and then settled back into sleep. At 3 hours and 11 minutes (12:46 a.m.), the mother woke up again, moved her arm out from under the infant's head, and repositioned herself into a prone position facing away from the infant. The baby's head was located on the mattress in the space between the two pillows, with the edge of one pillowcase covering her ear and part of her forehead, but away from her nose and mouth. The baby remained asleep, and the mother returned to sleep quickly. 3 minutes later, the mother turned her head so that she was facing the infant, and settled with her arm lying on top of the infant's arm although the movement did not awaken the infant. The movement caused the edge of the baby blanket the infant had been lying on to fall down over the top of the infant's forehead, but it too was not near the infant's nose or mouth. The mother visually inspected the infant again at 3 hours and 15 minutes (12:50 a.m.). She moved the bed covers up to the baby's shoulders and removed the corner of the baby blanket from the infant's forehead, although it fell right back to the infant's forehead almost immediately and remained there. The mother kissed the infant's head, then settled onto her side facing the infant, and both returned to sleep. At 3 hours and 25 minutes (1:00 a.m.), the infant stirred and her movements caused the corner of the baby blanket to fall even farther down onto her face, touching the top of her nose, although it did not appear to cause any obstructions of the infant's breathing. At 3 hours and 59 minutes (1:34 a.m.), the mother turned onto her other side so that she was facing away

from the infant. The infant's body was in contact with the mother's back, and the infant's face was still partly covered by the baby blanket. The mother's long ponytail was also touching the infant's face, although it was not near the infant's nose or mouth. While still asleep, the infant engaged in some arm movements that managed to move the blanket off of her own head, but by 4 hours and 1 minute (1:36 a.m.) the blanket had fallen back down onto her face, although the infant's nose and mouth were still visible. 2 minutes later the infant again moved the blanket off her face, and periodically made a lot of limb movements including some that were quite vigorous, but the mother did not stir or respond.

At 4 hours and 18 minutes (1:53 a.m.), the infant woke and increased her limb movements, which still did not wake the mother, but the infant began to fuss and cry, and the mother did finally respond. The mother gave a pacifier to the infant and patted the infant's stomach, and she settled back to sleep. The mother moved the baby blanket off the infant's forehead, kissed the infant's head several times, and pulled the bed covers up to the infant's chin. The mother settled into a sleeping position curled up around the infant. The infant's face was partially covered by the blankets, but the blankets were tented over the infant's face with the mother's arm, so they did not appear to be actually touching the infant's face. The mother returned to sleep almost immediately. After only a couple of minutes, the baby blanket fell down onto the infant's head again, leaving only a small portion of the infant's face uncovered between the baby blanket above and the bed covers below (see Figure 7.17). The bed covers were still tented by the mother's body and did not appear to be lying directly on the infant's face. At 4 hours and 40 minutes (2:15 a.m.), the baby's limb movements moved both the bed covers and the baby blanket, so that the infant was only covered from the waist down, with the baby blanket over her forehead and one eye but no longer over her nose or mouth. Neither the infant nor the mother awakened, and the infant settled in a supine position orientated toward the mother. 6 minutes later, the mother woke briefly, causing the infant to stir. The mother turned onto her back, moving the covers as she did so, so that the infant was completely uncovered from the waist up except for one corner of the baby blanket which remained over her ear. After a minute, the mother rolled back onto her side facing the infant, kissed the infant's head, and pulled the bed covers up to her own neck, completely covering the baby's entire body and head (see Figure 7.18). The blankets were tented by the mother's body and were not lying directly on the infant's face. The mother quickly returned to sleep. The infant made periodic movements while in this arrangement, but none of the movements altered the position of the bedding. At 5 hours and 29 minutes (3:04 a.m.), the mother turned onto her

back, moving the blankets with her and uncovering the infant from the waist up. She stayed in this position only briefly before turning onto her other side, facing away from the infant, but the infant remained uncovered. At 5 hours and 43 minutes (3:18 a.m.), the infant turned her head farther to the side, closer to the mother's body, and the blankets again became tented over the infant's face but were not actually touching her nose or mouth. 4 minutes later, the mother woke briefly, lifted her head off the pillow but did not look at the infant, and repositioned herself into a prone position facing away from the infant. Her movement uncovered the baby, and the mother settled back to sleep with her long ponytail lying across the side of the infant's head but not touching the infant's nose or mouth (see Figure 7.19). The infant was at a 45 degree angle with the mother's body, with her head touching the mother's shoulder. The infant continued to be very active in her sleep, but her movements did not wake the mother.

At 6 hours and 11 minutes (3:46 a.m.), the infant increased her body movements, woke up, and the mother also woke and turned over to kiss the infant. The mother settled back into a prone position facing the infant, and the infant remained in a supine position and was still without any blankets covering her. Both mother and infant returned to sleep almost immediately. At 6 hours and 23 minutes (3:58 a.m.), the mother turned onto her other side, facing away from the infant, and her hair covered the infant's face. The infant was able to remove the hair on her own. The infant held on to the mother's hair, and continued to move frequently in her sleep including some pulling of the mother's hair, but the mother did not wake. At 7 hours and 19 minutes (4:54 a.m.), the infant woke up and began moving, and the mother stirred but did not wake. The infant settled again but did not fully return to sleep, and 3 minutes later the baby resumed pulling the mother's hair which finally caused the mother to wake. The mother briefly visually inspected the infant and turned into a prone position facing the infant, and adjusted the position of her own pillow. The edge of her pillow ended up completely covering the infant's face. The mother lay down on the pillow, but the infant's movements caused her to re-adjust the position of the pillow so that only the edge of the pillowcase was over the infant's head and she returned immediately to sleep. The infant remained awake, and pushed against the pillowcase with her fingers and continued squirming. Her movements resulted in the pillowcase covering her entire face (see Figure 7.20). The baby continued moving frequently, and at times her movements seemed aimed at removing the pillowcase whereas other times, she seemed to be just moving her arms and limbs. The mother was not in direct physical contact with the infant during this time, and the infant's body movements

did not rouse the mother. By 7 hours and 31 minutes (5:06 a.m.), the infant appeared asleep, with her face still covered by the pillowcase, and her breathing was visible. The baby's movements increased again 3 minutes later, and by 7 hours and 37 minutes (5:12 a.m.), her movements woke the mother, but the mother did not visually inspect the infant even though she was positioned facing the infant, and the mother returned to sleep within mere seconds without adjusting the pillowcase in any way. The infant continued to engage in periodic bouts of movement, followed by settled periods, but the conditions surrounding the infant remained the same. The infant's regular breathing was visible throughout this time.

At 7 hours and 40 minutes (5:15 a.m.), the infant began crying, and the mother woke. She finally noticed the pillowcase covering the infant and moved the position of the pillow so that the infant's face was fully uncovered. The mother gave a pacifier to the infant, pulled the bed covers up to the infant's neck, and settled into a sleeping position curled up around the infant, and they both fell back to sleep. At 7 hours and 57 minutes (5:32 a.m.) the baby woke again and began fussing, and the mother woke up quickly and visually inspected the infant. The mother was affectionate with the infant, and the baby settled immediately. The mother settled back onto her side facing the infant, and both fell asleep again almost immediately. At 8 hours and 16 minutes (5:51 a.m.), the mother woke up briefly, quickly visually inspected the infant, and then returned to sleep immediately. At 8 hours and 33 minutes (6:08 a.m.), infant movements again woke the mother, and she again visually inspected the infant and then returned immediately to sleep.

At 8 hours and 36 minutes (6:11 a.m.), both mother and baby woke up. The mother kissed the infant and gave her a pacifier, and adjusted the infant's body position so that she was vertical in the bed with her head touching the bottom of the pillow but not actually on the pillow. The mother pulled the covers up to her own neck and up to the baby's chin, and lay down on her side facing the infant. The mother closed her eyes again immediately, but the infant remained awake and moving, but content. 2 minutes later, the mother kissed the infant, sat up in bed, talked to the infant, and engaged in affectionate interactions with the infant. The mother swaddled the infant and moved her higher in the bed so that her head was on a pillow, and then the mother lay back down on a pillow and closed her eyes while stroking the infant's cheek. The baby remained fully awake and alert, and the mother kept her eyes closed and eventually appeared to be asleep again. The infant's fussing woke the mother at 8 hours and 47 minutes (6:22 a.m.), and she was affectionate with the infant but fell back asleep quickly. The infant's fussing escalated into crying 2

minutes later, and the mother responded promptly by giving the baby a pacifier and kissing her, and the baby settled immediately. The mother remained awake, and at 8 hours and 52 minutes (6:27 a.m.), the mother got out of bed and left the room to prepare a bottle for the infant. The baby began crying a minute later, but stopped within a minute when the mother returned to the room carrying a bottle. The mother fed the bottle of formula to the infant while the infant lay supine in the bed. While still holding the bottle, the mother lay down curled up around the infant and pulled the bed covers up to her shoulders and up to the infant's chin. The mother closed her eyes and appeared very sleepy, but continued holding the bottle for the infant. At 9 hours and 12 minutes (6:47 a.m.), the mother set down the empty bottle, and the baby began fussing so the mother gave her a pacifier. The baby settled but remained awake, and the mother appeared to be trying to go back to sleep. 1 minute later, the baby began fussing when the pacifier fell out of her mouth, so the mother gave her the pacifier again and repositioned the infant into a prone position, rubbing her back and showing affection for the infant. Both mother and infant remained awake, and the mother talked to the infant and continued to engage in affectionate interactions until the sleep study ended.

At the end of the sleep study, the mother reported that both she and her infant slept about the same amount as a typical night at home, and that she was very satisfied with her experience in the sleep lab.

Figure 7.17 Participant 4108 – picture 1

Figure 7.18 Participant 4108 – picture 2

Figure 7.19 Participant 4108 – picture 3

Figure 7.20 Participant 4108 – picture 4

7.5.3 Notable Features of the Overnight Sleep Study

- The infant experienced several instances of head covering with a pillow case, a baby blanket, and the bed covers, several of which were caused by the mother's movement in the bed.
- The infant was able to resolve some of the head coverings on her own, but many of the head coverings lasted for an extended amount of time and were not promptly addressed by the mother.
- Some maternal night wakings, including those prompted by infant movement, were not accompanied by a visual inspection of the infant and/or adjustments to the infant's bedding.
- The mother displayed high levels of affection and prompt responsiveness at certain times during the night, and slow responsiveness and some lack of awareness of the infant at other times.

7.6 Case Study 6: Infant Sleeping Alone in an Adult Bed

The final case study provides some insights into potential safety issues which may arise when infants sleep alone in an adult bed. The mother in this case used multiple items of soft bedding to manage her infant's position in the bed when she was absent, creating a border of pillows and blankets to keep the infant from rolling too close to the edge of the bed. This suggests that one reason why sleeping alone in an adult bed might represent a substantial risk to infant safety is because of the manner in which mothers use material

items when the infant is alone compared to the use of material items when the mother is present. However, the mother in this case did not remove all of the pillows bordering her infant's body when she entered the bed, which was not typical of most of the mothers who shared a bed with their infants in this sample. Additionally, when infants are alone in an adult bed mothers are not available to manage the infant's exposure to soft bedding. In this particular instance, the infant was placed in a supine position with his head on a pillow, and was subsequently able to roll into a prone position while sleeping on the pillow. Although the infant was not observed sleeping face down while in the sleep lab, similar scenarios might create substantial risk for infants, without the mother being physically able to mediate the infant's relationship with the items located in his or her immediate environment.

7.6.1 Participant Description

Participant 4030 was a 23 year old mother of African American ethnicity. Her son was 24.1 weeks old at the time of the sleep study. She reported being partnered with but not married to her child's father. During the sleep study, she added multiple items to the adult bed while her infant was sleeping there, including extra pillows located on a separate shelf in the sleep lab that were not within the bedroom areas and which were not typically used by participants.

7.6.2 The Overnight Sleep Study

The sleep study began at 9:45 p.m. on 11 July, 2003. The infant was asleep at the beginning of the study, and the mother held him as she moved about the bedroom, arranging her belongings for the night. The mother used the two pillows from the head of the bed, and moved them into a vertical position along the outside edge of the bed so that they served as a border between the sleep space and the side of the bed. She retrieved an additional full-sized pillow from a separate area of the sleep lab, and placed this at the head of the bed. The mother then placed the infant in a prone position on the bed and began to change his clothes, causing the infant to awaken. He settled into sleep again within minutes, and remained lying on the bed while the mother continued to arrange her belongings. 3 minutes into the study (9:48 p.m.), the mother repositioned the infant onto his back and changed his nappy, causing him to awaken again. One minute later, she picked up the infant and placed him supine in the bed, with his head on the pillow at the top of the bed and his body touching the two pillows which bordered the edge of the bed.

The mother leaned over her infant to kiss him and touch his forehead, and gave him a pacifier. The baby soon fell asleep, and the mother left the bedroom at 9:50 p.m. The mother returned shortly carrying a baby blanket, which she rolled up and placed vertically along the opposite edge of the bed (see Figure 7.21). She briefly adjusted the bed covers, which were not covering the infant's body, and then turned out the light and left the room. She went into the living room and began watching television and reading a book. The infant slept in this position until 53 minutes (10:38 p.m.), when he stretched and rolled into a prone position, with his head still on the pillow (see Figure 7.22). At 1 hour and 4 minutes (10:49 p.m.), the infant moved his body again and settled onto his side. A few minutes later, at 1 hour and 17 minutes (11:02 p.m.), the mother entered the room, visually inspected the infant, made a minor adjustment to the position of his arm without repositioning his body, and then returned to the living room.

At 2 hours and 10 minutes (11:55 p.m.), the mother entered the bedroom again, removed the rolled-up baby blanket, and then got into bed with her infant. She repositioned his body so that he was again in a supine position, with his head on a pillow, and lay close to him with her legs curled up under his body. After a couple of minutes, the mother rolled over onto the front side of her body, with her own head on the mattress only and not on a pillow, and fell asleep in this position. The infant remained asleep as she settled into bed, and had only the bed sheet pulled up to his chin. Both mother and baby were orientated away from each other. The infant made small movements frequently, and at 2 hours and 59 minutes (12:44 a.m.) he kicked the sheet off of his body and settled back to sleep with one arm lying under the pillows along the edge of the bed. A short while later, at 3 hours and 16 minutes (1:01 a.m.), he stirred and increased his movements, and the mother turned her head in response but did not fully awaken, and the infant settled back into sleep quickly. At 3 hours and 33 minutes (1:18 a.m.), the infant woke up and his movements awakened the mother, who rolled over and visually inspected the infant. He finally settled into a sleeping position on his back, but with his face turned upwards toward the bottom edge of the pillow above his head. The mother lay back down on her side, with her legs tucked up under the infant's body, and placed her own head on the same pillow that the infant had been lying on. The infant's ear became covered with the corner of the pillow lying along the outside edge of the bed, and his arm became fully covered by the second pillow along the edge. At 3 hours and 37 minutes (1:22 a.m.), the infant turned his head so that it became covered by the pillow at the top of the bed, but the mother promptly opened her eyes and moved the pillow from his face, although the pillow was still located

near his head. The infant settled back to sleep facing away from the mother, and the mother returned to sleep lying on her side orientated toward the infant.

During the next several hours of sleep, the infant stirred numerous times. He was fairly active in his sleep and engaged in frequent body movements, but rarely woke up. Most of his movements caused the mother to awaken, and she quickly visually inspected the infant at each awakening before promptly returning to sleep. Increased movements at 3 hours and 52 minutes (1:37 a.m.) caused the mother to awaken long enough to sit up in bed, reach for the pacifier and put it into the infant's mouth before returning to sleep. Throughout much of the sleep period, the infant's body was at a 45 degree angle with the mother's body, so she was kicked in the stomach each time he moved his legs. This resulted in frequent awakenings, although they were very brief. At 4 hours and 16 minutes (2:01 a.m.), the infant woke again, and the mother woke and stroked his forehead until he fell asleep again. He settled into a sleeping position on his side, facing the mother, with his head tilted up towards the pillow the mother was lying on (see Figure 7.23). Both returned to sleep, but increased infant movements at 4 hours and 35 minutes (2:20 a.m.) again woke the mother. She brought the infant's body close in to her own, gave him the pacifier again, and patted his back for several minutes until they both fell back to sleep with the infant lying supine in the crook of the mother's arm.

The infant continued to be very active in his sleep, and the mother awakened frequently as a result of his movements. Her sleep continued to be fairly interrupted, but most awakenings lasted only a matter of seconds. The mother was prompt to awaken with each movement, and patted the infant's body each time he stirred. At 6 hours and 34 minutes (4:19 a.m.), the infant awakened fully, and the mother woke up as well. She sat up in bed, re-inserted the pacifier into his mouth, and affectionately stroked his head and kissed him. He settled onto his side facing away from the mother, with his face very close to but not touching the two pillows bordering the edge of the bed, and both mother and infant quickly returned to sleep. The infant woke once again at 7 hours and 18 minutes (5:03 a.m.), and the mother woke two minutes later. She inspected the infant, adjusted the bed covers, and then closed her eyes, but opened them again and sat upright when the infant began vocalising. The mother got out of bed, turned on the light, and then sat back on the bed talking with and engaging in affectionate interactions with the infant. She left the bedroom at 7 hours and 22 minutes (5:07 a.m.), leaving the infant alone in the bed, awake and content. She returned to the bed 5 minutes later, and held the baby and began a period of playful interactions that lasted until 7 hours and 34 minutes (5:19 a.m.). At that

point, she left the infant with a toy, lying supine on the bed, and moved the pillows so that there was one pillow above his head and one pillow on either side of his body. The mother went into the living room to prepare a bottle, and the infant remained awake lying on the bed and vocalising continuously. The mother returned to the bedroom to pick up the infant, and brought him into the living room and sat him in an upright position on the sofa where she fed him a jar of baby food. During the feeding, she placed a full-sized pillow brought from the bed behind his back to keep him in a more secure sitting position. At 7 hours and 48 minutes (5:33 a.m.), the mother lifted the infant onto her lap and offered him a bottle of formula, but he cried and refused the bottle, so she set it down. She stood and added more water to the bottle and offered it to the infant again, but the baby again began to cry and again rejected the bottle. The mother brought a new bottle to the living room, poured the formula from the first bottle into the new bottle, offered it to the infant and the infant readily took it. The feeding lasted from 7 hours and 54 minutes (5:39 a.m.) to 8 hours and 8 minutes (5:53 a.m.). Following the feeding, the infant fell asleep while the mother held him, patting his back. She fell asleep sitting upright, but changed position at 8 hours and 17 minutes (6:02 a.m.) so that she was reclining on the sofa, with two pillows taken from the bed propped behind her head, and the infant asleep on her chest (see Figure 7.24). Mother and infant slept in this position, although the infant continued to be active in sleep and the mother showed a high level of responsiveness, patting his back with each of his movements without opening her eyes. The infant woke up again at 8 hours and 56 minutes (6:41 a.m.) and woke the mother, and the two remained awake while the baby continued moving about and playing with the mother's hair. The mother was very affectionate with her infant during this time. The mother then carried the infant into the bedroom and placed the infant in a prone position on the bed with several toys nearby, but only left him in this position for a minute before moving him to the bassinette in the same room. She again placed him in a prone position and placed several toys within his reach. The mother continued arranging her belongings, and the infant remained active and content in the bassinette. At 9 hours and 24 minutes (7:09 a.m.), the mother removed the infant's clothes, and engaged in very affectionate interactions with the infant. She carried him into the living room and gave him a bath in the sink. She carried him back to the bedroom at 9 hours and 34 minutes (7:19 a.m.) and dressed him for the day. At 9 hours and 46 minutes (7:31 a.m.), she placed the infant again in the bassinette with toys while she packed her bags, walking in and out of the room frequently. She then went into the bathroom to shower, and returned to the bedroom at 10 hours and 11 minutes (7:56 a.m.). At that time,

she picked the infant up and sat on the edge of the bed rocking him in her arms, and he appeared to fall asleep. He only remained asleep for several minutes, however, and woke again when the mother began changing his nappy at 8:00 a.m. She returned him to the bassinette at 10 hours and 21 minutes (8:06 a.m.), while she walked in and out of the room repeatedly. At 10 hours and 30 minutes (8:15 a.m.), the infant began crying, and the mother came into the room a minute later and carried him to the second bedroom with the rocking chair. She held him and rocked him, giving him a pacifier, and the infant appeared to fall asleep after only a few minutes. The mother then stood up, carried the infant to the cot and lay him down in a supine position, but he woke up upon being placed in the cot. When he failed to settle back into sleep, the mother lifted him out of the cot and returned to the rocking chair, where he again fell asleep in the mother's arms. At 10 hours and 45 minutes (8:30 a.m.), she carried him to the adult bed and placed him on his back. He stirred briefly when the mother set him down, but fell back asleep within two minutes. The mother continued sitting next to him, stroking his forehead, and then placed two pillows near him along the outside edge of the bed. The sleep study ended at 11 hours and 17 minutes (9:02 a.m.) as she placed the infant in a car seat and gathered her belongings in preparation for leaving.

At the end of the sleep study, the mother reported that both she and her baby slept about the same amount as a typical night at home, and she reported being very satisfied with her experience in the sleep lab.

Figure 7.21 Participant 4030 – picture 1

Figure 7.22 Participant 4030 – picture 2

Figure 7.23 Participant 4030 – picture 3

Figure 7.24 Participant 4030 – picture 4

7.6.3 Notable Features of the Overnight Sleep Study

- Multiple pillows were used to create a border around the infant's sleep space whenever he slept in the adult bed.
- The mother did not remove all pillows when she was bedsharing with the infant. When bedsharing, the infant slept in a space between the mother's body and a row of pillows bordering the edge of the bed.
- The infant rolled from a supine position into a prone position during the time he was alone in an adult bed, and his head was located on a pillow for his entire sleep period.
- No acute risks were observed during the time the infant slept alone in the adult bed. There was the potential for the pillows to pose a breathing risk to the infant if his breathing became obstructed at any point, but such a scenario was not observed when the infant was alone in the bed, and the one instance of face covering during bedsharing was resolved by the mother within a few seconds.
- When the infant was awake, the mother placed him in a bassinette at all times when she was not directly holding him or monitoring him. When the infant was asleep, the mother used pillows to prevent him from rolling off the bed but did not place him in the bassinette when she was not with him in the bed.

CHAPTER 8
DISCUSSION

8.1 Study Outcomes

This study revealed significant differences between teen and adult mothers in how they managed the costs of caring for an infant at night. This study follows from the extensive body of research documenting the factors that predispose individuals to initiate reproduction at certain ages, and adds to this literature an awareness of how those differential reproductive trajectories play out in terms of parenting practices. This suggests that particular life experiences (such as age at first reproduction) do not just alter life event timing, but that they also have meaningful and tangible implications for an individual's parenting style. The study finds that feeding methods and sleeping environments differ between the two groups of mothers, and that the nature of infant sleep environments inevitably depends on what mothers do with those environments and how they interact with infants in relationship to specific sleep locations. The study also revealed that teens adopted a proximal care strategy involving a high degree of physical proximity between mother and infant while both awake and asleep; the physical distance exhibited by adult mothers, as well as the amount of time they spent separated from their infants, was greater than that observed for teen mothers. Finally, the study documented the occurrence of sleep-related risks for infants in both groups, and found that the nature of those risks differed depending on the mother's approach to nighttime caregiving, especially her choice of infant sleep location.

Some of the results of the present study are consistent with existing literature, while others are not. As discussed in Chapter 3, breastfeeding is much less common among adolescent than adult mothers, and the sample in this study displayed the same pattern. Exclusive breastfeeding was not the norm for either group of mothers, and this too is consistent with national breastfeeding rates and duration of exclusive breastfeeding in the United States (see Chapter 3). Although it was not statistically significant, there was a trend toward a higher incidence of prone positioning among the adolescent mothers; this trend might have become significant had sleep lab staff not intervened to discourage use of this sleeping position while in the lab (discussed in section 8.4 below). This trend is consistent with literature documenting more frequent use of the prone sleeping position for infants among younger mothers (Willinger et al. 2000). However, other findings differed

from existing literature. Previous studies on nighttime parenting, discussed in Chapters 2 and 3, have shown a strong association between breastfeeding and bedsharing (Ball 2003; Ball 2002; Ball, Hooker & Kelly 1999; McKenna, Ball & Gettler 2007; McKenna, Mosko & Richard 1999; McKenna 2002). The present study did not find evidence of such an association, and in fact revealed a high rate of bedsharing among those mothers who were not breastfeeding their infants. There are a few other studies that have documented the prevalence of bedsharing in populations where breastfeeding is not the norm, including a higher incidence of bedsharing among adolescent mothers (e.g. Fu et al. 2008). The present study reinforces the notion that multiple factors influence infant sleep location and that there are no singular relationships between sleep and feeding routines. The results of the present study also differed substantially from many of the existing studies discussed in Chapter 3, largely based on daytime measures of parenting, which found adolescent mothers to be less sensitive and responsive to their children's needs. In the current sample, adolescent mothers were not more likely to ignore infant cues, were not less in tune with infant needs, were not out of synchrony with their infants' schedules, and did not treat their infants in an overall neglectful manner.

8.2 Evaluating the Theoretical Models

The overall aim of the study was to assess the behavioural data in light of two different, although not mutually exclusive, theoretical models. The first involved a conventional approach informed by the literature that suggested that teen mothers pursue a sub-optimal parenting style expressing itself in terms of more risky nighttime parenting, more neglectful and less responsive caregiving patterns, and less engagement with infant care during the night compared with adult mothers. The contrasting perspective, informed by life-history theory, suggested a more complex picture wherein maternal caregiving strategies are calibrated to best balance maternal self-investment and infant investment, and that these strategies would inevitably be shaped by the larger life-history trajectories and reproductive strategies of the mothers involved. Each of these perspectives generated a series of specific predictions, listed in Chapter 4, which were applied to the behavioural data. A summary of the predictions and outcomes is presented in Table 8.1.

Table 8.1 Results of hypothesis testing

CONVENTIONAL MODEL	LIFE-HISTORY MODEL
Hypothesis: **Compared with adult mothers, teens will engage in less direct care of their infants during the night and will exhibit fewer behaviours consistent with infant sleep guidelines. Infants of teen mothers will be exposed to more sleep-related risks than infants of adult mothers.**	**Hypothesis:** **Adults will prioritise their infant's sleep needs over their own, whereas teen mothers will care for their infants in ways that minimise conflict over maternal and infant sleep needs. Exposure to risk is not expected to be greater for either group.**
PROXIMITY	PROXIMITY
Rationale: Adult mothers will be more involved with their infants during nighttime routines than teen mothers, and adults will be more likely to follow current rooming-in guidelines about infant sleep location.	Rationale: Responding to infant needs at night requires less effort when infants are in close proximity. Here, use of separate cribs and separate rooms, and hence decreased proximity, is taken to reflect increased investment, because it leads to reduced maternal sleep.
Prediction: Adult mothers will spend more time in close proximity to their infants compared to teen mothers.	Prediction: Teens will spend more time in closer proximity to their infants than adults.
SLEEP POSITION	SLEEP POSITION
Rationale: Increased use of the prone position for infant sleep among teen mothers may result from decreased awareness about current recommendations or a greater tendency to disregard those recommendations.	Rationale: Increased use of the prone position among teen mothers compared to adults may occur because the prone position promotes prolonged infants sleep duration, hence potentially minimizing maternal costs.
Prediction: There will be more frequent use of the prone position for infant sleep among teen mothers compared to adults.	Prediction: There will be more frequent use of the prone position for infant sleep among teen mothers compared to adults.
SLEEP LOCATION	SLEEP LOCATION
Rationale: Teen mothers will be less likely to follow rooming-in guidelines compared to adult mothers.	Rationale: Teen mothers will use proximity to minimise maternal sleep disruption, and will keep their infants with them during the night more than adults.

Prediction: No one sleep location will predominate for the teen mothers.	Prediction: Infants of teen mothers will spend more time bedsharing and/or sofa sharing than infants of adult mothers.
Prediction: Infants of teen mothers will spend less time in a cot in the mother's bedroom compared with infants of adult mothers.	Prediction: Infants of teen mothers will spend less time sleeping in a cot in a separate room compared with infants of adult mothers.
Prediction: Infants of teen mothers will experience a greater number of sleep locations than infants of adult mothers.	Prediction: Infants of teen mothers will experience a greater number of sleep environments than infants of adult mothers.
AMOUNT OF SLEEP	AMOUNT OF SLEEP
Rationale: Teen mothers will be less engaged with infant care during the night than adult mothers, and this will affect their sleep duration.	Rationale: Teen mothers have greater sleep requirements than adults. Teens will reduce parent-infant conflict over sleep by synchronising their own sleep periods with those of their infants than adults.
Prediction: The sleep period of teen mothers will be longer than the sleep period of adult mothers.	Prediction: The sleep period of teen mothers will be longer than the sleep period of adult mothers.
Prediction: Teen mothers will obtain more uninterrupted sleep (fewer awakenings) than adult mothers.	Prediction: Teen mothers will experience shorter awakenings during the night than adult mothers.
	Prediction: Teen mothers will go to sleep sooner after their infants and sleep for a more similar length of time as their infants compared to adult mothers.
BEDSHARING	BEDSHARING
Rationale: Teen mothers will exhibit diminished engagement with infants during the night compared with adult mothers.	Rationale: Teen mothers will not be less engaged with infants during bedsharing.
Prediction: Teen mothers will spend less bedsharing time orientated toward their infants than adults.	Prediction: Teen mothers will not spend less time orientated toward their infants than adults.

FEEDING
Rationale: Lack of breastfeeding and involvement with infant feeding sessions among the teen mothers will result from a lack of willingness to breastfeed or a lack of knowledge about the importance of breastfeeding compared with adult mothers.
Prediction: There will be less breastfeeding in the teen group than in the adult group.
Prediction: Teens will promote infant "self-feeding" through bottle-propping more frequently than adults.
CRYING
Rationale: Increased crying among infants of teen mothers will result from teen mothers ignoring their infant's signalling and from the diminished levels of caregiving behaviour evident among teen mothers compared to adults during nighttime routines.
Prediction: Infants of teen mothers will experience longer crying bouts than infants of adult mothers.
Prediction: Teen mothers will respond more slowly to infant crying than adult mothers.
RISK
Rationale: Infants of teen mothers will experience more sleep-related risks than infants of adult mothers. Teen mothers will be less likely to safely modify sleep environments for their infants than adults, and will be less aware or less likely to implement risk reduction guidelines than adult mothers. This also suggests that when teens bedshare, they will do so less safely than adult mothers.

FEEDING
Rationale: Lack of breastfeeding and involvement with infant feeding sessions reduces the costs of infant care, which will be particularly important for teen mothers.
Prediction: There will be less breastfeeding in the teen group than in the adult group.
Prediction: Teens will promote infant "self-feeding" through bottle-propping more frequently than adults.
CRYING
Rationale: Infant crying represents an increased demand on mothers that teens will attempt to minimize more than adult mothers, and teen mothers will respond more quickly than adults to infant crying in order to minimize their own sleep disturbance.
Prediction: Infants of teen mothers will experience shorter crying bouts than infants of adult mothers.
Prediction: Teen mothers will respond more quickly to infant crying than adult mothers.
RISK
Rationale: Risks are predicted to occur for both groups equally and are expected to vary in nature based on mother's choice of infant sleep location and perception of what constitutes a risk.

Prediction: Infants of teen mothers will be more likely to experience sleep-related risks than infants of adult mothers.	Prediction: Infants of teen mothers will not experience more sleep-related risks than infants of adult mothers.
Prediction: Infants of teen mothers will spend a longer time exposed to sleep-related risks than infants of adult mothers.	Prediction: Infants of teen mothers will not spend a longer time exposed to sleep-related risks than infants of adult mothers.
Prediction: Teens will exhibit different placements of infants in the bed during bedsharing compared with adults.	Prediction: There will be no group differences in the placement of infants in the bed during bedsharing between teen and adult mothers.
Prediction: More teen mothers will place their infants at risk for SIDS via cigarette smoking than adult mothers.	Prediction: There will be no group differences in maternal smoking between teen and adult mothers.
Prediction: Teen mothers will have more instances of infants sleeping with pillows and other items than adult mothers.	Prediction: There will be no group difference in the use of pillows or other items in the infant sleep environment for teen and adult mothers.
Prediction: Teen mothers will leave infants alone in adult beds for more substantial periods of time than adult mothers.	Prediction: There will be no group difference between teens and adults in the use of an adult bed as a substantial sleep environment for infants.

Key:

	Prediction Supported
	Prediction Supported (Trend)

8.2.1 Findings Consistent with the Life-History Model

Overall, the life-history model emerged as a better fit for the behavioural data than the conventional model. Where the two models generated contradictory predictions about maternal behaviour, the life-history predictions were more often borne out by the data. These outcomes can be understood in light of the overall proximal care strategy that is normative for the teen mothers. This proximal care strategy explains why the teen mothers remained closer to their infants while both awake and asleep, and why they almost never chose to place their infants in a separate room during the sleep period. It further explains why bedsharing was almost universal among the teen sample and why there was a trend toward having infants sleep on a sofa while the mother was awake. It also points to why leaving an infant alone in an adult bed for a substantial period of time was rare, and why infants were located wherever their mothers were and therefore had a greater number of sleep locations compared with infants of adult mothers. The close proximity of the teen mothers to their infants also explains why the teen mothers matched their own sleep period to their infant's more closely by going to sleep sooner after their infants fell asleep than adults and sleeping for a more similar length of time compared to mother-infant dyads in the adult group. The adolescents had greater synchrony between maternal and infant sleep periods than dyads in the adult group, and there was a trend toward teen mothers waking up more often but getting back to sleep sooner during nighttime caregiving. Finally, the trend towards much shorter crying bouts in the teen group is also explained by a proximal care strategy. Although the time it took mothers to respond to infant crying was similar for both groups, the teen mothers were more likely to respond by picking-up or holding their infants, and this pattern of physical contact resulted in crying bouts that were almost half as long compared to adults, although the difference in length of crying bouts was not statistically significant.

The greater frequency of risky parenting practices among the teen group that was predicted by the conventional model was not supported by the data. The life-history model predicted that teens would be no more likely to put their infants at risk than adults, and that where risk to infants resulted from various maternal caregiving strategies, it would do so for both groups and across all sleeping locations, and these predictions were supported by the data. The finding that infants of teen mothers were not exposed to more maternal smoking nor were they subjected to breathing-related, feeding-related, or other types of sleep-related risks more frequently than those in the adult group is consistent with the life-history model, as is the fact that neither group of mothers was 'risk-free'. Furthermore, the

risks observed for both groups occurred in each of the sleep locations, so sleep-related risks were also not specific to any particular sleeping location and there was no infant sleep environment that was inherently safe or inherently dangerous. When bedsharing occurred, teens did not practise bedsharing in a manner that was different than adults, and there were no group differences detected in either orientation or head position during bedsharing. This finding is noteworthy since several previous studies have shown that breastfeeding naturally promotes orientation of infant to mother and vice versa. Bedsharing dyads in the present study spent the majority of time orientated toward each other, even where breastfeeding was absent, so it seems that some aspects of bedsharing behaviour may be related to other variables besides feeding method. The one difference observed here compared with breastfed bedsharing infants was that in the present study infants were typically positioned with their heads on a pillow, whereas breastfed bedsharing infants have been documented as being positioned at maternal breast height and placed flat on the mattress (Ball 2006a).

8.2.2 Findings Consistent with Both the Conventional and the Life-History Models

There was some degree of overlap in the predictions generated by the two models, and the data are thus consistent with both models in these areas. Both the conventional and the life-history models predicted that there would be an increased incidence of prone positioning for infant sleep among the teen group, and the sample revealed a trend in this direction. Both models also predicted that the infants of teen mothers would sleep in a greater number of locations across the night, and this too was borne out by the data. Finally, the two models anticipated a lack of breastfeeding among the teen mothers and a greater tendency in teen than in adult mothers to have infants self-feed during the night, and these patterns were observed in the current sample. Although these predictions were the same for the two models, they are based on different rationales about maternal perceptions and motives. For example, the conventional model predicts an elevated number of sleep locations for infants in the teen group because they are subjected to chaotic lifestyles and are cared for by mothers who do not prioritise or structure their infant's nighttime routines. Alternatively, the life-history model also predicts a greater number of sleep locations for infants of teens, but suggests that the more common relocations which occur for this group result from a practice in which teen mothers keep their babies close as a way to care for them in the most efficient manner possible, thereby reducing maternal costs. Ultimately, assessing the two rationales was beyond the scope of

the current study because mothers were not asked about the reason they chose to place their infants in the prone position or move their infants during the course of the night. Although questions about maternal reasoning are not fully addressed here, the fact that these behavioural patterns were found can be used to inform future studies and to pinpoint key behaviours around which ethnographic reports should be collected.

8.2.3 Findings That Did Not Support Either Model

There were several behavioural practices where neither the predictions of the conventional model nor the life-history model were supported. Both of the models predicted that teens would find a way to get more sleep than adult mothers, but no group difference in sleep duration was found. There was a trend towards teen mothers tending to their infants and getting back to sleep more quickly following a night waking than adult mothers, and this finding supports the life-history model that suggests that teens engage in strategies to minimise maternal sleep disruption. It is possible that bedsharing allows mothers to awaken, respond, and return to sleep as quickly as possible, and because there were a number of adult mothers who also bedshared (which may have been confounded by breastfeeding; see section 8.4.4 below for further discussion) a teen-adult difference in duration of sleep was not found. Minimising the length of nocturnal awakenings might be understood to enhance maternal sleep quality. Although mothers in the present study were not asked to rate the subjective quality of their sleep on the night they spent in the lab, it may be that quality of maternal sleep is as important or more important than simple sleep duration. Additionally, the conventional model also predicted that teens would take longer to respond to crying infants whereas the life-history model predicted that they would respond more quickly than adults. In fact, no group difference in lag time between the start of a crying bout and the first maternal response was found, nor was there a significant group difference in the length of crying bouts. The results suggest that despite variation in nighttime parenting styles, most mothers of 4-month old infants are generally sensitive and responsive to infant signals regardless of maternal age.

8.2.4 Findings Consistent with the Conventional Model

The use of pillows for infants was the sole finding that supported the conventional model instead of the life-history model. The conventional model predicted that the unsafe sleep-related practices of teen mothers would include use of pillows for their infants; the life-history model predicted no differences between the two groups in the use of pillows or

other bedding. Mothers in the teen group did place their infants to sleep with their heads on pillows more frequently than adult mothers, and this does have potential implications for sleep safety. A recent study in the U.K. identified pillow use as a significant risk factor for SIDS (Blair et al. 2009). It is possible that this group difference related to breastfeeding status, although assessing the influence of feeding method on pillow use was beyond the scope of the present study (discussed in section 8.4.4 below). Again, it would be helpful to collect additional data in future studies, including self-reports, in order to establish what factors prompt mothers to use pillows for their infants and to ascertain why such motives seem to be more common among young mothers.

8.2.5 Summary of the Outcomes of Hypothesis Testing

The overall picture of elevated risk and sub-optimal parenting practices for teen mothers that was predicted by the conventional model was not observed. The lack of responsiveness, the dismissal of infant needs or cues, the increased exposure to risks, and the lack of engagement with nighttime caregiving that would have supported the conventional model was not found. Taken as a whole, the data do not support the predictions of the conventional model with the exception of use of pillows within the infant sleep environment. There were outcomes congruent with the life-history model, so on balance the life-history approach seems to offer a more compelling fit for the behavioural data. However, the comparison of teens to adults is somewhat complicated by the degree of heterogeneity among the adult sample, for whom there was a good deal of variation in nighttime caregiving practices. For example, although bedsharing was the norm for the teen group, it was also not uncommon among the adult mothers, and this may have obscured differences in maternal strategies between the two groups. Future studies can build on the findings presented here by incorporating a larger sample and more controls for key behaviours, such as sleep location and infant feeding method.

8.3 Main Study Outcomes

The findings presented here suggest several key points related to the life-history strategy of teens and adults, and offer some insight into how those strategies affect sleep-related risks to infants in a variety of contexts. The findings also relate to current discourse on the relationship between young maternal age and infant risk, and shed light on the ongoing debate about bedsharing safety.

8.3.1 Minimisation of Parent-Infant Conflict

The most surprising finding that emerged from the data related to how the life-history strategy of teen mothers played out in terms of care for infants. As discussed above, life-history theory predicted that teens would engage in cost-cutting measures to buffer maternal reserves (needed for mothers' own continued growth and development) against the high costs of caring for infants at night. These cost-cutting measures were evident, but teens accomplished them by pursuing a behavioural strategy that minimised parent-infant conflict and brought maternal and infant needs in line with each other during the night. This was primarily accomplished through the proximal care strategy discussed above; teen mothers kept their infants with them wherever they happened to be, slept in close proximity to infants during the night, showed a trend toward waking up frequently but being able to get back to sleep more quickly because of the ease of tending to infants that bedsharing allowed, and quickly picked up their infants in response to crying, resulting in a trend toward shorter crying bouts. They also matched their own and their infant's sleep habits more closely than the adult mothers did, thereby ameliorating conflict over the timing and length of the sleep period. Bottle feeding certainly played a key part of this strategy to reduce parent-infant conflict, especially where it allowed mothers to delegate some of the responsibility for feeding sessions to the infants themselves. Remarkably, the teen nighttime parenting strategy allowed mothers to meet both maternal and infant needs, all without appearing to compromise infant care or sacrifice prompt responsiveness more than the adult mothers. Interestingly, the teen strategy achieved a reduction in maternal costs through *increased* involvement with and proximity to infants, rather than through the withdrawal and distancing that the conventional model predicted.

8.3.2 Variability in the Construction of Infant Sleep Environments

The data generated in this study indicated that there was a degree of variability in how infant sleep environments were constructed, which has implications for infant sleep safety. This variability existed even within the standardised environment of the sleep lab, where the furniture was identical for each participant. Much of the infant sleep literature recommends that infants be put to sleep in cots, which indicates an assumption that cots constitute a relatively uniform and reliably safe sleep environment (e.g. Nakamura, Wind & Danello 1999); however, the findings of the present study contradict this assumption. Through the introduction of pillows, blankets, toys and other forms of soft bedding, a single piece of furniture represented a very different sleep space from one infant to the

next. Likewise, mothers who bedshared with their infants varied in their tendency to remove or add items to the sleep environment. It appears that mothers often deliberately add items to infant cots, in order to create a comfortable sleep space for infants in preparation for a period of separation. Mothers were less apt to bring these items into the bedsharing environment, perhaps because the mother's own presence offered comfort to the infant or because of space limitations, but the bedsharing environment already contained items of bedding and was also quite variable in whether or how it was altered by mothers in order to maximise infant safety and minimise exposure to soft bedding.

8.3.3 Nighttime Parenting Strategies and Sleep-Related Risks to Infants

It is important to note that infants in both groups were exposed to sleep-related risks. The groups were not polarised with regard to risk and neither group took an inherently safe or unsafe approach to infant sleep safety. Life-history theory focuses on cost-benefit ratios and hence provides an approach for understanding why mothers might tolerate or even create certain risks for their infants. That these risks may stem from rational and perhaps even very loving conceptions of infant needs is an interesting point, and one that has important clinical implications. Risks can occur based on what judgments mothers make about what is most appropriate for their infants' needs as well as their own. Clinicians may be assisted in knowing that mothers who separate from their infants at night may be likely to tolerate risks that include use of soft bedding, stuffed toys or other security objects in spite of existing advice to remove all such items from an infant's sleep environment. Likewise, it may be helpful to know that mothers who bedshare may be creating risk for their infants by placing their infants' heads on or between pillows, perhaps especially if they are adolescent mothers. Furthermore, clinicians may be better able to anticipate who will disregard current advice if they are aware that soft bedding is occasionally used to prop bottles into an infant's mouth.

8.3.4 High-Risk Practices among a Subset of Mothers

Although a number of sleep-related risks were observed during the course of this study, overall mothers took very good care of their infants and were highly attuned to infant needs and infant safety during the night. The case studies suggest that extremely high-risk practices are not the norm, and that they occur for a sub-set of mothers whose common characteristics need to be further explored in future studies. Based on the case studies presented in Chapter 7, clinicians may be better able to inquire about specific

practices, and researchers may be better able to design protocols for gathering more specific information about key risk factors. Simple inquiries in a clinical setting, informed by the case studies presented here, may facilitate the identification of mothers who are engaging in behaviours such as bottle propping, sleeping with their infants on sofas, or foregoing nighttime feedings, for example. Future studies using larger samples may be further able to establish some of the common characteristics of mothers who engage in such practices, and this may allow researchers to identify predictors of risk that can also be used to inform clinical practice.

8.3.5 Young Maternal Age and Risk to Infants

In light of the findings from the present study, it is worthwhile to reflect on the elevated incidence of SIDS and other sleep-related risks among infants of young mothers that have been previously reported (L'Hoir et al. 1998; NCCC 2007; FSID 2009). The data presented here cannot support an indication of elevated risk to infants simply as a consequence of young maternal age. It seems more plausible that young maternal age is an important marker for other risk factors. This is in line with the findings of Fleming and colleagues (2003), who found that the relationship between young maternal age and SIDS risk was no longer significant once social deprivation was controlled. It may therefore be that the environment of social deprivation in which many young mothers raise their children is the key contributing factor to elevated SIDS risks and other negative sleep-related outcomes.

8.3.6 Bedsharing Safety

The findings presented in Chapters 6 and 7 also afford an opportunity to reflect on the contemporary debate concerning bedsharing safety. The data do not indicate that bedsharing was unsafely practised by the majority of mothers most of the time, nor that the teen mothers practised bedsharing in a manner that was universally more risky than the adults. The one elevated risk that was observed for teens during bedsharing and for teens in general was use of pillows for infants, and this habit should be targeted for intervention in order to improve bedsharing safety. It is possible that pillow use during bedsharing is more prevalent when bedsharing is practised in the absence of breastfeeding. Previous studies have shown that infants tend to be placed higher in the bed when they are not breastfed (Ball 2006a). The present study lends support to this finding, although it was not possible to establish with certainty that infant placement varied in relationship to feeding

method because so few breastfeeding/bedsharing dyads were included in the sample. There does appear to be a small subset of mothers for whom bedsharing includes periods where infant safety is compromised, as illustrated by the case studies presented in Chapter 7. However, the present study cannot support a recommendation that bedsharing be discouraged for all mothers, particularly in light of the important role bedsharing plays in the teen nighttime parenting strategy. Indeed, it is possible that efforts to prevent bedsharing among teen mothers might have unintended adverse effects, since bedsharing may function as a way in which teen mothers manage to meet their own basic needs without sacrificing infant care. It is conceivable that pushing them to select alternative infant sleep locations would require them to adopt other strategies for dealing with parent-infant conflict at night that could be worse for infant safety. Instead, it would behove clinicians to advocate simple adjustments to the manner in which bedsharing is practised, such as discouraging pillow use. The present study reinforces the arguments of previous researchers (Ball 2009; Ball 2008; Ramos, Youngclarke & Anderson 2007; Lahr, Rosenberg & Lapidus 2007) that bedsharing should not be discouraged *per se* and that parents should be informed and supported about how to bedshare safely. This study further indicates that bedsharing is not automatically unsafe if practised in the absence of breastfeeding, and reinforces the notion that no unilateral relationships exist between sleep and feeding routines (however, see discussion concerning ecological validity in section 8.4.2 below).

8.3.7 Life-History Theory as an Organising Principle for Understanding Maternal Behaviour

In general, evolutionary life-history theory offers an important organising principle for understanding parenting behaviour, including nighttime care. It helps explain how mothers and babies function as a co-adapted system, suggests that the system is limited by finite maternal resources, and addresses the manner in which mothers are required to strategically allocate resources to self and infant (Trivers 1972). It also helps explain why mothers are not all equally endowed with similar resources, and that life-history characteristics (including but not limited to maternal age) fundamentally affect the strategies mothers devise to invest in their offspring within their individual limits and constraints. The life-history perspective is also clinically useful because it explains why infant exposure to risk persists in spite of significant public health efforts and campaigns to prevent such risks. Unlike the conventional wisdom that ranks mothers, based on age and

other characteristics, in terms of their ability to provide care for their infants in line with contemporary advice and recommendations, life-history theory offers a view of parenting that is more complex but ultimately more congruent with human behaviour (Ball & Panter-Brick 2001). It explains how mothers attempt to do the best they can with the resources available to them, and that their strategies for doing so can be surprisingly creative and rational, if not always ideal in terms of outcomes (Hrdy 2000).

8.4 Limitations of the Study

The findings of the present study should be interpreted with a degree of caution appropriate to the specific limitations of the methods employed. The purpose of the present study was to gather data on an as-yet little explored aspect of parenting behaviour, and more specifically, whether and how such behaviours function as part of broader maternal reproductive strategies. The exploratory nature of this study was appropriate given the lack of previous findings about the nighttime parenting behaviour of adolescent and adult mothers. The study attempted to gain a general behavioural overview of nighttime parenting by coding almost all the activities of the mothers and infants while they were in the lab, and aimed to generate insights that may be useful for informing both clinical practice and future research.

8.4.1 Participant Recruitment

Although the sample presented here did not differ in any significant way from the larger population from which it was drawn (see Chapter 6), my experience of conducting the study suggests that certain participants were harder to recruit for the study than others. Specifically, adult mothers were more difficult to recruit for an overnight sleep study than the adolescent mothers. No specific data on reason for refusal were collected because the mothers were encouraged to accept or decline the invitation to the sleep lab freely and were not questioned about reason for refusal in order to preserve the quality of their relationship with research staff for the larger project. Anecdotally, however, it seemed that adult mothers were more difficult to recruit because they had less need for financial remuneration, and they had more established home lives and routines and were more hesitant to disrupt those routines by spending the night away from home. Furthermore, more of the adult mothers were partnered and because partners were not included in the sleep study this factor may have also affected acceptance rates.

It is possible that some mothers in either group may have refused to participate in the sleep studies because they were concerned about the prospect of being video-taped, and this may have been a particular barrier to participation among high-risk mothers or those who were aware that some of their parenting behaviours were neglectful or otherwise problematic. This could have resulted in an under-estimate of the actual risk involved in nighttime parenting practices. However, at the time of the sleep study the mothers had established relationships with research staff that had been formed over the preceding four months. Prior to completing a sleep study, all of the women in the larger project had already allowed researchers to conduct in-home interviews and assessments, including direct observations of parenting behaviour in the home, and they had already been informed about the protocols in place for reporting instances of abuse, neglect, or threats of harm to self or others in line with legal requirements. The sleep lab study posed no additional threats to the mothers in this regard compared to assessments in which they had already taken part. It is also my impression that mothers typically relaxed and became accustomed to the laboratory environment after a short adjustment period, and that mothers were so tired and focused on caring for infants and then returning to sleep during nocturnal awakenings that their level of self-awareness and their concern about being filmed were minimal. However, it must also be acknowledged that the lack of a habituation night (as discussed in section 5.3) was a methodological limitation of this study. Although it was deemed necessary for the reasons previously discussed, it may have altered the findings presented here by capturing the behaviour of mothers who were operating in a novel environment to which they had not fully become accustomed when the behavioural studies took place.

8.4.2 Ecological Validity

The above issues concerning a disruption to home routines and videotaping of nighttime parenting behaviours relates to a larger issue of ecological validity that must be addressed in relationship to the conclusions drawn in the present study. The fact that the study took place in a sleep laboratory represents both a methodological strength and a weakness. Data collected in the sleep laboratory did not fully capture the true home lives and behavioural repertoires of the mothers in the sample, since their lives existed in relationship to their own physical space as well as to other co-resident family members. Furthermore, nighttime parenting routines that involved the use of specific materials were also not fully captured in this study, since mothers differed in the amount of items they

brought with them to the overnight sleep studies. This may have affected some of the behavioural data collected, particularly with regard to sleep-related risks caused by the presence of soft bedding and other items in the infant's sleep environment. It may be that mothers who normally incorporated a number of such items into their nighttime parenting practices did not bring these items to the sleep lab, and thus certain aspects of their normal routines were not completely documented here. More generally, the sleep lab setting may have led to an underestimate of risk across the board. Because the sleep lab was an 'artificially safe' environment where proper safety precautions were taken and where infants were monitored at all times, the present study may have captured a very incomplete view of the risks that infants might have been routinely exposed to in their homes. Finally, the sleep lab study also altered naturalistic behaviour by limiting participation to mothers only. It is possible that in many households the participants included here were not the sole nighttime caregivers, and this limited the ability to document the normal care that infants would have typically received at home.

In spite of these limitations, the choice to conduct the sleep study in a laboratory setting was deemed appropriate and important for a number of reasons. First, it allowed researchers to look solely at the mother's behavioural practices, since virtually all other aspects of the sleep laboratory were identical from one sleep study to the next. The choice to collect data in a setting where maternal behaviour operated as the sole variable made it possible to look more specifically at behavioural strategies that were not confounded by the presence of additional people or widely differing aspects of the physical environment. Additionally, because this study was the first of its kind and was therefore designed to capture a general behavioural overview of nighttime parenting behaviour, without knowing exactly what types of behaviour might be observed, the sleep lab setting solved a number of logistical issues. Methods used for collecting similar data in the home have relied on stationary cameras located at the foot of the bed or cot where participants normally sleep (Ball 2006a). For the purposes of the present study, this would likely have resulted in far more time 'off-camera' and therefore a significant increase in the amount of missing data. The use of multiple cameras in the sleep lab also enabled researchers to collect data on pre-sleep routines spent in a living room, which would have been missing altogether had the present study relied on stationary cameras alone.

Collecting data in the laboratory environment also had implications for certain ethical issues. In order to mount cameras in the home, informed consent documents would have needed to be provided to any persons who might possibly have come on-camera

during the night. Similarly, because the larger study was limited to mother-infant dyads, the exclusion of additional participants from the sleep study preserved the standards of the study protocol and allowed for comparisons between the daytime and nighttime parenting practices of individual mothers.

Although one of the limitations discussed above suggests that the sleep laboratory created an artificially safe view of infant sleep environments, it was important that a preliminary study on nighttime parenting practices which included high-risk participants be conducted in a controlled setting. The study was designed to capture any sleep-related risks to infants, but at the outset of the study it was unclear what such risks might entail or how they would actually affect infants. Therefore, it was appropriate to gather data that included risk to infants in a setting where mother and infant were monitored at all times and where research staff could intervene to preserve infant safety if necessary. Ideally, the data presented here can be used to design more informed research methods including a more detailed behavioural taxonomy for future studies, which may ultimately include in-home studies of nighttime parenting.

A further aspect of the data collection protocol which limited the ecological validity of this study was the lack of data collected during the PFT assessments on infant feeding and sleeping practices, as well as data on the income of the study participants. Data on breastfeeding rates and other aspects of infant feeding practices, as well as PFT data on the sleep routines of the mothers and infants in their home environment, would have allowed for a broader view of the nighttime parenting practices of the participants and would have enabled a comparison between behaviours in the sleep lab and behaviours in the home. Additionally, it would have been helpful to have had more specific data on the socio-economic status of the participants. The sole variable available for each participant reflected her personal annual income, but was an incomplete picture of the economic resources available to her. This hindered the ability to address the ways in which socioeconomic status might have affected the nighttime parenting strategies of the participants, and whether any variation in economic status interacted with, or perhaps superseded, a mother's age to shape aspects of her parental investment strategy. Future research will benefit from the inclusion of these additional variables.

8.4.3 Sample Size and Type I and II Errors

Another limitation of this study was the inclusion of a relatively small sample. This proved to be both a benefit and a hindrance. Although a sample size of 45 dyads is

consistent with most previous studies of nighttime parenting in which detailed behavioural data were collected (Ball, Hooker & Kelly 1999; Ball 2007a; McKenna & Mosko 1993), the inherent constraint on sample size did limit statistical power. Hence, it is indeed possible that, due to the small sample, the statistical analyses failed to detect group differences that actually existed (Type II error). No post-hoc power calculations were completed because of general concerns about the validity of this approach for interpreting results (e.g. Hoenig & Heisey 2001). For example, a power value and required sample size required to detect an effect will be estimated even when the null hypothesis is true.

Additionally, there was a possibility that the number of group difference tests run on this data set may have increased the chances of a Type I error, wherein a null hypothesis was rejected in error. In order to minimise the possibility of such occurrences, all tests were limited to those where a clear rationale could be made for conducting the test, based on the theoretical framework and informed by existing research. No statistical tests were run without first formulating this type of rationale. Even within this structured approach to statistical analysis, however, it is nevertheless possible that Type I errors did occur.

Although sample size is a very real issue here, the small sample did permit the collection of very detailed behavioural data that would have been prohibitive for a substantially larger sample. For each sleep study, a real-time behavioural log was produced that documented nearly every activity undertaken by mothers and infants while in the lab. This technique was most appropriate for an exploratory study of this kind, since it was unclear which behaviours might be observed, what their potential significance might be, and when during a sleep period these behaviours might occur. Alternative methods, such as time sampling or event sampling, although more efficient, would have resulted in a less accurate portrait of the nighttime parenting styles of these participants. Again, the aim of this study was to contribute to a more informed, empirically-based understanding of how mothers care for their infants at night, and to help inform future research in this area. Drawing on the data presented here, future research can employ a more specific and limited behavioural taxonomy which can be tailored to very discrete research questions and applied to a larger sample.

8.4.4 Hypothesis Generation

The hypotheses included in the present study were specifically designed to test the life-history theory perspectives on teen and adult nighttime parenting behaviours. Clearly, other hypotheses could also have been generated to explain behavioural patterns using

alternative theoretical perspectives. For instance, psychologists might have used attachment theory as an organising principle to describe nighttime parenting styles, with a potential focus on differences in attachment status among the infants in the sample. Likewise, a sociological perspective might have emphasised socioeconomic differences as a determinant of parenting behaviour. Other speculations regarding the hypothesised relationship between nighttime parenting behaviour and maternal age might have included the possibility that adult mothers might have specific motivations to maximise their own sleep if they were required to return to work early in the postpartum period, or that socioeconomic conditions directly determined the participants' nighttime parenting behaviours. For instance, teen mothers might have bedshared simply due to a lack of alternative options. All of these alternative hypotheses suggest potential areas for future research.

8.4.5 Remaining Questions

Given the particular limitations of this study, there were a number of relevant research questions that I was unable to address. Foremost among these was the issue of how the presence or absence of breastfeeding impacted mothers' interactions with their infants. It is possible that a mother's breastfeeding status represented a group difference that was as important as the teen-adult group differences observed. Indeed, it would be interesting to know whether breastfeeding mothers have a common nighttime parenting strategy regardless of maternal age, or whether maternal age ultimately influences maternal strategies above and beyond any specific feeding method. Unfortunately, the sample size did not permit me to break each group into sub-groups based on breastfeeding status, so it was not possible to answer this question with the present data set. The fact that so few teen mothers breastfed their infants suggests that maternal strategy strongly affects feeding methods, but the issue is an important one which deserves to be more thoroughly addressed in future studies. Likewise, it would have been important to understand how partner status relates to what happens for mothers and infants at night. Co-resident partners might serve to buffer maternal expenditure, thereby permitting mothers to tolerate a level of cost that they would be unable to sustain on their own, or they might otherwise alter nighttime parenting strategies by encouraging or discouraging certain practices or choices of infant sleep location. Partner status would have been interesting to include as another dichotomous variable, but again the sample size did not permit the partitioning of an already small number of dyads into separate sub-groups. Nighttime parenting behaviour

might likewise be affected by the influence of kin support networks or other sources of social support. Although these issues were not addressed here, they offer an interesting avenue for future research.

8.4.6 Reflections on the Behavioural Taxonomy

The behavioural taxonomy used in the present study was originally based on taxonomies used previously (McKenna, Mosko & Richard 1999; McKenna, personal communication, September 2002; Ball, personal communication, February 2004; Leech 2006). The selected behaviours were further refined based on an iterative process until the taxonomy reflected a balance between capturing all behaviours that were thought to be of interest, encompassing a broad array of behaviours since the taxonomy was designed for a sample in which not all significant behaviours were foreseen at the outset of the study, and being narrow enough to be of practical utility. This process was extremely lengthy and involved, but was ultimately necessary because there was no existing model appropriate to the research questions, behaviours of interest, and characteristics of the participants involved in the present study. The definitions of certain behaviours (e.g. sleep status) were limited to behavioural cues, and would have been more precise had they been coupled with physiological data collected concurrently. Likewise, in reviewing the taxonomy, it is clear that a few modifications would have been helpful and should be taken into consideration for all future projects. Research staff would have benefited from a more systematic approach to identifying what liquids (or in some cases, what substances) were present in the bottles that infants were given. The lack of specificity in this area resulted from a general assumption that mothers of 4-month old infants would either be breastfeeding their babies at the breast or feeding bottles which contained infant formula. The greater diversity of actual practices, which at various times involved breast milk, water, sugar water, or infant cereal administered in bottles, was not adequately anticipated and was therefore incompletely captured by the taxonomy. Additionally, looking back on the experience of conducting the sleep studies, it seems that the protocol that required intervention by research staff whenever infants were placed by their mothers in the prone position was not warranted. At the time of the sleep study, all infants had passed the peak risk for SIDS. Furthermore, it is highly unlikely that any of the mothers placed their infants in the prone position in the sleep lab if they did not do so at home, and in retrospect the intervention caused an excessive interruption to naturalistic behaviour in relationship to any actual risk posed to the infants.

Certain changes to the taxonomy also would have made the coding procedure more compatible with the structure and limitations of the Noldus Observer coding software. The taxonomy for the present study was designed to capture all relevant behaviours using as few behavioural categories as possible, and as many combinations of behaviours and modifiers as necessary. In retrospect, this produced an overly complicated output of data. Future studies using the Observer should separate behaviours into as many behavioural classes as necessary, and should employ very few modifiers in order to produce a more practical and manageable data set. For example, in the present study sleep-related risks to infants were captured within a single behavioural category titled "risk to infants." Within this behavioural class, the exact type of risk was specified, followed by a modifier indicating what material was causing the risk, followed by a second modifier indicating whether the infant was being exposed to a second type of risk concurrent with the first. Ultimately, the analytical process would have been far easier had the taxonomy involved a separate behavioural class for each type of risk (i.e. breathing, feeding, etc.) and within that class, included a separate code for every possible combination of risk and material. This format would also have removed the need for a modifier class related to secondary risks, since multiple types of risk could have occurred simultaneously if the risks did not belong to the same behavioural class.

Several other specific changes to the taxonomy would have also been helpful. The addition of items into an infant's sleep environment was coded as an event, again based on the assumption that once mothers structured their infants' sleep environment with whatever items they saw fit, these items were likely to remain in the infant's immediate sleep environment for the duration of the sleep period. The frequency with which items were added and subtracted and added again was not fully anticipated, and this made it more difficult to measure the amount of time infants spent in the presence of these materials. In the future, the use of additional soft bedding and other items should be captured as a behavioural state and not as an event. Finally, the overall lesson learned from using the Observer in this study was that the software is better suited to very limited taxonomies and very specific research questions. Although the broad capture of numerous behaviours was necessary for the present exploratory study, future studies would be wise to code video recordings multiple times for very select behaviours each time, rather than attempting to code all behaviours at once and thus producing a single comprehensive but cumbersome data set.

CHAPTER 9
FUTURE DIRECTIONS

The present study measured the nighttime parenting behaviours of first-time adolescent and adult mothers in order to better understand how the different life trajectories that determine timing of first reproduction also play out in terms of behavioural strategies that include parenting styles at night. The purpose of this undertaking was twofold. First, the thesis aimed to apply evolutionary theory to a novel aspect of human behaviour which had previously been examined only in a more limited context. The study was designed to evaluate the behavioural data against two theoretical models, and assess whether evolutionary perspectives on nighttime parenting behaviour had more predictive and/or explanatory value than the conventional wisdom that is often espoused in both academic and popular media. Second, the thesis aimed to determine whether an empirical study of nighttime parenting behaviour could add to the clinical literature about infant sleep and sleep-related risks in ways that could be of practical utility for clinicians and public health policy makers.

9.1 Summary

The findings of the study revealed that meaningful differences existed in the nighttime infant care practices of teen and adult mothers, and that nighttime parenting strategies are congruent with a larger reproductive and parenting strategy. The evolutionary perspective offered an organising principle for understanding why mothers engaged in the behaviours they did, and why the proximal care strategy evident among the teen mothers made sense in terms of life-history trade-offs. Furthermore, the evolutionary approach also helped explain the cost-reduction tactics necessitated by adolescent motherhood, but perhaps surprisingly this was accomplished through increased involvement with and proximity to infants rather than through serious reductions in caregiving practices. That teens found a way to reduce parent-infant conflict by bringing their own and their infants' needs in line with each other during the night was evidence of the dynamic nature by which life-history strategies are devised and implemented.

The conceptual framework used in the present study also highlighted the potential contributions of evolutionary models to understanding health-related risks. Among the sample included here, sleep-related risks to infants were affected by a mother's nighttime

parenting strategy. However, risks to infants were tolerated by mothers in both groups and across all sleeping-conditions, adding weight to the argument that public health messages must accommodate diverse practices since no demographic group and no sleeping arrangement is necessarily immune to infant sleep-related risks. The study further supports the notion that sleep environments can be made safe or unsafe based on maternal behaviour, and that such behaviours are ultimately informed by an individual's life-history strategy. The potential significance of this finding for clinical practice is that trade-offs are a specific reality for all mothers, and that such trade-offs must be an acknowledged part of any intervention programme design or public health campaign. Until the benefit to mothers of tolerating certain degrees of risk is understood, efforts to improve infant health and safety outcomes will not realise their full potential for impacting health-related behaviours.

The present study is offered as another example of the utility of research in evolutionary medicine for applied anthropology and empirically-based clinical practice. The expanded paradigm through which evolutionary medicine explores topics relevant to contemporary health patterns benefits from the complementary contributions of the social, biological and clinical sciences (Trevathan, Smith & McKenna 1999). Ultimately, this interdisciplinary and multi-method approach can contribute to more informed and effective public health policy. Life-history theory serves as an important organising principle for understanding nighttime parenting behaviour, and suggests that mothers and infants function as an intertwined system that is responsible for outcomes to both. By incorporating maternal needs and constraints into future programming, clinical practice can be made more congruent with the daily realities and complex decision-making processes of diverse groups of mothers. By meeting a mother where she is, rather than where singular health policies would want her to be, behaviours can be more strategically changed, and large-scale policies can begin to accommodate a wider array of parenting practices.

9.2 Implications for Health Policy

The present study has several implications for public health policies related to infant sleep. First, it supports the idea that one-size-fits-all approaches to health and behaviour are inappropriate, and provides an evolutionary rationale for explaining why this is the case. Because mothers arrive at parenting from very different life trajectories, and because each of these trajectories causes them to evaluate and tolerate parenting costs and

trade-offs in variable ways, it is incongruous to expect that they should all be encouraged to parent in a similar manner or to structure their infants' nighttime routines in a uniform way. It is worth noting that all parenting styles represent a balance between costs and risks, and prescribing what constitutes an acceptable level of risk is subjective. The life-history perspective offers an alternative paradigm for understanding maternal behaviour, and explains why nighttime caregiving patterns differ as a function of maternal resources, requirements, and constraints. This reinforces the findings of other researchers, who argue that because outcomes are context-specific, so too must recommendations be sufficiently elastic and/or tailored to specific populations to allow for the range of contexts within which infant care occurs (McKenna & McDade 2005).

By failing to address the contingencies that all parents must navigate, public policy has stagnated in key areas. For instance, Lahr, Rosenberg and Lapidus (2007) point out that efforts to eliminate bedsharing through distribution of cots are limited in their efficacy because they fail to recognise that factors beyond availability of alternative sleeping arrangements motivate bedsharing, and because they fail to acknowledge and incorporate diverse cultural norms. Life-history theory offers an organising principle for understanding why message exposure alone fails to reach certain groups, and suggests an alternative pathway for intervention based on an awareness of the needs of the dyad rather than the individual. Clinical discourse has been hindered by focusing on the identification of risk factors without undertaking parallel efforts to more fully understand in what contexts tolerating those risks might make sense. Devoting resources to educating parents about risk factors and discouraging them from engaging in those risky behaviours is essential, and has without doubt saved countless infant lives and significantly reduced the incidence of key threats to infant health and safety. However, there is concern about why specific populations continue to be disproportionately affected by sleep-related risks to infant health, and why message exposure has not been sufficient to bring about changes in parenting behaviours in these groups. I would suggest that ongoing efforts in this regard can be assisted by an evolutionary perspective that calls on researchers and clinicians to focus on maternal motives and discover exactly why some mothers disregard advice, why they are willing to tolerate certain risks to their infants, what benefits they receive from tolerating those risks, and what alternative strategies public health agencies might undertake to meet the needs of the mother in an alternative way that does not compromise infant safety. There is an assumption evident in the SIDS-reduction literature and elsewhere that certain mothers who assiduously follow "Reduce the Risk"

recommendations and other paediatric sleep advice can achieve a risk-free environment for their infants. However, the mothers in this study did not achieve risk-free infant sleep environments, and it may be that the assumption that mothers are able or willing to produce risk-free environments for their infants is unrealistic.

Another important contribution of the life-history perspective is that it highlights the fact that infant outcomes only make sense in light of maternal strategies, and that public health recommendations will be more effective whenever they are calibrated to work with rather than against maternal motives and strategies. The process of negotiating trade-offs, as defined by life-history theory, is a reality for parents which too few policies have adequately recognised. Indeed, even the most well designed and empirically-based recommendations, such as those related to SIDS-reduction strategies, will be ignored if the recommendations do not make sense and are not easily applied by an exhausted mother struggling to care for her infant in the middle of the night. It is therefore essential that the needs of both mother and infant be targeted in any intervention programming, since promoting certain outcomes for an infant without addressing the impact those outcomes might have on the mother will likely be of limited utility. Intervention programs should further acknowledge that mothers are necessarily working with a finite resource base, and manipulating them to operate in ever greater service to their infants without recognising their constraints will also likely prove ineffective.

The present study also offers some thoughts concerning contemporary debates over bedsharing. Ultimately, this ongoing debate over whether bedsharing is safe or desirable may be likely to produce diminishing returns. Simply put, bedsharing is a frequent occurrence, and a very essential component of nighttime caregiving strategies, particularly for select groups including breastfeeding mothers and adolescents. It is possible that public health campaigns might be more effective if they shifted their focus from preventing a behaviour that makes intuitive sense for very diverse groups of mothers, to attempting to find new and more creative ways to promote and ensure infant safety within the environments to which infants are actually exposed. By acknowledging the utility of a wider range of maternal strategies, clinicians will be better positioned to assist mothers in providing safe and effective care for their children. From there, efforts can be made to help shift the micro-behavioural aspects of specific sleep environments to support and enhance infant safety without unintentionally increasing maternal costs beyond what maternal 'systems' can tolerate.

9.3 Directions for Future Research

The theoretical perspective presented here suggests a number of fruitful avenues for future research. One interesting direction for life-history research will be to examine how maternal strategies vary in relation to high-risk categories of infants. For instance, pre-term, sick, or low birth-weight infants require higher parental expenditure because of their compromised health and developmental status (e.g. Bereczkei 2001; Soltis 2004), and mothers of these infants should therefore be predicted to weigh the costs and benefits of nighttime parenting differently than mothers of healthy, full-term infants. Those individuals who are unable to tolerate these additional costs will likely be at increased risk for adverse outcomes, and life-history theory offers a useful tool for predicting which parents under which circumstances will or will not be able to tolerate increased parental burden. Similar research could be conducted on parents of twins, who also navigate disproportionate costs. Previous research has shown that parents engage in deliberate strategies to reduce the cost of caring for twins at night (Ball 2007c; Ball 2006b), and an expanded perspective on nighttime parenting strategies using life-history theory can further develop this line of inquiry, identifying behavioural strategies that ameliorate maternal burden and exploring the outcomes associated with these strategies.

Clinical practice can also benefit from ongoing research using life-history theory. First, clinical discourse should begin to accommodate the view that health problems and risk-taking are rarely the result of random or aberrant behaviour. Rather, an evolutionary perspective would suggest that risk-taking is typically borne of rational strategies for optimising outcomes within a particular socioenvironmental context, even if the rationale is initially unclear and the 'optimal' outcomes are considered relatively poor or undesirable. Recognising that behavioural strategies can be rational even when they produce undesirable outcomes might fruitfully be used to shape future research agendas and to guide the development and implementation of intervention policies. Ongoing research in this vein will likely further illuminate the potential applications of life-history research. For example, a recently completed study examining birth outcomes in a contemporary hospital setting proposes a conceptual model for understanding why early cessation of breastfeeding might occur using cost-benefit analyses (Klingaman 2009).

To add to the findings presented here, it will be important and clinically useful to understand how adolescent and adult parenting strategies change over time, and whether the way mothers negotiate trade-offs related to infant care is different at various time

points. A longitudinal perspective on nighttime parenting strategies would expand existing discourse on how maternal strategies relate to infant and child outcomes, and where, how, and why risk factors that contribute to poor outcomes are introduced. It would also be important to know how maternal strategies and life-history trade-offs play out for other groups of high-risk parents. For example, mothers who smoke, use drugs or alcohol, or those who are clinically depressed might all have differing sets of priorities and might perceive different trade-offs as appropriate. Certainly, it would be important to understand why maternal needs are such that the significant risk posed to infants by exposure to cigarette smoke is a tolerated aspect of an individual's reproductive strategy (Anderson et al. 2002). Likewise, mothers who are clinically depressed may have fewer resources than mothers who are not depressed, and therefore may be less able to tolerate elevated parenting costs and may be more in need of engaging in cost-cutting measures. Various groups of high-risk mothers may be prioritising maternal over infant needs in different ways or to differing degrees, and understanding how specific maternal characteristics shape fitness maximisation strategies will be an important avenue for future research.

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APPENDIX I:
SLEEP STUDY CONSENT FORM

Parenting for the First Time Project

Mother-Baby Behavioral Sleep Laboratory
103 Reyniers Building
Notre Dame, IN 46556
574-631-5919

Center for Children and Families
1602 North Ironwood
South Bend, IN 46635
574-631-0959

Research Consent Form

As a part of the 'Parenting for the First Time' project, we would also like to learn more about parenting at night. We'd like to tell you more about this part of our project and hope you will be interested in being part of it.

What do we want to learn in this study?

You are invited to participate in a study that will document the diverse ways in which parents organize and arrange nighttime sleeping arrangements for themselves and their children. Before visiting the sleep lab, you will be asked to answer some questions regarding your usual nighttime sleeping 190ehaviour and will be asked to keep a sleep and feeding log for **one week** which reports where your baby was sleeping at different parts of the night, and how (if at all) and when the babies were fed during the night. Some of the interview questions will be aimed at understanding how you think about and evaluate your infant's sleep, in relationship to your own sleep and the sleep of other members of your family. We will, with your permission, contact you in a few months to inquire as to whether your nighttime sleeping practices have changed or varied since your laboratory visit and whether you would be interested in another visit to the sleep laboratory. While in the laboratory, we may ask you to clarify some of your responses to the questions we asked previously—or ask you questions about your sleep and feeding logs.

What does this study involve?

You will be asked to arrive at the sleep laboratory sometime before 9:00 PM, and you can retire to bed at your usual time. You are agreeing to spend the evening sleeping in the Mother-Baby Behavioral Sleep Laboratory at the University of Notre Dame with your infant, and by signing below, are agreeing to be video recorded continuously by cameras mounted in the ceiling. If your baby sleeps in his/her own room in the lab, you are giving permission for the baby to be video taped as well. You should be aware that infra red video recording devices are positioned above your head and run continuously while you are asleep. We also have a video camera in the lounge area that is used to record general mother-baby interactions. By signing below you are giving permission to use these behavioral observations to conduct scientific analysis. Some of those scientific purposes may include showing select portions of those tapes to scientists including medical audiences interested in sleep research and/or child development. The tapes are of a quality that does not mostly permit individual recognition, but nevertheless, occasionally, on some tapes, it is possible for an individual to be identified. Also, some black and white photos will be made for purposes of publications. But no photos of you (or your infant) will be published from the study without your advance written consent.

The videotapes of you and your infant's sleep behavior may, at some future date, be shared by other scientists. However, any information that is obtained with this study and that could identify you will remain confidential and will be disclosed only with your permission.

How will we protect your privacy?
You may feel that some of this information is very personal. We consider everything you tell us and that occurs in the sleep laboratory to be strictly confidential, and so we will protect your privacy in several ways. First, all of our records for your family, including video-tapes, will be identified by special code numbers – only the members of the research staff will have your names. When we report the results of this study, you and your child will never be named or identified in any other way.

If you agree to participate, can you change your mind later?
Of course, you are free to leave at any time should you feel uncomfortable in the laboratory environment, for any reason.

Are there any risks associated with this project?
There is no added risk, or known risks, of sleeping in the laboratory compared with the risks of sleeping at home. The experience will be similar to spending the evening in a hotel room, except for the video recording and the interviews. There will be no manipulation of the environment, or experiments performed on you or your baby, other than simply recording nighttime behavior. **But should you or your baby become sick, injured or experience a catastrophic medical event leading to death or serious injuries during your sleep in the laboratory, you agree not to hold the University of Notre Dame responsible.**

What are the benefits of being a part of this research project?
You will receive compensation for the completed night study in the form of a $50 gift certificate to Wal-Mart. The overnight sleep study contributes to scientific knowledge of how parents feed, nurture and take care of their babies during the night. Medical, psychological and social scientists, and especially parents, will benefit from the knowledge derived from these studies

We will do our best to answer any questions you might have now or at any time during the study – even after the study is finished. Please feel free to call us at the numbers listed below.

We hope you will decide to be part of our project, and that it will be a good experience for you and your child. If you would like to participate, please sign below. Thank you very much.

Sincerely,

Dr. James J. McKenna	Lane Volpe	Dr. John Kubinski
574-631-3816	574-631-6327	574-631-5919

You are making a decision about whether or not to participate. Your signature indicates that you have decided to participate, having read the information provided above and having had a chance to ask questions. You will be given a copy of this form to keep. Your decision about whether or not to participate will not prejudice your future relations with the University of Notre Dame. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

By signing this, I verify that I have received a copy of this consent form to keep.

_____ Birth date _____
Name of Participant (please print clearly)

_____ Date signed _____
Participant's Signature (or signature of legal guardian if participant is less than 18 years old)

APPENDIX II:
POST-SLEEP QUESTIONNAIRE

1. How many times did your baby wake up last night? _____

2. How many times did you wake up last night? _____

3. How many times did you feed your baby last night? _____

4. How long did you spend feeding your baby last night? (approximate total minutes) ___

_____

5. About how long was each feeding session, in minutes? _____

6. Compared to the average night at home, was last night's feeding:

_____less than _____about the same _____more than ____much more than usual

7. How would you describe the amount of your sleep last night:

_____less than usual _____ about the same as usual _____more than usual

8. How would you describe the amount of your baby's sleep last night:

_____less than usual _____ about the same as usual _____more than usual

9. Overall, how would you describe your sleep experience in the lab?
(1 is not satisfied at all, and 5 is very satisfied)

1	2	3	4	5
not satisfied at all				**very** satisfied

THANK YOU FOR PARTICIPATING IN THIS STUDY!!

APPENDIX III: BEHAVIOURAL TAXONOMY

Mother-Baby Behavioral Sleep Lab
University of Notre Dame
"Predicting and Preventing Child Neglect in Teen Mothers" Project

Configuration Review:
"Sleep Lab Full Taxonomy 20(1)newiv"

Location
D:\Documents and Settings\All Users\Noldus\The Observer\Workspaces\Projects\Sleep Lab Full Taxonomy 20(1)newiv.opp,.ocp,.opd

Observation recorder: PC

I. Description

Settings

Setting	Value
Recording method	Continuous
Automatically generate key codes	No
Case sensitive	Yes
Duration of Observation	Open Ended

Independent Variables

Number of Independent Variables: 5

Independent Variable Name	Type	Values
Participant Number	Numeric	0 to 9999
Date of Sleep Study	Nominal	(None) (...Add while scoring)
4 or 8 month Sleep Study	Numeric	4 to 8
Audio	Nominal	(None) (...Add while scoring)
Teen or Adult	Nominal	teen adult (...Add while scoring)

Subjects

Participants were all first-time mothers, and were divided into two sub-samples: adolescent mothers who were 15-18 years of age at childbirth,

and high-education adult mothers who were 22-35 years of age at child birth and who had completed at least 2 years of a 4-year college degree.

Number of Subjects: 3

Subject Name	Code
Missing subject	?
Mom	M
Infant	I

Element Descriptions:

Subject Name	Description
Missing subject	
Mom	Mother
Infant	Infant

II. Behaviors

Number of 194behavioural classes: 16

Behavioral Class 1: Inf. Sleep State

Type: Nominal
Number of Elements: 4

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Awake	Sia	State	(None)	(None)
Appears Asleep	Sis	State	(None)	(None)
Indeterminate	SIX	State	(None)	(None)
No Sleep Data	SIN	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
Awake	Subject is clearly awake. Behavioral indicators of being awake include having eyes open, body movement, vocalizations, being engaged in an activity.
Appears Asleep	Subject is physically inactive and appears to be asleep, with eyes closed. Certain behavioural classes were considered mutually exclusive with being asleep. For example if infants were feeding they were automatically coded as being awake.
Indeterminate	Subject is in sight but it is not possible to determine sleep state, i.e. when subjects are off camera for more than five minutes.
No Sleep Data	No Data is available about sleep. Use as default setting for missing data, i.e. when video is shut off, or when equipment failure caused an interruption in video capture.

Behavioral Class 2: Mom Sleep State

Type: Nominal
Number of Elements: 4

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Mother Awake	Sma	State	(None)	(None)
Moth App. Asleep	SMs	State	Mom Bedsharing	Mom Slp Orient.
Moth Indeterm	SMX	State	(None)	(None)
Moth No Slp Data	SMN	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
Mother Awake	Subject is clearly awake.
Moth App. Asleep	Subject is physically inactive and appears to be asleep, with eyes closed. When mothers were coded as asleep, we also coded (as modifiers 1 and 2) whether the mother was bedsharing with her infant, and if so, whether she was oriented toward or away from her infant. With regard to feeding behaviours, both breastfeeding and bottle feeding mothers were coded as awake while they began a feeding session and situated their infants to feed. However, while infants could not simultaneously be asleep and feeding, mothers, including breastfeeding mothers, were coded as asleep during feeding sessions if they displayed the behavioural indicators of being asleep. Mothers who were interacting with their infants,including affectionate interactions, were coded as awake.
Moth Indeterm	Subject is in sight but it is not possible to determine sleep state, i.e. when subjects are off camera for more than five minutes.
Moth No Slp Data	No Data is available about sleep. Use as default setting for missing data, i.e. when video is shut off or when equipment failure caused an interruption in video capture.

Behavioral Class 3: Proximity

Type: Nominal
Number of Elements: 4

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Same Room	Psr	State	Rel. Distance	(None)
Different Room	Pdr	State	(None)	(None)
Indeterminate Pr	PX	State	(None)	(None)
No Proximity Dat	PN	State	(None)	(None)

Element Descriptions:

Behavior Name	Description

Same Room	Infant is in same room as mother. In this case, we elaborated on the proximity between mother and infant by describing the relative proximity between the two (modifier 1) to clarify whether they were in direct contact, within the mother's arms reach of each other, or beyond the mother's arms reach of each other.
Different Room	Infant is in a different room from mother.
Indeterminate Pr	Indeterminate Proximity.
No Proximity Dat	No Proximity Data is available. Use as default setting for missing data, i.e. when video is shut off.

Behavioral Class 4: Inf Slp Position

Type: Nominal
Number of Elements: 8

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
CUPI	SPc	State	Relative HP	Slp. Orientation
Supine	SPs	State	Relative HP	Slp. Orientation
Prone	SPp	State	Relative HP	Slp. Orientation
Lateral	SPl	State	Relative HP	Slp. Orientation
Held	SPh	State	Slp. Orientation	(None)
Indeterm Pos.	SPX	State	(None)	(None)
No Pos. Data	SPN	State	(None)	(None)
N/A Inf Slp Pos.	Sna	State	(None)	(None)

Element Descriptions:
All infant sleep position codes included modifier codes stating where the baby's head was in relation to the mother's body (i.e. at waist,breast, shoulder, head level) if the infant was bedsharing. If the infant was not bedsharing, relative head position was coded as not applicable. The infant sleep position codes were further elaborated by modifier 2, which captured whether the infant was oriented toward or away from the mother while bedsharing. If the infant was not bedsharing, sleep orientation was coded as not applicable.

For bedsharing infants who were held, their sleep orientation (either toward or away from the mother) was coded as not applicable. For bedsharing infants who were held relative head position was not coded.

Behavior Name	Description
CUPI	Curled Up Protecting Infant. Infant is sleeping in a space created by the mother's body, where the mother is lateral/supine and is forming a sleep space for infant w/ her arms and/or legs partially encircling or enclosing the infant. CUPI is coded regardless of whether the infant is

	supine or lateral within the sleep space created by the mother's body. However, if the infant is prone within this sleep space, the infant is coded as prone rather than CUPI.
Supine	Infant is lying supine (on back).
Prone	Infant is lying prone (on front).
Lateral	Infant is lying on left or right side, with one shoulder completely off the sleep surface.
Held	Infant is held in mother's arms or is on mother's body while sleeping. The majority of the infant's body is off the sleep surface, and is fully on the mother's body.
Indeterm Pos.	Indeterminate Position. Subject is in sight but it is not possible to determine sleep position.
No Pos. Data	No Position Data is available. Use as default setting for missing data, i.e. when video is shut off.
N/A Inf Slp Pos.	Infant Sleep Position is Not Applicable because the infant is not asleep.

Behavioral Class 5: Risk to Infant

Type: Nominal
Number of Elements: 10

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Breathing Risk	Rbr	State	Risk Material	SecondaryRisk
Overheating Risk	Rov	State	Risk Material	SecondaryRisk
Falling Risk	Rfl	State	Risk Material	SecondaryRisk
Entrapment Risk	Ret	State	Risk Material	SecondaryRisk
Feeding Risk	Rfd	State	Risk Material	SecondaryRisk
Punitive Behav.	Rpu	State	Secondary Risk	(None)
Behav. Rejection	Rbj	State	Secondary Risk	(None)
None	Rno	State	(None)	(None)
Other Risk	RO	State	Risk Material	SecondaryRisk
No Risk Data	RN	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
Breathing Risk	Breathing Risk. Situation where infant's breathing may be compromised, i.e nostrils and/or mouth covered or obstructed by bedding or other material; or a situation in which the infant is at risk of choking, on food/liquid or other objects placed in the mouth.
Overheating Risk	Overheating Risk. Situation where infant may become overheated by excessive blanketing, clothing, etc.

Falling Risk Situation where infant is at risk of falling, i.e. on extreme edge of bed or sofa.

Entrapment Risk Situation where all or part of the infant's body may become trapped, i.e. between mattress and headboard.

Feeding Risk Feeding Related Risk. Situations in which the infant is fed an inappropriate substance(e.g. juice, soda, sugar water, water) or is being fed in a manner that is inappropriate or ineffective (e.g. being fed cereal through a bottle)

Punitive Behav. Punitive Behavior. Mother engages in harsh or punitive behavior, including vocalizations with increased volume or intensity, hitting, spanking, etc.

Behav. Rejection Behavioral Rejection. Mother displays no affective response, is disengaged from infant and/or actively rejects infant's attempt to engage/make contact.

None No risk situation is taking place.

Other Risk Any other risk situation (specify in notes).

No Risk Data No Risk Data is available. Use as default setting for missing risk data, i.e. when video is shut off.

Behavioral Class 6: Infant Crying

Type: Nominal
Number of Elements: 4

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Crying	Ccy	State	(None)	(None)
Not Crying	Cnc	State	(None)	(None)
Indeterm Cry	CX	State	(None)	(None)
No Cry Data	CN	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
Crying	Infant is visibly/audibly engaged in a sustained cry, lasting for at least 5 consecutive seconds. Visible cues of crying included: infant mouth wide open, limbs may become rigid or limb movement may increase, eyes are often closed and facial expression is grimacing. Other visible cues of crying included the mother's behaviour, such as increased attention and alertness, attending to baby in an attempt to soothe the infant, or quickly entering the room where the baby is and interacting with the infant in an attempt to soothe the infant. Infants who were coded as crying were necessarily considered awake and coded accordingly. Crying and feeding were

also considered mutually exclusive, and infants who were crying were necessarily coded as not feeding. Crying bouts were considered distinct episodes if they were denoted by pauses of at least five seconds where there was no crying.

Not Crying Infant is visibly/audibly not engaged in a sustained cry.

Indeterm Cry Indeterminate Crying. Infant is visible and audio is available but it is not possible to determine if infant is crying. Also, if the infant was fully visible but the audio capture was compromised (i.e. low or no sound) this code was used when the infant's behavior (as described above) indicated that a crying episode was taking place.

No Cry Data No Crying Data is available. Use as default setting for missing data, i.e. when video is shut off.

Behavioral Class 7: Feeding Type

Type: Nominal
Number of Elements: 8

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Breastfeeding	Fbr	State	(None)	(None)
Bottle Feeding	Fbt	State	Who Feeds Bottle	(None)
Spoon/ Hand Feed	Fsp	State	(None)	(None)
Inf Attempt Feed	Fia	State	Feed Substance	(None)
Mom Attempt Feed	Fma	State	Feed Substance	(None)
Not Feeding	Fnf	State	(None)	(None)
Appears to Feed	Fap	State	Feed Substance	(None)
No Feed Data	FN	State	(None)	(None)

Element Descriptions:

Behavior Name **Description**

Breastfeeding Infant is latched on to mother's breast and appears to be actively feeding. Behavioral indicators of breastfeeding included being latched onto the breast, infant jaw and mouth making sucking and/or swallowing movements. Once these behavioral cues ceased, the breastfeeding session was considered terminated even when the infant remained latched onto the breast. A breastfeeding session was considered a distinct episode if it was separated from any other breastfeeding by at least five minutes during which there was no feeding.

Maternal behavioral cues that indicated the termination of a breastfeeding session included removing the infant from the breast, altering her clothing and/or body position to signal the end of a feeding session.

Bottle Feeding Infant is sucking on bottle and appears to be actively feeding. Behavioral indicators of bottle feeding include an infant having a bottle in his or her mouth, making sucking/and or swallowing movements with his or her mouth and jaw, being awake, liquid being visible in the bottle, and either the mother's hands or the infant's hands holding the bottle. A bottle feeding session was considered a distinct episode if it was separated from any other bottle feeding by at least five minutes during which there was no feeding.

Bottle feeding behavior is elaborated on by modifier 1, which specifies whether the mom is conducting the feeding session or whether the baby is managing its own bottle feeding session either by holding own bottle, or sucking off a bottle that has been propped on bedding, in carseats, etc. with no assistance from the mother and usually while not in contact with the mother.

Spoon/ Hand Feed Infant is being fed cereal or other foods on a spoon or by hand (specify type of substance in notes).

Inf Attempt Feed Infant Attempted Feed. Infant is attempting to feed but is not ingesting anything, i.e. infant attempts to self-feed from an empty bottle, or infant is rooting for the mother's breast but does not latch on. The material the infant is trying to obtain during an infant attempted feed is coded as modifier 1, feeding substance, i.e. formula, juice, breastmilk, water, solid foods, etc.

Mom Attempt Feed Mother Attempted Feed. Mother offers to feed infant but is not successful, i.e. infant rejects food, is not interested in feeding. The material the infant is trying to obtain during a mother attempted feed is coded as modifier 1, feeding substance, i.e. formula,juice, breastmilk, water, solid foods, etc.

Not Feeding Infant is not feeding.

Appears to Feed Visual or auditory cues strongly suggest that the infant is feeding, but this cannot be confirmed by audio/video, i.e. view of infant is obscured by bedding, etc. The material the infant is trying to obtain during an apparent feed is coded as modifier 1, feeding substance, i.e. formula, juice, breastmilk, water, solid foods, etc.

No Feed Data No Feeding Data is available. Use as default setting for missing data, i.e. when video is shut off.

Behavioral Class 8: Sleep Location

Type: Nominal

Number of Elements: 12

Note: all codes for Infant Sleep Location were further described in terms of the type of surface the infant was sleeping on. These included: Mattress, Pillow, Pillow/Mattress, Mother, Sofa Cushions, Floor, Carseat/Carrier, Other. If mother was coded, the infant necessarily had to be bedsharing, and the proximity code was necessarily coded as Same Room, In Contact. Can't code mother as sleep surface if baby is in crib or bassinette. So, all of the above modifiers don't necessarily apply to every possible sleep location.

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Crib Sep. Room	Lcr	State	Surface Type	(None)
Bass. Same Room	Lba	State	Surface Type	(None)
Alone Adult Bed	Lab	State	Surface Type	(None)
Bedsharing	Ltb	State	Surface Type	(None)
Sofa	Lsf	State	Surface Type	(None)
Sofa w/ M Asleep	Lsm	State	Surface Type	(None)
Floor	Lfl	State	Surface Type	(None)
In Mother's Arms	Lma	State	Surface Type	(None)
Carrier/Car Seat	Lcs	State	Surface Type	(None)
Other Location	LO	State	(None)	(None)
No Location Data	LN	State	(None)	(None)
N/A Slp Location	Lna	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
Crib Sep. Room	Full-sized wooden crib in separate room.
Bass. Same Room	Bassinette Same Room. Stand alone unit in bedroom near adult bed (roomsharing).
Alone Adult Bed	Alone on Adult Bed. Infant is sleeping in full sized adult bed while mother is not in the bed, and while mother may or may not be in the same room with the sleeping infant.
Bedsharing	In bed with mother. Infant is sleeping in full sized adult bed alongside mother. Mother may or may not be asleep.
Sofa	Infant is asleep on sofa in lounge while mother is awake. Mother may or may not be on the sofa with the infant.
Sofa w/ M Asleep	Sofa with Mother Asleep. Infant and mother are both asleep on sofa.
Floor	Infant is asleep on floor.
In Mother's Arms	Infant is sleeping in mother's arms, i.e. in her arms, on her lap, lying on her body, etc.
Carrier/Car Seat	Infant is sleeping in carseat, bouncy chair, etc.

Other Location Other Sleep Location (specify in notes).

No Location Data No Location Data is available. Use as default setting for missing data, i.e. when video is shut off.

N/A Slp Location Sleep Location is Not Applicable. Infant is not asleep.

Behavioral Class 9: Mod. Slp. Envir.

Type: Nominal
Number of Elements: 8

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Added to crib	Acb	Event	What add/remove	(None)
Added to bass.	Abs	Event	What add/remove	(None)
Added to ad. bed	Aab	Event	What add/remove	(None)
Added to mom	Amo	Event	What add/remove	(None)
Added to couch	Aco	Event	What add/remove	(None)
Other (Add note)	Aot	Event	What add/remove	(None)
Item removed	Are	Event	What add/remove	Mod. sleep env.
Locat. rem. from	Arl	Event	Item remove from	(None)

Element Descriptions:

Behavior Name	Description
Added to crib	Normal sleep environment of crib modified by bedding or other items. Normal sleep environment consisted of a tight-fitting mattress covered by a tight-fitting sheet. Any additional items, including blankets, toys, etc. were coded as being added to the crib environment. There were no bumper pads, pillows,toys or blankets of any kind already in the crib, although two baby blankets were available in the sleep lab for mothers to use with their infants.
Added to bass.	Normal sleep environment of bassinette modified by bedding or toy. Normal sleep environment consisted of an "Arms-Reach Cosleeper" with the sleep surface set to the lowered position to accommodate infant weight above 15 pounds. The bassinette had a thin mattress covered in a tight-fitting sheet, and the sides of the bassinette were a mesh material. Any additional items, including blankets, toys, etc. were coded as being added to the bassinette environment. There were no bumper pads, pillows, toys or blankets of any kind already in the bassinette, although two baby blankets were available in the sleep lab for mothers to use with their infants.
Added to ad. bed	Normal sleep environment of adult bed modified by additional bedding or toy. Normal sleep environment consisted of a full-sized standard

	bed with headboard, with a fitted and flat sheet, blanket, and a thin bedspread (not a comforter or duvet), plus two standard-sized pillows covered by pillowcases. An additional standard-sized pillow was available in the sleep lab for mothers to use, but was not kept in the bedroom.
Added to mom	Normal sleep environment of mom modified by bedding or other items. Normal sleep environment consisted of mother's body with clothes. Any items she was holding, or blankets used to swaddle or cover the infant, were considered added items.
Added to couch	Normal sleep environment of couch modified by bedding or toys. Normal sleep environment consisted of a small sofa with two small throw pillows.
Other (Add note)	Normal sleep environment of other arrangement (primarily using a car seat) modified by bedding or toy.
Item removed	Sleep environment modified by removing additional bedding or toy. This event was further clarified with modifier 1, specifying what item was added or removed, then modifier 2, specifying whether the sleep environment still had modifications, or whether it had returned to its normal condition.
Locat. rem. from	Sleep location the item was removed from.

Behavioral Class 10: TV Usage

Type: Nominal
Number of Elements: 2

Note: television use was coded for a twenty-minute segment of the pre-sleep period only, from 5 minutes after the start of the sleep study (00:05:00.00 timestamp) to 25 minutes after the start of the sleep study (00:25:00.00 timestamp).

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
TV is ON	ON	State	TV Usage	(None)
TV is OFF	OFF	State	(None)	(None)

Element Descriptions:

Behavior Name	Description
TV is ON	Television in the lounge is on. If tv was on, additional information in modifier class 1 was coded to include whether the mom was actively watching the tv, in the same room as the television but passively watching the tv (i.e. her primary focus was not on the tv), or whether she was out of range of the tv (i.e. in a different room and not watching the tv).

TV is OFF	Television is off. This behavior was coded if the television was off during the twenty-minute coding segment, and was then used as the default setting for the remainder of the sleep study after 00:25:00.00 regardless of actual tv use.

Behavioral Class 11: Affectionat.Care

Type: Nominal
Number of Elements: 1

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Affectionat.Care	AFF	Event	(None)	(None)

Element Descriptions:

Behavior Name	Description
Affectionat.Care	Includes maternal kissing, patting, rubbing, rocking, tickling, caressing, peek a boo, and other affectionate gestures. Affectionate care was not coded if mom was reading books, or playing with toys or stuffed animals. Affectionate care was coded in ten second increments (i.e. each event lasted less than or equal to ten seconds). If the mother was engaging in these behaviors as a response to her infant's crying, then these behaviours were coded as "response to cry" and not as affectionate care. Once the infant stopped crying, if the mother continued to engage in these behaviour they were then coded as affectionate care. Mothers had to be coded as awake in order to be coded as engaging in affectionate care, but infant sleep state was not a factor in the coding of affectionate care (i.e. a mother could display affectionate behavior toward her sleeping infant).

Behavioral Class 12: Tech Interfere

Type: Nominal
Number of Elements: 2

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Tech Interfere	Tiy	Event	(None)	(None)
No Interference	Tin	Event	(None)	(None)

Element Descriptions:

Behavior Name	Description
Tech Interfere	Technician Interference. Technician intervenes in such a way as to affect or alter mom's or infant's behavior (specify in notes). This included interventions where the technician responded to a real, potential, or perceived threat to the infant's safety. Examples included

	technician requesting that the mom reposition the infant from prone to supine, or technician alerting mother that blankets were covering the infant's face. Specific descriptions were included in the notes section of the data file.
No Interference	No technician interference. This was used as the default setting for the duration of sleep studies, except in the instances described above.

Behavioral Class 13: Prone Initiator

Type: Nominal
Number of Elements: 3

This behavioral class was coded in conjunction with the "Infant Sleep Position" behavioral class, so Prone Initiator was only coded when infants were asleep. Infant body position while awake was not coded.

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Mom initiator	Pim	Event	(None)	(None)
Infant initiator	Pii	Event	(None)	(None)
Indeter. initiat	PIX	Event	(None)	(None)

Element Descriptions:

Behavior Name	Description
Mom initiator	Mom places baby in the prone position while the infant is asleep.
Infant initiator	Infant positions self in the prone position while asleep.
Indeter. initiat	Indeterminate initiator. Initiator of infant prone sleeping position cannot be determined(i.e. when camera is not positioned correctly, or when mom and baby are off camera for a brief time).

Behavioral Class 14: Response Type

Type: Nominal
Number of Elements: 10

All of these behaviors were coded in ten second increments (i.e. each behaviour lasts less than or equal to ten seconds). Once infant crying was resolved, these behaviours were no longer coded even if the mom continued to engage in these behaviors. The events in this behavioural class were not considered mutually exclusive, and maternal response to crying usually did take more than one form. In these cases, all forms of response to cry were coded as appropriate.

Behavior Name	Code	Type	Modifier Class 1	Modifier Class 2
Hold/Pick-Up	RTh	Event	(None)	(None)
Contact	RTc	Event	(None)	(None)
Feed	RTf	Event	(None)	(None)
Vocal response	RTv	Event	(None)	(None)
Give Object	RTg	Event	(None)	(None)
Passive Response	RTp	Event	(None)	(None)

Mixed Response	RTm	Event	(None)	(None)
Mix Resp. w/Feed	RTw	Event	(None)	(None)
Other Response	RTO	Event	(None)	(None)
No Response	RTn	Event	(None)	(None)

Element Descriptions:

Behavior Name	Description
Hold/Pick-Up	Mother holds or picks up infant.
Contact	Mother makes contact with infant including any form of physical contact, such as rubbing, patting, caressing, kissing, etc.
Feed	Mother initiates a feeding session.
Vocal response	Mother vocalizes to infant.
Give Object	Mother gives object to infant, such as toy, pacifier, stuffed animal, etc.
Passive Response	Mother responds indirectly to infant. Can include eye contact, visual inspection, or increased frequency of monitoring.
Mixed Response	Mixed response involving picking up infant, maternal vocalizations, and/or give object. (Note to researchers: Check data set to see if we ever used this code and if not, remove it from the taxonomy).
Mix Resp. w/Feed	Mixed Response with Feed. Mixed response plus initiates a feeding session. (Note to researchers: Check data set to see if we ever used this code and if not, remove it from the taxonomy).
Other Response	Other response type (specify in notes).
No Response	Mother does not respond to infant. (Note to researchers: Check data set to see if we ever used this code and if not, remove it from the taxonomy).

III. Modifiers

Number of modifier classes: 15

Modifier Class 1: Rel. Distance

Type: Nominal
Number of Elements: 4

Modifier Name	Code
Missing modifier	?

In Contact	Dic
Within Mom's Arm	Dwl
Beyond Mom's Arm	Dbl

Element Descriptions:

Modifier Name	Description
Missing modifier	
In Contact	Mother and infant are touching/ in physical contact.
Within Mom's Arm	Infant is not touching mother but is approximately within an arm's length of the mother (the mother's arm).
Beyond Mom's Arm	Infant is not touching mother, but is in the same room as the mother and is beyond an arm's length of the mother.

Modifier Class 2: Slp. Orientation

Type: Nominal
Number of Elements: 4

Note: Head position/orientation was determined after the infant had settled into a specific position (i.e. not moving head continually back and forth). Once head was settled in a position for at least 3 seconds, that position was coded as the sleep orientation.

When infant's head position seemed completely neutral (i.e. neither oriented toward or away from the mother, but rather directly facing up at the ceiling), no change in the infant's orientation was coded and the last head position remained in effect.

Modifier Name	Code
Missing modifier	?
Infant Face Mom	Oif
Infant Face Away	Oia
N/A Inf Slp Orie	Oix

Element Descriptions:

Modifier Name	Description
Missing modifier	
Infant Face Mom	Infant is bedsharing with mother, and infant's head and face are oriented toward the mother.
Infant Face Away	Infant is bedsharing with mother, and infant's head and face are oriented away from the mother.
N/A Inf Slp Orie	Infant sleep orientation towards the mother is not applicable, either because a)the infant is not bedsharing, or b) because the infant is bedsharing but the infant's body position is perpendicular to mother's body or the infant is

being held by the mother. This code was used as the default code for when the infant is awake.

Modifier Class 3: Relative HP

Type: Nominal
Number of Elements: 7

Note: relative head position was coded based on where the infant's eye level was in relation to the mother's body. When the infant was in between levels, the closest applicable level was coded. This modifier class was only coded for bedsharing infants. However, for bedsharing infants who were held by the mother, relative head position was not coded.

Modifier Name	**Code**
Missing modifier	?
Mother's Face	HPf
Mother's Should.	HPs
Mother's Breast	HPb
Mother's Waist	HPw
Other	HPO
N/A Head Pos.	HPn

Element Descriptions :

Modifier Name	**Description**
Missing modifier	
Mother's Face	Infant's eyes level with mother's face.
Mother's Should.	Infant's eyes level with mother's shoulder.
Mother's Breast	Infant's eyes level with mother's breast.
Mother's Waist	Infant's eyes level with mother's waist.
Other	Other Head Position (specify in notes). There were occasions where the infant was higher in the bed than the mother, or so low in the bed in relation to the mother's body, that the "other" head position was coded and then described in the notes section.
N/A Head Pos.	Not Applicable. This code was used when the infant was not bedsharing, or when the infant was being held by the mother while bedsharing. This code was also the default code used when the infant was awake.

Modifier Class 4: Risk Material

Type: Nominal
Number of Elements: 13

Modifier Name	**Code**
Missing modifier	?
Blanket	RMb
Pillow	RMp

Toys	RMt
Mother's Arm	Rma
Clothing	RMc
Food or Liquid	RMf
Mother's Hair	RMh
Sofa Cushion	RMs
Mattress	RMm
Indeterm Risk	RMX
Other	RMO
N/A Material	RMn

Element Descriptions:

Modifier Name	Description
Missing modifier	
Blanket	Blanket.
Pillow	Pillow.
Toys	Toys or stuffed animals.
Mother's Arm	Mother's arms or legs.
Clothing	Clothing.
Food or Liquid	Food or Liquid.
Mother's Hair	Mother's hair.
Sofa Cushion	Sofa Cushion
Mattress	Mattress
Indeterm Risk	Indeterminate Risk. Subject is in sight but it is not possible to determine risk material.
Other	Other Risk Material (speficy in notes).
N/A Material	Risk Material is Not Applicable. This code was used when the type of risk taking place did not involve a material. This code was used as the default code when no risk situation was present.

Modifier Class 5: Secondary Risk

Type: Nominal
Number of Elements: 9

Modifier Name	Code
Missing modifier	?
Breathing Risk	R2b
Overheating Risk	R2o
Falling Risk	R2f
Entrapment Risk	R2e
Punitive Behav.	R2p
Behav. Rejection	R2j
Other	R2O
N/A Second Risk	R2n

Element Descriptions:

Modifier Name	Description
Missing modifier	
Breathing Risk	Infant breathing at risk, nostrils/mouth may be covered by pillows, bedding, mother's arm, ect.
Overheating Risk	Infant temperature at risk, i.e. infant's head covered by bedding, infant excessively covered, etc.
Falling Risk	Infant at risk of falling, i.e. placed on extreme edge of bed or sofa, etc.
Entrapment Risk	Infant may become trapped, i.e. between mattress and headboard, etc.
Punitive Behav.	Punitive Behavior. Mother engages in harsh or punitive behaviours, including vocalization characterized by increased volume and/or tonal intensity.
Behav. Rejection	Behavioral Rejection.
Other	Other Secondary Risk (specify in notes).
N/A Second Risk	Secondary Risk is Not Applicable. There is no secondary risk to the infant.

Modifier Class 6: Surface Type

Type: Nominal
Number of Elements: 9

This modifier class refers to the type of surface the infant's body is resting on while the infant is asleep.

Modifier Name	Code
Missing modifier	?
Mattress	STb
Pillow	STp
Pillow/Mattress	STh
Mother	STm
Sofa Cushions	STs
Floor	STf
Carseat/Carrier	STc
Other	STO

Element Descriptions:

Modifier Name	Description
Missing modifier	
Mattress	The infant's entire body is resting on the mattress, which can be the mattress in the crib, bassinette, or the adult bed.
Pillow	The infant's entire body is resting on a pillow, in any of the possible sleep locations.

Pillow/Mattress Pillow/Mattress. The infant's head is resting on a pillow, with the infant's body resting on the mattress.

Mother The majority of the infant's body is resting on some part of the mother's body.

Sofa Cushions The majority of the infant's body is resting on the sofa cushions.

Floor The infant's body is resting on the floor.

Carseat/Carrier Infant's body is resting in a car seat.

Other Other Surface Type (specify in notes) [i.e. the infant's body is resting on a pile of blankets substantial enough that the infant's body is not touching the mattress or any other surface and the blankets constitute the sleep surface for the infant].

Modifier Class 7: Who Feeds Bottle

Type: Nominal
Number of Elements: 3

Modifier Name	Code
Missing modifier	?
Mom Feeds Bottle	BFm
Infant Feed Self	BFs

Element Descriptions:

Modifier Name	Description
Missing modifier	

Mom Feeds **Bottle** Mother feeds infant bottle. Mother is in physical contact with the infant and/or supporting the bottle while the baby feeds. The infant may also have his or her hands on the bottle, but the mother is providing the primary support for the bottle.

Infant Feed Self Infant bottle feeds self. Mother is not in contact with the infant during the feeding session and/or the mother is not handling the bottle during the feeding session. Infant is providing the primary support for the bottle.

Modifier Class 9: TV Usage

Type: Nominal
Number of Elements: 4

This behaviour was coded in one distinct time period beginning 5 minutes after the start of the observation and lasting twenty minutes. This time period was selected to coincide with the subjective nighttime parenting

matrix in order to see if TV use of mother influenced quality of infant care.

Modifier Name	Code
Missing modifier	?
Active TV	Tva
Passive TV	TVp
Out-of-Range	TVx

Element Descriptions:

Modifier Name	Description
Missing modifier	
Active TV	Mother's primary activity is watching the TV. Her body and face are positioned toward the TV.
Passive TV	Mother is occasionally looking at the TV screen but is mostly engaged in other activities.
Out-of-Range	Mother is out of room.

Modifier Class 10: Mom Slp Orient.

Type: Nominal
Number of Elements: 4

Modifier Name	Code
Missing modifier	?
Mom Face Infant	Omf
Mom Face Away	Oma
N/A Mom Slp Orie	Omx

Element Descriptions:

Modifier Name	Description
Missing modifier	
Mom Face Infant	Mother is bedsharing with the infant, and her head and face are oriented toward the infant.
Mom Face Away	Mother is bedsharing with the infant, and her head and face are oriented away from infant.
N/A Mom Slp Orie	Mother sleep orientation towards infant is not applicable. Mother is awake, or is not bedsharing with the infant, or is holding the infant while bedsharing.

Modifier Class 11: Mom Bedsharing

Type: Nominal
Number of Elements: 3

Modifier Name	Code
Missing modifier	?
Yes Bedshare	Bsy
No Bedshare	BSn

Element Descriptions:

Modifier Name	Description
Missing modifier	
Yes Bedshare	Mother is asleep and is bedsharing with the infant.
No Bedshare	Mother is asleep and is not bedsharing with the infant.

Modifier Class 12: Feed Substance

Type: Nominal
Number of Elements: 4

Modifier Name	Code
Missing modifier	?
Formula	FSf
Other substance	FSO
Breastmilk	FSb

Element Descriptions:

Modifier Name	Description
Missing modifier	
Formula	Mother attempts/offers to give a bottle of formula to the infant.
Other substance	Mother attempts/offers to give another food or liquid(other than formula) to the infant.
Breastmilk	Mother attempts/offers to breastfeed the infant. This code also used when mother offers a bottle that is known to contain breastmilk.

Modifier Class 13: What add/remove

Type: Nominal
Number of Elements: 8

Modifier Name	Code
Missing What add/remove	?
Baby blanket	Ibb
Pillow	Ipl
Adult blanket	Iab
Soft toy	Ist
Hard toy	Iht
Baby Bottle	Ibt
Other (Add note)	IO

Element Descriptions:

Modifier Name	Description
Missing What add/remove	
Baby blanket	Baby blanket added.
Pillow	Pillow added.

Adult blanket Adult blanket added. If adult blanket is added to adult bed, then this modifier is only coded if an additional blanket is added in addition to the blanket that is included in the "normal" sleep environment for the adult bed.

Soft toy Includes stuffed animal, cloth book, etc.

Hard toy Includes plastic toy, hardback and paper books, etc.

Baby Bottle Baby bottle

Other (Add note) Other item added or removed (example: cell phone, pacifier). Specify in notes.

Modifier Class 14: Mod. sleep env.

Type: Nominal
Number of Elements: 3

Modifier Name	Code
Missing Mod. sleep env.	?
Still modified	Mm
Normal	Mn

Element Descriptions:

Modifier Name	Description
Missing Mod. sleep env.	
Still modified	Infant sleep environment remains modified by additional items.
Normal	Infant sleep environment is no longer modified by additional items.

Modifier Class 15: Item remove from

Type: Nominal
Number of Elements: 7

Modifier Name	Code
Missing Item remove from	?
Remove from Crib	Irc
Remove from Bass	Irb
Remove from Bed	Ira
Removed from Mom	Irm
Remove from Sofa	IRs
Remove from Othr	IRo

Element Descriptions:

Modifier Name	Description
Missing Item remove from	
Remove from Crib	item removed from crib
Remove from Bass	item removed from bassinet
Remove from Bed	item removed from adult bed

Removed from Mom item removed from mother

Remove from Sofa item removed from sofa

Remove from Othr item removed from other location (specify in notes)

IV. Channels

Number of channels: 14

Channel Name

Infant*Feeding Type
Infant*Inf. Sleep State
Infant*Inf Slp Position
Infant*Infant Crying
Infant*Proximity
Infant*Risk to Infant
Infant*Sleep Location
Infant*Prone Initiator
Mom*Affectionat.Care
Mom*TV Usage
Mom*Tech Interfere
Mom*Mom Sleep State
Mom*Response Type
Mom*Mod. Slp. Envir.

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APPENDIX IV:
PFT SCHEDULE OF ASSESSMENTS

Mother	Measure	Pre	4	6	8	12	18	24	30	36
Parenting/Neglect	Maternal Warm Responsiveness(Landry)		X		X		X		X	
	Maternal Harshness (Landry)		X		X		X		X	
	Language (Landry)		X		X		X		X	
	Child Well-Being Scales						X	X	X	X
	Observation of Parenting Essentials		X		X		X		X	
	Parent Child Activities Mobile Phone Interview		X		X		X		X	
	Short Cell Phone Interview		X		X		X			
	Risk of Physical Neglect(incomplete data at 4-months)		X	X	X	X	X	X	X	X
	Child Abuse Potential Inventory-Short Form(CAPI-SF)	X		X					X	
	Mother Child Neglect Scale									X
	Responsibilities and Perceptions of Child Neglect (UAB & GU only for complete interview at each time point)	X		X		X		X		X
	Hopes & Goals	X								
	Questions from the Family and Maternal Life History(FMLH)	X								X
Environment	Home Observation for Measurement of the Environment- Infant/Toddler + Supplement to the HOME for Impoverished Families		X		X		X		X	
	Family Routines Inventory				X				X	

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	Home Stimulation Perception		X							
Maternal Socio-Emotional Functioning	Beck Depression Inventory II	X		X		X		X		X
	Self Esteem(Pearlin)			X				X		X
	Self Efficacy(Pearlin)	X		X				X		X
	Parenting Self Efficacy (Pearlin)	X		X		X		X		X
	Social Desirability(Social Perceptions)	X								
Maternal Cognitive Readiness to Parent	Parenting Style	X		X						
	Knowledge of Infant Development Inventory – Short Form (KIDI-SF)	X		X			X			
	Parent Opinions Survey			X			X			
	Parenting Perceptions (My Child's Behavior) (KS and ND only at 8-months, KU only at 18-months)				X		X			
	Parentification									X
Mother	**Measure**	**Pre**	**4**	**6**	**8**	**12**	**18**	**24**	**30**	**36**
Maternal Intelligence	Wechsler Abbreviated Scale of Intelligence – Vocabulary and Matrix Design subscales			X						
Maternal Literacy	From FMLH							X	X	X
Maternal History of Maltreatment	Childhood Trauma Questionnaire			X						
	About My Parents/History of Neglect			X						
	From FMLH	X								
Maternal Violent Experiences	Externalizing (YSR & YASR)	X		X				X		
	From FMLH	X		X		X		X		X
Stress	Parenting Stress Index – Short Form			X		X		X		X
	Difficult Life Circumstances			X			X		X	
Social Support	Social Support Interview	X		X			X			

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	Maternal Social Support Inventory(UAB and GU only at 18-months) (MSSI)	X		X			X	X		
Community Support	Community Support Inventory	X	X		X		X		X	
Maternal Health	From FMLH					X		X		X
Maternal Eating and Exercising	From FMLH									X
Maternal Height and Weight	From FMLH									X
Substance Use	From FMLH	X		X		X		X		X
Sleep	From FMLH	X		X		X				
	From PCA		X		X		X		X	
Education	From FMLH	X		X		X		X		X
Citizenship	From FMLH			X		X		X		
Family Planning	From FMLH/My Future Family	X		X		X	X	X	X	X
Religion	From FMLH	X		X		X				
Mother	**Measure**	**Pre**	**4**	**6**	**8**	**12**	**18**	**24**	**30**	**36**
Life Satisfaction	From FMLH	X								
	From PCA		X		X		X		X	
Income	From FMLH			X		X		X		X
Child Care	From FMLH			X		X		X		X
	From PCA		X		X		X		X	
Custody/CPS Involvement	Contact Information/Custody Form		X	X	X	X	X	X	X	X
Other Members of Family Teen Parents	From FMLH									X

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Who lives in the Home	From FMLH	X	X	X	X	X	X	X	X	X
Father Information	From FMLH and Father Information Survey	X	X	X	X	X	X	X	X	X
Maternal Relationship with her Father	From FMLH							X		
Demographics	From FMLH	X		X		X		X		X

Child	Measure	Birth	4	6	8	12	18	24	30	36
Intellectual	Attention(Landry)		X		X					
	Bayley Mental Scale II					X		X		X
Language	Pre-school Language Scales 4					X		X		X
Socioemotional Adjustment	Behavioral Regulation(Landry)		X		X		X		X	
	Bayley Behavioral Rating Scale II					X		X		X
	Attachment/Strange Situation					X				
	Brief Infant Toddler Social and Emotional Assessment(BITSEA at 12-months, ITSEA at 24 and 36-months)					X		X		X
Social Behavior	Warmth Seeking(Landry)		X		X					
	Social Engagement(Landry)						X		X	
	Cooperation(Landry)						X		X	
Physical Development	Height and Weight	X				X		X		X
Health	From FMLH			X		X		X		X
Safety	From FMLH			X		X		X		X

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	From PCA		X		X		X		X	
Sleep	From FMLH	X		X		X		X		X
	From PCA		X		X		X		X	
	From Short Calls				X		X			
Eating	From FMLH	X		X		X		X		X
	From PCA		X		X		X		X	
Accidents	From FMLH					X		X		X
Exercise	From FMLH									X
Intervention Services	From FMLH									X
Dental Care	From FMLH									X