

Towards an integrated anthropology of infant sleep

Helen L. Ball, Cecilia Tomori, Parent-Infant Sleep Lab., Anthropology, Durham University, UK.
& James J. McKenna, Mother-Baby Sleep Lab., Anthropology, Notre Dame University, USA.

Abstract

This paper provides a novel synthesis of anthropological research on infant sleep focusing on work in biological and sociocultural anthropology in the past decade. First, we briefly review early biological anthropological research into infant sleep between 1987-2007, which provided the foundational evidence base for the core argument that proximate parent-infant sleep combined with lactation represents a complex set of adaptations that constitute the human evolutionary norm. This work challenged the traditional western pediatric infant sleep research paradigm, which positioned formula- or bottle-fed, solitary sleeping infants as the basis for research and universal models about human infant sleep. Next, we address how recent research across the subfields has built on these foundations and extended anthropological insights into new aspects of infant sleep. Biological anthropologists, who continue to lead this area of research, have advanced research into the hormonal and behavioural ecology of parent-infant sleep and trade-offs in night-time care, and parent-infant conflict. Moreover, they have made significant progress in translating of anthropological research into policy and practice in clinical and health delivery settings. Anthropology has transformed health guidance for safe infant sleep in the UK, and has been instrumental in raising awareness about the needs of women and babies during the early postpartum period (called “the 4th trimester”) in the US. Until recently, sociocultural anthropology has primarily addressed infant sleep as part of broader endeavors, without an explicit focus on infant sleep. We highlight key ethnographic works that shed light on the cultural normalcy and inter-embodied experience of shared maternal-infant sleep with breastfeeding that help to de-center western discourses of infant sleep. We also review recent research that explores the western, capitalist cultural origins and power dynamics entailed in the global rise of biomedicalization of infant sleep that emphasizes physical separation and regimentation of infant bodies. We conclude by discussing future research agendas to forward an integrated anthropology of human infant sleep that considers infant sleep in its full biological and sociocultural context. Current biomedical models of infant sleep increasingly recognize the importance of breastfeeding and encourage greater proximity than in the past, but also continue to replicate many western cultural assumptions from earlier decades. Integrated anthropological approaches to infant sleep not only present a path forward for novel cross-subfield anthropological research but could help guide more effective and equitable approaches to maternal-infant health.

I. Introduction

Substantial anthropological evidence indicates that evolution has produced an unusually helpless human neonate that is born into a cultural world that shapes their life experiences, including sleep, from the very first moments after birth (Trevathan & Rosenberg 2016). While parents and carers in the majority of cultures around the world carry their infants and sleep in close proximity to them, dominant models of infant care in WEIRD settings (western¹, educated, industrial, rich and democratic), emphasize lengthy periods of separation and minimal bodily contact, particularly at night (Trevathan and Rosenberg 2016; Jones and Ball 2012; Ball and Russell 2012; Ball 2008). These WEIRD models of infant care are biomedicalized – conceptualized to belong to the realms of medical experts that set the standards for what is considered “normal” and “healthy” sleep – and are codified in authoritative medical guidelines and recommendations (McKenna et al 2007, Ball 2008, Tomori 2014). A key anthropological finding, however, is that these models are incongruent with maternal–infant evolved biology, and dramatically differ from infant care in other societies and cultures where a vast majority of the global population resides (McKenna et al 2007; Ball 2017; Airhihenbuwa et al. 2016).

The engagement of anthropology with infant sleep began three decades ago when biological anthropologists focused an evolutionary lens upon issues of night-time infant care. They observed that solitary infant sleep, dominant in these researchers’ own societies, was in fact an unusual and historically recent behaviour confined to a historically and culturally limited sub-group of contemporary humans. Therefore, solitary infant sleep was both evolutionarily novel, and incongruent with the limited biological and behavioural competence of the immature human infant (Trevathan and Rosenberg 2017). Yet, western biomedical and psychological infant care experts at the time emphasized that solitary, continuous sleep was “normal” and desirable for infants, night-wakings were undesirable and to be eliminated, and shared sleep was unsafe and psychologically damaging. In contrast to these recommendations, anthropologists explored the potential negative relationship between solitary infant sleep arrangements and sudden and unexpected infant death (McKenna 1986; Konner and Super 1987). Super and Harkness drew attention to the characteristic pattern of frequent night waking and feeding among non-Western human infants, and suggested that ‘pressuring’ infants to sleep through the night with no parental involvement was ‘pushing the limits of infant adaptability’ (Super and Harkness 1982, cited in Wolf et al. 1996: 365). These comparative observations provided the foundation for anthropological critiques of clinical and popular views regarding infant sleep environments and unexpected infant deaths. In drawing together the extant information on infant developmental biology and night-time parent-infant behaviour McKenna (1986) hypothesised that close sleep proximity (co-sleeping) helped to regulate infant breathing, and reduce the propensity for prolonged periods of deep sleep, thereby protecting against Sudden Infant Death Syndrome (SIDS). This novel synthesis galvanised interest in anthropological perspectives on infant sleep, but also instigated an unanticipated collision course between anthropologists and epidemiologists over the role of parent-infant sleep proximity in preventing or promoting sudden infant deaths.

The historical transition from shared to solitary infant sleep in Euro-American settings over the late 19th and 20th centuries was accompanied by other substantial changes in infant

¹ We understand “western” as an ideological construct, not a geographic one.

care, such as the use of human milk substitutes, highly regimented infant feeding schedules, and long periods of infant isolation in confined spaces, all of which resulted in a dramatically different experience of infancy compared with previous infant care practices (Ball 2007, Stearns et al 1996, Russell et al 2016, Tomori 2014, 2018). In researching infant sleep and SIDS, anthropologists quickly identified a crucial relationship between infant sleeping and feeding mode (Ball, Hooker, and Kelly 1999; Ball 2003; Ball 2006b) and the role of early night-time separation in hindering the establishment of breastfeeding (Ball et al. 2006; McKenna, Ball, and Gettler 2007). This attention to the interrelationship of bodily proximity, breastfeeding, and infant sleep as central aspects of the evolutionary context of infant sleep set anthropological work apart from the majority of biomedical research, which continued to treat these processes separately from one another.

Over the past decade the scope of anthropological research employing evolutionary, ethological and biological perspectives to infant sleep has grown substantially, encompassing the interaction of mother-infant sleep proximity with lactation physiology (Ball et al 2006, Ball et al 2012) and breastfeeding behaviour (Ball et al 2016, McKenna & Gettler 2016), infant sleep development (Rudzik and Ball 2016, 2018), infant night-time care following caesarean section (Tully and Ball 2012), the effects of co-sleeping on paternal hormonal physiology (Gettler et al 2012), parental coping strategies (Ball 2018, Rudzik & Ball 2016, Volpe and Ball 2015), and the role of parent-infant conflict theory in understanding infant sleep and night-time care (Tully & Ball 2013, Volpe et al. 2013, Haig 2014, Hinde 2014). Together, this work strengthens the evidence base for the core biological anthropological argument that proximate parent-infant sleep combined with lactation represents a complex set of adaptations that constitute the human evolutionary norm.

Interest in infant sleep has also spread across anthropology more broadly as colleagues have begun to apply critical medical and sociocultural anthropological perspectives to these topics. Ethnographic research has provided rich understandings of night-time breastfeeding and sleep practices in different cultural settings, and has illuminated the cultural ideologies and power dynamics entailed in negotiating western biomedical models of infant sleep, which have helped to de-center dominant western paradigms of infant sleep (Gottlieb 2004; Wolf-Meyer 2012; Tomori 2014; Tahhan 2014). Despite significant progress, however, the sociocultural aspects of infant sleep remain far less studied compared to biological anthropological work on the topic.

In the sections below we provide a brief contextual overview of the first two decades of anthropological involvement in infant sleep research, with its close focus on the behaviour and biology of co-sleeping (see McKenna et al 2007 for greater detail). We synthesise and consider the increasingly diverse anthropological and anthropologically-informed work addressing issues of parent-infant sleep and night-time infant care conducted over the past decade, and then advance a discussion of future research agendas for an integrated anthropology of infant sleep. We argue that the discipline of anthropology, with its four-field approach, is uniquely positioned to address the complexities of infant sleep, which is a simultaneously biological and cultural phenomenon.

II. Contextual background – a brief overview 1987-2007

In the last decade of the twentieth century, the anthropology of infant sleep was dominated by McKenna and Mosko's studies of mother-baby co-sleeping pairs (Mosko et al. 1993;

McKenna and Mosko 1993; McKenna et al. 1994; Mosko et al. 1996; Richard et al. 1996; Mosko, Richard, and McKenna 1997; Mosko et al. 1997; McKenna, Mosko, and Richard 1997), which aimed to empirically test McKenna's hypothesis that solitary sleeping removes the infant from the regulatory effects of its mother's body and places it in a more physiologically challenging sleep environment. The polysomnography and observation of 43 breastfeeding mothers and babies who slept together and apart in the University of California at Irvine Sleep Lab found that babies experienced more light sleep, less deep sleep and longer total sleep time (TST) when bed-sharing than when sleeping alone, and that they and their mothers experienced more overlapping arousals (McKenna and Mosko 1993; Mosko et al. 1993; McKenna, Ball, and Gettler 2007), supporting the hypothesis that sleep contact between mother and baby provided an empirically different infant sleep experience than solitary infant sleep.

During these experiments mothers also experienced more light sleep, less deep sleep, but with no difference in overall TST (Mosko, Richard, and McKenna 1997) suggesting that maternal sleep biology is altered by infant presence—an important finding overlooked in epidemiological critiques of co-sleeping, and insufficiently replicated by other research teams with the capacity to conduct infant polysomnography. Examination of breastfeeding inter-feed intervals found that regular bed-sharing dyads fed twice as frequently (every 97 minutes, on average) than separately sleeping dyads (every 187 minutes on average) (McKenna, Mosko, and Richard 1997) demonstrating that maternal and infant experiences of both feeding and sleep differ substantially according to their immediate sleep ecology. McKenna postulated that the solitary sleeping infant's experience of prolonged deep sleep with fewer arousals increased their vulnerability to SIDS, and noted that breastfeeding bed-sharing mothers were particularly responsive to their infants during the night (McKenna, Ball, and Gettler 2007). These comparative studies provided the beginnings of an evidence base with which western epidemiological and psychological perspectives on infant sleep could be critiqued.

Building on this novel work, anthropologists in the UK began developing their own strands of infant sleep and night-time care research, examining parental attitudes and behaviours around bed-sharing/co-sleeping (Ball, Hooker, and Kelly 1999; Hooker, Ball, and Kelly 2001; Ball 2006c), and twin infant sleep arrangements (Ball 2006a; Ball 2007), and conducting a series of studies in a UK postnatal unit of mother-infant sleeping and feeding behaviour in the immediate post-birth period (Ball et al. 2006; Ball and Klingaman 2007). Although McKenna's research continued via various collaborations (McKenna and Volpe 2007; Gettler and McKenna 2011), the implications of his work on the role of co-sleeping in SIDS prevention faced significant resistance from biomedical practitioners, including clinicians, pathologists, and epidemiologists who felt strongly that parents should be advised against bed-sharing with their babies (e.g. Thogmartin et al 2001, Carpenter 2006, Mitchell 2007, Mitchell 2010, Hauck et al 2014, Fleming et al 2015). Consequently, a major strand of McKenna's work in the U.S. turned towards critical papers that aimed to expose, challenge, and gradually alter the dominant ideologies around infant sleep (e.g. McKenna 2000; McKenna and McDade 2005; Gettler and McKenna 2010, McKenna & Gettler 2016).

The first 20 years of anthropological infant sleep research was therefore dominated by a bio-anthropology and evolutionary medicine perspective that revealed:

- an intricate interrelationship between mother-infant sleep contact and night-time breastfeeding behaviour (McKenna & Bernshaw 1995, McKenna, Mosko, and Richard 1997)
- the mutual physiological regulation of mother-infant sleep architecture during sleep contact (Mosko et al. 1996; Mosko, Richard, and McKenna 1997; Mosko, Richard, and McKenna 1997);
- an appreciation of the variability of sleep ecology within UK families and the (often hidden) prevalence of social sleep arrangements (Ball, Hooker, and Kelly 1999; Blair and Ball 2004; Ball 2006c)
- an understanding of the wide range of motivations for and circumstances of different parent-infant sleeping arrangements (Ball, Hooker, and Kelly 2000; Ball 2002; Ball 2003; Ball 2006a)

This work provided a foundational evidence base for the core biological anthropological argument that proximate parent-infant sleep combined with lactation represents a complex set of adaptations that constitute the human evolutionary norm upon which more recent work has built. Given the applied value of this research, these findings also informed researchers working in a wide array of disciplines, influencing and challenging health care practice and policy in the US, the UK and around the world (e.g. McKenna 2000, Wailoo et al. 2004; Fleming and Blair 2006; Thoman 2006).

III. Evolutionary anthropology of adult sleep

In addition to these advances in anthropological infant sleep research, the last decade has seen anthropologists challenging the western model of adult sleep by exploring sleep patterns in non-electrified societies (e.g. Knutson 2014, Samson et al 2017a, Yetish et al 2015). For instance, in documenting sleep ecology and behaviour among hunter-gatherers, Samson et al (2017b) have highlighted a lack of sleep synchrony among co-resident group members, potentially linked to group defences and demonstrated that human sleep is more flexible than nonhuman primate sleep, with humans exhibiting less overall sleep and more REM sleep than would be predicted by body size (Nunn and Samson 2018). Consonant with rich historical reporting on the segmentation of sleep into two distinct nighttime periods in pre-industrial Europe (Ekirch 2005) Samson et al (2017c) revealed a similar structure of sleep amongst hunter-gatherers. Furthermore Nunn, Samson and Krystal have used evolutionary interpretations of human sleep to question the status of several so-called sleep disorders diagnosed by Western biomedicine (see Nunn et al. 2016). This work builds upon the cross-cultural examination of sleep budgets and sleep sufficiency amongst Egyptian families and exploration of the ecological circumstances under which human sleep evolved (Worthman and Brown 2013, Worthman and Melby 2002).

IV. Developments in anthropological infant sleep research 2008-2018

Anthropological research in infant sleep has flourished over the past decade by a) building incrementally on preceding work, b) integrating new methodological approaches, c) applying new theoretical perspectives, and d) offering critical insights to mainstream infant sleep science. In summarising this work, we have grouped the contributions of anthropologists to parent-infant sleep research into the following thematic strands:

- A. Advances in biological and biocultural anthropology of infant sleep;

- B. Translation of biological anthropological research into policy and practice in clinical and health delivery settings; and
- C. Sociocultural anthropology of infant sleep and night-time care.

A. Advances in biological anthropological research on infant sleep

a. Hormonal and behavioural ecology of night-time infant care

This work considers the bidirectional nature of sleep relationships, examining the influence of maternal and paternal behaviour on infant physiology, and in turn, the effects of infant sleep on parental physiology. Given the public health emphasis placed on improving breastfeeding rates in the US and UK, and the perceived conflict between breastfeeding support and SIDS reduction (Fetherston and Leach 2012), the relationship between breastfeeding and sleep proximity has been the most intensely investigated of these.

1. *Sleep location and breastfeeding*

Research on sleep location and breastfeeding yielded the key insight that small deviations in sleep ecology have substantial consequences for the functioning of maternal lactation biology. Ball et al (2006) found that infant sleep location affects infant feed frequency among breastfeeding mother-infant dyads in the immediate postpartum (Ball et al 2006; Ball and Klingaman 2007; Ball 2008). This is important due to the effect of feed frequency in modulating human lactation physiology, with earlier and more vigorous onset of lactogenesis II (LII, copious milk production) (Riordan 2011; Salariya, Easton, and Cater 1978; Tennekoon et al 1994). LII is triggered when prolactin levels in maternal plasma reach a threshold accumulated over several days (Neville and Morton 2001, Neville et al 2001). As a prolactin surge is experienced with every feed or attempted feed, and as each surge in prolactin declines after 45 minutes, repeated frequent feeding day and night results in circulating blood prolactin rising swiftly, and earlier attainment of the threshold that triggers onset of LII (Neville et al 2001). Contemporary postnatal hospital environments that enforce mother-infant separation at night (even separation via the wall of a hospital bassinet) therefore exert physiological and psychological influences on the behavioural and biological relationship between mother and baby (Ball 2008).

A subsequent study by the same team, involving 1200 UK mother-newborn pairs, examined whether variations in early postnatal sleep ecology might also affect long-term breastfeeding outcomes. This hypothesis was based on the physiological link between frequent feeding in the early post-natal period and the establishment of a robust long-term milk supply, predicated on the Prolactin Receptor Hypothesis (Marasco and Barger 1999). The latter (based on some evidence from non-human lactation) posits that prolactin receptors in the breast proliferate under the influence of prolactin secretion immediately post-partum. More frequent feeding produces higher concentrations of prolactin, which in turn promotes the development of more receptors. At galactopoiesis, when control of breastmilk switches from endocrine to autocrine control, the density of prolactin receptors previously established influences the establishment of long-term milk production. Ball and colleagues hypothesised that close proximity in the immediate postpartum would, via more frequent suckling, promote prolactin receptor development and thereby support sustained lactation. The trial found no difference in breastfeeding duration between the two groups overall (Ball et al. 2011), however, sub-group analysis demonstrated greater breastfeeding duration for those dyads who slept in close-contact following vaginal deliveries with no medical interventions (Robinson 2012). Dyads in the sample who experienced clinical interventions such as opiate

analgesia (including epidurals), or assisted delivery (which were excluded from the previous trial) did not show higher rates of breastfeeding with close sleep contact. The impediments to breastfeeding associated with birth interventions appear likely to pose greater breastfeeding challenges to mothers and babies than changes in sleep proximity can overcome (Tully and Ball 2018).

The above trial also found that, regardless of sleep location on the postnatal unit, 56% of mothers opted to bed-share at least occasionally with their infant during the first 13 weeks of life, and twice the proportion of these dyads were still breastfeeding at 6 months, compared to those who did not bed-share (Howel and Ball 2013). Those mothers who chose to sleep with their babies, and who subsequently exhibited the longest breastfeeding durations, also had the strongest prenatal intentions to breastfeed (Ball et al. 2016). These findings support McKenna and Gettler's proposal that breastfeeding and co-sleeping form an adaptive and mutually reinforcing behavioural complex that they have termed 'breastsleeping' (McKenna and Gettler 2016). This concept is further explored in Tomori's work below.

2. Circadian development and infant sleep patterns

Cortisol and melatonin are important hormones involved in the regulation of mammalian circadian rhythms and synchrony with diurnal patterns. Researchers have begun exploring the implications of night-time care behaviour on infant hormonal development, particularly regarding sleep patterns and circadian rhythms. Human infants have no independent circadian clock at birth. It is largely under maternal control in utero (Mirmiran and Lunshof 1996) and emerges over the first few months of life. Joseph et al. (2015) found that the diurnal antagonistic production of cortisol and melatonin appear earliest during infant development, with other circadian processes (such as day-night change in body temperature) subsequently taking on a diurnal pattern, and peripheral clock gene activity appearing at the end of the sequence. These biological rhythms are closely linked to sleep patterns, and the timing of both circadian development and sleep consolidation (the joining up of sleep bouts into longer night-time sleep periods) appear to be linked with sleep ecology and care-giving behaviour (Joseph 2011). The role of infant care practices in the development of infant rhythms is particularly important for understanding external influences on the regulators of infant sleep. Infant sleep development in different micro- and macro-environments is an important emerging research area, where the development of robust methodologies is needed to facilitate cross-cultural study.

One intriguing question involves how maternal melatonin, passed to the infant via breastfeeding, affects the development of infant circadian rhythms and sleep patterns. Melatonin concentration in human milk displays a clear circadian rhythm that runs in parallel to the concentration present in maternal blood (Illnerová, Buresová, and Presl 1993). Melatonin levels in human milk produced during day-time are extremely low, and peak around 3am (Cohen Engler et al. 2012). As melatonin rhythms appear stable during the early post-partum period, melatonin is well suited to regulate the circadian system of the infant when other potential entrainers, such as maternal activity and sleep-wake cycles are disrupted (Illnerova et al. 1993), and so endocrine signals in maternal milk such as melatonin may prime the development of circadian biological systems. Rudzik et al (2016) found that day and night-time concentrations of melatonin (measured as a urinary metabolite) among exclusively breastfed infants were strongly predictive of sleep duration during the first 8 postpartum weeks. For exclusively formula-fed infants there was no relationship. Beyond 8 weeks postpartum there was no association between day-night

melatonin concentrations and sleep duration for either group. The strength of the relationship between melatonin and infant sleep duration among exclusively breastfed infants suggests that maternal melatonin, transmitted through breast milk, may play a functional role in promoting infant sleep prior to the development of the endogenous melatonin circadian rhythm (Rudzik et al 2016). This is a promising area for further investigation examining the socio-ecology of infant circadian development and the role of maternal biological signaling under a variety of infant care regimes and in different cultural settings.

3. Paternal testosterone and father-infant co-sleeping

Although various clinical studies conducted over the last decade have begun to extend McKenna and Mosko's work on the effects of co-sleeping on maternal sleep (e.g. Hunter et al. 2009, Volkovich et al. 2015), the behavioural and physiological consequences of sleeping arrangements are not limited to mothers and babies. An anthropological study of father-infant sleep proximity in the Philippines extended the literature regarding the effects on male hormonal physiology of paternal involvement in day-time care, to examine the role of sleeping arrangements (Gettler et al. 2012). Previous research had found an association between lower testosterone and more hands-on child-care (Storey et al. 2011) with fathers having lower testosterone than non-fathers (Gettler, McDade, and Kuzawa 2011). Gettler found that same-surface co-sleeping by fathers was associated with significantly lower evening testosterone levels and a greater diurnal decline in testosterone in comparison with fathers who did not share a sleep surface with their child(ren). In a subsequent analysis comparing cross-sectional testosterone data on men collected at two time points, four-years apart, those who had become fathers and were co-sleepers exhibited a significantly greater reduction in testosterone than those who had become fathers but did not co-sleep. Men's testosterone levels at baseline, however, did not predict their future paternal sleep arrangements (Gettler et al. 2012). This work suggests possible future areas for research on the bidirectional relationship between paternal involvement in night-time care and infant outcomes. The examination of the relationship between paternal sleep architecture and hormones associated with shared and separate father-infant sleep practices in different settings would shed light on the ramifications of father-infant sleep contact.

The above work of biological anthropologists exploring the hormonal and behavioural ecology of night-time care of course intersects with the work of researchers in other disciplines who are also interested in these topics.

b. Trade-offs/selection pressures and parent-infant night-time conflict

Theoretical evolutionary concepts of parental investment, parent-infant conflict, and life-history trade-offs are frequently used by biological anthropologists to consider the evolutionary ramifications of parental behaviour such as infant feeding, carrying and weaning (e.g. Tomori, Palmquist, and Quinn 2018; Quinlan, Quinlan, and Flinn 2003; Fouts, Hewlett, and Lamb 2005; Sellen 2001; Jones 1986). Over the past decade these concepts have begun to be employed to better understand the trade-off decisions associated with infant sleep biology and night-time infant care.

1. Reducing the burden of night-time breastfeeding

The concept of parent-infant conflict has been used to consider maternal investment decisions regarding night-time breastfeeding (Tully and Ball 2013; Tully and Ball 2018) under the proposal that individual women experience different thresholds at which real or

perceived costs to themselves or their future offspring outweigh the real or perceived benefits of continuing to breastfeed their current infant. Factors that lower the real or perceived maternal costs of night-time breastfeeding, such as bed-sharing or partner support, help mothers to breastfeed their infant for longer than they might otherwise do (Tully & Ball 2018). Tully's study examining the night-time experiences of mothers and infants following C-section delivery explored whether the use of side-car cribs could facilitate breastfeeding initiation among this group (already challenged by the consequences of operative delivery) by reducing the costs (physical, emotional, motivational etc.) to mothers of night-time feeding (Tully and Ball 2012; Tully and Ball 2013; Tully and Ball 2013). The difficulties faced by mothers and babies in establishing breastfeeding post-C-section were too great for this intervention to overcome, and many mothers reached their breastfeeding investment threshold (the point at which they were no longer willing/able to invest effort in continued breastfeeding) sooner than did mothers experiencing less challenging births (Tully and Ball 2012). An evolutionary-informed approach can therefore help us to better understand how parent-infant needs conflict in the experiences of individual mothers and infants and therefore provide better support to mothers who are experiencing challenges.

2. Risks and benefits in night-time infant care

Concepts from evolutionary theory have also been used to explore why and how parents might implement risky sleep practices as part of night-time infant care (Volpe, Ball, and McKenna 2013). One of the key categories of trade-offs related to parental effort involves investing in one's own growth and maintenance versus an offspring's growth and maintenance (Borgerhoff Mulder 1992; Clutton-Brock 1991). By considering their behaviour in the context of life-history strategy Volpe (2010) explored differences in night-time infant care behaviour of adult and adolescent mothers. Overnight observations found that adolescent mothers kept their infants in close proximity and were more likely to bed-share, experiencing more frequent but shorter night-time awakenings; infants slept in more locations compared to infants of adult mothers, and a greater overlap was seen between maternal and infant sleep periods for adolescent mothers. In contrast adult mothers spent more of their infant's sleep time awake and with longer periods of separation, often sleeping in different rooms. Adult mothers invested more time in breastfeeding their infant, while teen mothers more frequently implemented infant self-feeding from bottles propped on blankets or pillows (Volpe, Ball, and McKenna 2013).

Efforts to prevent the exposure of infants to sleep-related risks require a good understanding of why, when and how such risks occur. Volpe's study found that although their mothers employed different night-time care strategies, neither group of infants were exposed to fewer risks, but the two groups of infants experienced different risks known to increase sleep-related infant mortality. Risks introduced by adult mothers attempting to reduce night-time investment involved sleeping infants alone in separate rooms, and using pillows, loose covers, and soft toys to promote comfort and prolonged sleep. Adolescent mothers introduced risk by reducing maternal investment during the night in other ways (e.g. falling asleep on sofa with baby while watching TV, bottle-propping with pillows) (Volpe et al 2013). Psychological literature on adolescent parenting suggests that young mothers reduce maternal investment by distancing themselves from, and therefore neglecting, their baby, but this was not observed (Volpe 2010). Volpe therefore was able to document that teen and adult mothers managed the 'work' involved in caring for their babies at night by employing different infant sleep environments. Examination of such caregiving strategies from social

anthropological perspectives (such as examination of social structures of power and socialisation) are clearly warranted, offering an opportunity for social and biological anthropologists to provide a more holistic perception of adolescent mother-infant care.

3. *Intra-genomic conflict?*

Although biological anthropologists tend to view bed-sharing behaviour as a maternal strategy to reduce the costs of night-time feeding during early infancy, another view invokes a more reductive evolutionary approach focussed on intra-genomic competition. In considering the parent-infant conflict inherent in night-time infant care, Haig (2014) proposed that “natural selection will have preserved suckling and sleeping behaviors of infants that suppress ovarian function in mothers because infants have benefitted from delay of the next birth” (p.34). Using the work of Blurton Jones and Costa (1987) regarding prolonged maternal lactational amenorrhea, Haig argued that conflict operates through the infant, with paternally-derived genes promoting infant night-time breast-feeding to delay maternal ovulation and thereby reduce sibling competition by lengthening the inter-birth interval and extracting increased maternal investment in the present infant. He takes issue with anthropological approaches to evolutionary medicine for challenging the assumptions of paediatric sleep medicine and for depicting proximate mother-infant sleep arrangements as the evolutionary ‘norm’ (Haig 2014)². Haig, however, fails to acknowledge that the research by biological anthropologists working on infant sleep to date has focussed upon the sleep ecology of infants in the first six months of life, a period during which physicians and anthropologists agree that human infants are wholly dependent upon close proximity with their mothers/allocarers for survival, both in terms of feeding and sleeping (Tully, Stuebe, and Verbiest 2017, Sellen 2016). In response to Haig, biological anthropologists argue that the expectation of clinicians that infants should develop consolidated sleep and mothers should be able to sleep uninterrupted is a historical artefact, and that embracing an evolutionary perspective to understand human health allows us to gain critical insights based on better understanding of our baseline expectations (Hinde 2014; Ball 2013). In addition to the large body of early ethnographic evidence, Hewlett and Roulette’s (2014) recent review provides further support for the argument that human juveniles sleeping close to their parents throughout their childhood and even in adolescence is the likely human evolutionary norm.

Together, biological anthropological work in the past decade has significantly advanced knowledge about biologically normal patterns of human infant sleep in an evolutionary theoretical framework. Nevertheless, there is significant need for further additional research, including comparative work from non-western settings, now beginning to emerge (e.g. Crittenden et al 2018, Vitzthum et al 2018).

B. Translation of anthropological research into clinical and public health settings

Although McKenna’s initial impetus for exploring parent-infant sleep biology and behaviour was driven by an interest in the conundrum of unexpected and unexplained Sudden Infant

² Haig supports his position by noting that babies with Prader-Willi Syndrome (a condition dominated by the expression of paternal genes) are particularly sleepy with a weak cry and feeble suck while babies with Angelmann Syndrome (a condition dominated by the expression of maternal genes) wake frequently at night. This, he claims, is evidence that paternal influence on infants promotes night-waking while maternal influence promotes prolonged sleeping. Clinically, however, the babies with Prader-Willi Syndrome suffer with sleep apneas – a condition in which babies experience frequent oxygen desaturations, associated with frequent night-waking, leaving them experiencing excessive daytime sleepiness. Some individuals with PWS also have narcolepsy. AS babies have disrupted sleep architecture and frequent nocturnal awakenings. The sleep patterns associated with these syndromes therefore relate to the proximate clinical problems these babies face.

Deaths – it soon became apparent that the anthropology of parent-infant sleep and night-time infant care would make substantial contributions to clinical practice and public health in a range of related areas.

The bio-anthropological approach to infant sleep has found particular translational success in the framing and testing of questions regarding breastfeeding and the practice and policy applications of this work (Ball 2017). The post-natal ward studies of Ball, Russell, Tully and colleagues (above) based on evolutionary-informed hypotheses about mother-infant separation has encouraged health professionals to question whether mother-infant sleep locations on postnatal wards optimise mother-infant well-being and facilitate breastfeeding initiation (e.g. Crenshaw 2014; Fetherston and Leach 2012; Bartick and Smith 2014; Drever-Smith, Bogossian, and New 2013; Laurent 2011). This work has been widely cited in practice and policy recommendations that aim to support the intertwined behaviour and biology of mothers and babies in the early post-partum, and remove barriers to the initiation of breastfeeding (e.g. World Health Organisation 2017; Feldman-Winter and Goldsmith 2016; Edwards et al. 2014; Holmes, McLeod, and Bunik 2013).

Anthropological research has also brought new perspectives to the discussion of infant sleep-related risks (Ball & Volpe 2013, Volpe & Ball 2014). In critiquing the hazardous sleep narrative this work provides evidence contradicting 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. Because mothers arrive at parenting from very different life trajectories, and because each of these trajectories causes them to experience and manage parenting costs in different ways, it is unrealistic to expect that they should all structure their infants' sleep ecology in a uniform way according to safe sleep guidelines. The results of Volpe's study support the idea that one-size-fits-all approaches to infant sleep safety are inappropriate, and that public health recommendations should be sufficiently elastic to allow for the range of contexts and trajectories within which infant care occurs. Volpe's 'risk trade-off' approach to understanding night-time infant care is enhanced by Tomori's (2014) discussion of the social construction of risk as moral danger (see below).

Expanding upon his original neuro-physiological model for SIDS (McKenna 1986), McKenna and colleagues (2016) developed a translatable model for the role that human speech breathing adaptations may play not only in infant susceptibility to SIDS while asleep, but in inconsolable infant crying (a.k.a colic), when awake. Using diverse lines of evidence this model proposes that during bouts of colic hyper-aroused infants are unable to cease either crying or the involuntary breathing that sustains it, with voice and breath being functionally bound together during a short developmental period of respiratory instability at 2-3 months of age. The proposal argues this occurs due to an infant's lack of inhibitory neurons in the basic mammalian cry circuitry of the prefrontal cortex during this phase of development. This model can be tested safely in infants with magnetic resonance imaging, offering a new perspective on the medical conundrum of infantile colic that has been clinically described, but not explained, for 65 years (Wessel 1954).

Finally qualitative and quantitative exploration of ethnic differences in night-time infant care practices by anthropologists have increased awareness of the ways in which infant care messages are received and perceived by minority populations, and how culturally determined infant care practices are prioritised by immigrant mothers seeking to raise their infants

according to the traditions of their culture of origin rather than that of the dominant culture in their new home (Crane and Ball 2016; Cronin de Chavez, Ball, and Ward-Platt 2016; Ball et al. 2012; Ball et al. 2012). Developing a multi-subfield approach to the complex interweaving of biological and sociocultural aspects of infant sleep has produced applied insights to address clinical and public health issues such as mother-infant experiences of sleep on postnatal units (Taylor, Tully, and Ball 2015), factors that prevent parents from implementing infant sleep recommendations (Volpe, Ball, and McKenna 2013b), and responses of immigrant communities to safe sleep guidance (Crane and Ball 2016). Building on this rich body of evidence, anthropological understandings of infant sleep are now challenging mainstream sleep medicine around the conceptualisation of ‘infant sleep problems’ (Ball 2013; Ball 2017, Rudzik & Ball 2018, Ball, Douglas et al 2018).

C. Socio cultural anthropology of infant sleep

a. De-centering western models of night-time infant care

Questions about human infant sleep patterns across cultural settings and what constitutes a “sleep problem” are central in the emerging sociocultural anthropological literature on infant sleep. To date, however, this literature has been fragmented and hampered by the simultaneous historical marginalization of the study of women and children (Gottlieb 2000), as well as limited interest in breastfeeding and sleep (Tomori 2014). Whereas early generations of anthropologists, led by Margaret Mead, have provided detailed comparative observations about infants and infant care, sociocultural anthropological work peaked during the 1950s and 1960s with the undertaking of the Six Culture Studies led by the Whitings (LeVine 2007, 2010³), with the last large-scale comparative analysis of infant care practices undertaken by Barry and Paxson (1971). Although infant care, including sleep, remained of interest to biological anthropologists and to some sociocultural anthropologists, work on infant care in later decades increasingly shifted to interdisciplinary researchers, especially psychologists and psychological anthropologists (LeVine 2007⁴). Significant theoretical challenges to the foundations of anthropology led to the decline of large-scale comparative ethnographic research, a widening gap between biological and sociocultural anthropology, and decline of interest in this area in sociocultural anthropology. While feminist anthropology reignited interest in the anthropology of reproduction (c.f. Ginsburg & Rapp 1991, 1995), this burgeoning literature focused primarily on women with far less consideration of infants as part of reproduction. Nearly 20 years ago Gottlieb (2000) lamented the absence of infants in anthropology, asking “Where have all the babies gone?” Gottlieb attributed this absence to lack of parenting experience among anthropologists, a difficulty in conceptualizing infant agency, communication and rationality, the marginalization of women and children, and the challenges of working with infant bodies that do not conform to adult norms. Despite Gottlieb’s calls for further work on infancy, and continued growth in the anthropology of reproduction (cf. Browner & Sargent 2011), and childhood (Lancy [2008] 2014, Montgomery 2008) in the last two decades, few monographs focus especially on infants, and infant sleep is rarely subject of sustained attention.

Although now fifteen years old, Gottlieb's (2004) outstanding ethnography of the Beng from Côte d'Ivoire remains an exception in its careful attention to social interaction and infant

³ See also ethnographic works reviewed in McKenna, Ball & Volpe 2007 and Tomori 2014 for specific discussions of infant sleep.

⁴ cf. Morelli et al 1992; Schweder et al 1995; Wolf et al 1996.

agency, its reflexive approach and its in-depth discussion on infant sleep. Gottlieb found that, in contrast to her expectations based on American parenting discourses, Beng mothers were not particularly concerned about infant sleep. They (and other helpers) carried babies around on their backs during the day in a *pagne* – a cloth wrapped around their bodies – and mothers laid down with them at night, breastfeeding them as their infants desired. Importantly, they did not track how often their infants breastfed, and could not recall when asked because they were not entirely awake during feedings. Mothers did report some night-wakings, during which babies were always offered the breast, and some babies clearly woke up more than others. While mothers considered these events bothersome at times, mothers considered them perfectly normal and not exceptionally burdensome. Beng mothers responded to their babies without hesitation and in a matter-of-fact manner. Paying attention to infant needs constitutes a central element of the Beng belief system in which infants are perceived as highly agentic due to their arrival from the afterlife, or *wrugbe*. Gottlieb's ethnographic work and her comparative discussion of middle class US practices provides a classic sociocultural critique that helps to de-center western models of infant care and personhood.

Infant sleep continues to receive limited attention even in recent sociocultural anthropological edited volumes on sleep (cf. Steger and Brunt 2008, Glaskin and Chenhall 2013). Nevertheless, the sharp contrasts observed by Gottlieb and prior ethnographic researchers between Euro-American traditions of night-time infant care that attempt to regiment infant sleep and limit night-time feedings, compared with other ethnographic settings where mothers and infants sleep in close proximity to one another and breastfeed throughout the night, remains a central theme in these works. Notably, it is primarily biocultural anthropologists who have continued to accumulate detailed evidence that proximate sleep arrangements with breastfeeding constitute culturally normative practices for infants and children (cf. Hewlett & Lamb 2005; Hewlett & Roulette 2014; Crittenden et al 2018).

b. Sleep at the intersections of capitalism, biomedicine, and colonialism

Recent sociocultural studies have provided key insight into the origins, rise and increasing global dominance of western biomedical conceptualizations of sleep for all ages. Wolf-Meyer's pioneering monograph, *The Slumbering Masses* (2012), explored how sociohistorical transformations that led to industrialization and the dominance of capitalist economic system ultimately drove the growing biomedicalization of sleep. Wolf-Meyer (2012) argued that these biomedical approaches problematize and pathologize normal variation in sleep and foster highly profitable industries in pharmaceutical treatment of sleep disorders. In the context of this larger project Wolf-Meyer also devotes a chapter to American practises of children's sleep, and highlights the importance of solitary infant sleep as a cultural value in the U.S. that is reinforced through children's literature as well as medical recommendations. Wolf-Meyer's insights unite the study of capitalism and sleep medicine, and highlight how thoroughly infant sleep science is influenced by Euro-American cultural assumptions that are presumed to be universally applicable – arguments that echo those made by McKenna regarding SIDS epidemiology.

The presumed universality and “correctness” as well as the globalizing power of Euro-American sleep ideologies is pursued further in other sociocultural works on sleep. In Brunt

and Steger's (2008) edited volume on sleep, Ben-Ari's (2008) chapter draws on his ethnographic research in Japan and secondary analysis of ethnography from western settings to de-center western middle class approaches to "bedtime" and the western cultural imperative to get infants to sleep through the night using a variety of "sleep training" methods. Ben-Ari demonstrates that the entire construct and perceived necessity of bedtime rituals are cultural constructions that only preoccupy a specific, and highly privileged minority of the world's population.

Couched in moral and medical terms, these cultural ideologies were first propelled to novel settings by colonial efforts to transform domestic practices of indigenous populations. Today, indigenous groups continue to negotiate the legacies of colonial power relations as they come up against these cultural ideologies once again, this time as they have been codified within authoritative biomedical recommendations. Alexeyeff (2013), writing in Glaskin and Chenhall's edited volume, *Sleep Around the World* (2013), provides a brief example of this conflict in New Zealand. Despite colonial attempts to transform domestic spaces and sleep habits, Cook Islanders continued to practice social sleep practices with families sleeping in the same room and mothers sleeping next to their breastfeeding infants. Cook Islanders made no attempts to schedule infant sleep, and the concepts of "private space" and of uninterrupted sleep for long blocks of time were unknown. When Cook Islanders migrated to New Zealand, however, they were confronted with SIDS reduction messages that strongly argued against sleeping next to infants. Alexeyeff found that Cook Islanders were not familiar with SIDS, and dismissed this advice. Instead, they believed that the proximity between the mother and child was protective. As one woman explained: "So, I think the main reason we don't have SIDS is that we've tended to sleep the children 'in' us so there's skin to skin contact and you're at hand when there's a problem." Alexeyeff notes that this sense of safety is constructed through intercorporeality – through the children sleeping 'in' the mother's body – a conceptualization that is fundamentally at odds with the biomedical model that focuses on separation of bodies to ensure 'safety'. Together, the above works demonstrate the importance of situating western medical treatment of infant sleep in its broader comparative, sociohistorical context: as fundamentally entangled in ideologies and power dynamics of capitalism and colonialism.

c. Embodied experience and intercorporeality

A focus on cultural variation in the embodied aspects of infant sleep and the interembodied experience of shared sleep is another significant strand in the sociocultural literature, including the work of the scholars above. Diana Tahhan's phenomenological approach to exploring the intercorporeal dimensions of shared sleep in Japan provides a particularly nuanced and significant contribution to this literature (2013, 2014). In Tahhan's study both men and women believed that co-sleeping (*soine*) was a central part of caring for children. Parents co-slept both for multiple reasons: to provide physical safety (e.g. to keep children safe in case of earthquakes), to facilitate caregiving, including breastfeeding, and to ensure their children's wellbeing. Tahhan's participants discuss how co-sleeping produces a feeling of *anshinkan* – a sense of safety, security, and reassurance – for both parents and children. The sense of safety and reassurance achieved via shared sleep echoes Cook Islanders' descriptions (Alexeyeff 2013) as well as other ethnographic evidence (cf Gottlieb 2004, Morelli et al 1992). The traditional co-sleeping arrangement is called *kawa no ji*, or "sleeping like the Chinese character for river" (Tahhan 2014:110), after the visual resemblance of the

arrangement of sleeping bodies to the three lines that comprise this character 川 (*kawa*). In this arrangement children sleep in the center, usually in close tactile contact with at least one parent, surrounded by the safety and protection of both. While such shared sleep is considered to be a highly desirable and positive experience for all involved, Tahhan also documents the constraints of gendered expectations for mothers and marital tensions around nighttime sleep practices that prioritize mother-child connection and unity over, and sometimes to the exclusion of, connectedness with fathers.⁵

d. Embodied moral dilemmas in a capitalist biomedical system

Tomori's monograph (2014) unites several strands of sociocultural anthropological literature on infant sleep, and locates breastfeeding and infant sleep at the center of constructing persons, kinship, and reproduction. She takes a historical and comparative ethnographic approach to situate the moral dilemmas contemporary U.S. parents face when the intercorporeal practices of nighttime infant care clash with capitalist biomedical regimes (2014). Her ethnographic findings, drawn from over 2 years of participant observation, demonstrate that western biomedical recommendations for solitary sleep not only conflict with non-western cultural norms, but they also present significant challenges for western families whose cultural expectations align with these western ideologies but who decide to breastfeed. Unlike Cook Islanders, the Beng, or Japanese families who value bodily proximity, prior to their babies' birth the mostly middle-class, white families in Tomori's study believed that sleeping on a separate surface was safer, desirable and beneficial for their infants. Most invested a great deal of effort during pregnancy to creating a separate, special space for their infants where they would eventually sleep on their own (the nursery)⁶. Moreover, most believed that it was important to get babies to sleep separately for increasing periods of time, ultimately "sleeping through the night," not only to gain more sleep for themselves but to facilitate "independence" for their children.

Through their embodied experiences with their infants, however, US parents in Tomori's ethnography learned that infants do not simply sleep fall asleep and stay asleep in their bassinets. Instead, they fell asleep at the breast, and woke up as soon as put down, only to be soothed and fall asleep at the breast once more. This posed significant pragmatic and moral concerns: if they responded to their infants' cues as they were directed in breastfeeding classes, parents could not put their infants down in their own space; but if they brought their babies into bed with them to breastfeed and sleep, they went against sleep guidelines and were told that they would endanger their babies' lives. Most families ultimately brought their babies into bed with them to facilitate breastfeeding, at least for periods of time, and hid this practice, especially from medical providers, precisely repeating the practices of families in the north-east of England documented a decade previously (Ball

⁵ The embodied experience of nighttime infant care is also the subject of Melody Howse's (2017) collaborative work among ten mothers of multiple nationalities mostly from western settings living in Berlin, Germany and in LA, USA, in which she employed novel collaborative, auto-ethnographic, and visual anthropological methods to produce an experience-oriented website: www.upallnightphenomenon.com. In contrast to Japanese, Beng, and many other non-western ethnographic perceptions of shared sleep, here intercorporeality is far more fraught, nighttime infant behaviour is considered a main source of disruption, and negotiating it presents a significant challenge. This work highlights the cultural construction and resultant wide range of embodied experiences. Moreover, it opens up new possibilities for the incorporation of novel methods and research outputs beyond conventional academic written form that is accessible to a wider range of audiences.

⁶ The disruption of cultural norms of nighttime home-space is further explored in Tomori & Boyer 2019.

et al 1999, Hooker et al 2001, Ball 2002, 2003). Some families continued to practice breastfeeding in the context of bedsharing over the course of the first year postpartum and found that their sleep synchronized and mothers no longer woke up fully to breastfeed. These families also challenged American ideologies about parent-child relations and infant personhood - that “training” infants to fall asleep and stay sleep in their own rooms “through the night” would yield “independence” and self-sufficiency.

Throughout the negotiation of these sleep arrangements, however, even relatively well-resourced white middle-class families faced considerable barriers to breastfeeding and stigmatization of their night-time care practices (Tomori 2014, Tomori, Palmquist & Dowling 2016). Families faced enormous pressure from authoritative biomedical experts who emphasized separate sleep with minimal and eventually no nighttime breastfeeding for safety and for optimal development as well as from family, friends, and others. In a sense, then, this ethnography highlights cracks in the dominant western ideologies driven by the return of breastfeeding in the U.S.⁷ Importantly, the ethnography documents the profound inequities in families’ ability to participate in these intercultural practices and to challenge dominant models of infant care. Tomori draws on the classic concept of stratified reproduction (Colen cited in Ginsburg & Rapp 1995) to highlight the lack of support for breastfeeding and moral judgment for shared sleep faced by families of color driven by pervasive racism. These findings comprise a part of the global power dynamics of biomedical models of infant sleep, wherein research reflecting dominant western cultural ideologies of separation without significant integration of breastfeeding dictates guidelines and expectations for infant sleep for all groups.

e. Bridging the subfields: breastsleeping as a biocultural body technique

The above research offers multiple avenues for building bridges across sociocultural and biological anthropology. Tomori has previously argued (2014) that Mauss’ classic essay, *Techniques of the Body* ([1935] 1973), offers a productive line of inquiry for breastfeeding as Mauss recognized that body “habits” or *habitus* that may appear solely biological, not only vary across individuals, but “they vary especially between societies, educations, properties and fashions, prestiges.” Talal Asad (1997) encouraged anthropologists to revisit Mauss’ construct as an “anthropology of practical reason”, to better understand embodied experience. Recently, Tomori (2018) has drawn together Mauss’ concept of *habitus* ([1935] 1973) with McKenna and Gettler’s novel construct of *breastsleeping* (2016) in order to develop a biocultural framework for studying mother-infant sleep. In her comparative analysis, Tomori has found clear ethnographic descriptions of the interembodied body technique of *breastsleeping* in numerous non-western cultures where infants practice continuous bodily proximity during the day- and night-times. In these settings, such as among the Beng described above (Gottlieb 2004), breastfeeding is simply a part of mother-infant sleep, and synchronized patterns of mother-infant sleep emerge in which breastfeeding is not considered to be a disruption since mothers are not fully awake for feedings. These patterns are consistent with McKenna’s and Gettler’s (2016) discussion of breastsleeping as an evolutionary adaptation. Tomori argues that this interembodied *habitus* is culturally contingent – in WEIRD settings where solitary infant sleep and artificial feeding was the cultural norm during the 20th century, breastsleeping virtually disappeared for decades.

⁷ There has always been considerable variation in infant sleep practices in the US, but solitary sleep has been considered the dominant cultural expectation, especially among middle class Americans, while alternatives to this have been considered suspect and subject to surveillance and intervention (Tomori 2014).

Tomori's own ethnographic findings in the US as well as work by Ball and colleagues in the UK, however, demonstrate that driven by the return of breastfeeding, this *habitus* has been re-discovered, despite cultural prohibitions and much to parents' own surprise. Breastsleeping in such settings may be practiced in secret, since bedsharing and breastfeeding throughout the night remain stigmatized (Tomori, Palmquist & Dowling 2016). Tomori's current research explores the historical origins, rising dominance and consequences of the fragmentation of breastfeeding and sleep as well as possibilities for reintegration (Tomori 2018b). Situating breastsleeping in its historical and cultural context, and associated power dynamics, offers a productive avenue for multi-sited, comparative inter-subfield collaborative work.

Together, sociocultural anthropology work on infant sleep provides further support for biological anthropological insights about the interembodied dynamics of parent-infant sleep, their cultural contingency as well as different theoretical approaches to their experience. Importantly, this work helps to situate the rise and globalizing spread of western biomedicalized concepts of infant sleep that dominate contemporary medical guidance in WEIRD settings.

V. Transforming the paradigm: An integrated anthropological approach to infant sleep

Anthropological infant sleep research has made significant strides in the study of SIDS, co-sleeping, and breastfeeding, and has increasingly expanded to examining the biology of parent-infant sleep. To date most of this work has been carried out in western settings by biological anthropologists, framed by a foundational evolutionary paradigm for infant sleep, which has remained intact and has been further elaborated.

Dialogue between anthropology and infant sleep research has been developing, with some significant uptake of anthropological concepts in some healthcare settings. The work of anthropologists in shaping policy at the intersection of SIDS and infant sleep location is increasingly being recognised in policy discussions in the US (e.g. Altfield et al 2017; Mileva-Seitz et al 2017; Gordon, Rowe & Garcia 2015) and practice recommendations in the UK (e.g. UNICEF UK 2018), and is firmly embedded in policy and practice recommendations addressing breastfeeding initiation and night-time infant feeding (e.g. Ball & Blair 2017; Feldman-Winter & Goldsmith 2016; Holmes et al 2013; Rapley 2002). There is a growing recognition in both settings that, compared with formula feeding, breastfeeding is associated with considerably lower risk of SIDS and that mother-baby bedsharing facilitates breastfeeding.⁸ However, considerable debate remains over whether bed-sharing is intrinsically hazardous. In the UK, guidelines have established that it is the context in which bed-sharing is performed, and the behaviour of parents, which can make it hazardous (Ball 2017b). In contrast, the most recent US guidelines (Moon and Task Force on Sudden Infant Death Syndrome 2016) still consider bed-sharing to be associated with greater risk, even in the context of breastfeeding⁹. Nevertheless, the 2016 guidelines emphasize breastfeeding and room-sharing, recognize that breastfeeding parents often fall asleep with their infants in

⁸ Notably, breastfeeding is still positioned as a risk-reduction agent, or "benefit," demonstrating the cultural default of formula-feeding against which breastfeeding is measured.

⁹ The recommendation against bed-sharing in all circumstances is made even though the detailed report for the guidelines acknowledges conflicting and limited evidence on this issue (Task Force on Sudden Infant Death Syndrome 2016). A more comprehensive recent review emphasizes contextual, rather than inherent risk (Baddock et al 2019).

bed, and encourage health care providers to have more open conversations around sleep practices and ways to reduce risk, which represents a significant shift in approach from prior guidance.

Building upon these advances anthropology could further revolutionize the field of infant sleep. With its focus on biological and cultural variation, and its multi-subfield approach, anthropology is uniquely placed to advance understanding into the landscape of human infant sleep across diverse cultural settings and the varied sleep issues affecting parents and babies in contemporary societies (Ball 2017a). From its beginnings, anthropologists researching infant sleep have challenged the cultural assumptions underlying western biomedical paradigms for infant sleep science. Recent sociocultural anthropological research has built on these biocultural critiques. This work has explored how dominant biomedical guidance arises from and reproduces western cultural ideologies that aim to regulate moral and embodied dimensions of infant personhood and parent-child relations via physical separation and regimentation of infant bodies. These ideologies are profoundly intertwined with the rise of capitalism, colonialism, and biomedicalization, wherein all aspects of life are increasingly brought under scrutiny and become objects of surveillance and pathologization (Lock & Nguyen 2010; Wolf-Meyer 2012; Tomori 2014, 2018b;). Consequently, medical guidance on infant sleep both reflects power relations and becomes an instrument of power; in its assumption that separation is the default safe state for infants, it can powerfully shape and limit parent-child proximity.

We argue that an integrated anthropological approach to infant sleep, encompassing evolutionary, historical, ethnographic and biosocial perspectives, provides the foundation for a Kuhnian paradigm shift in infant sleep science. We suggest that contemporary approaches to infant sleep must be reoriented with critical awareness of western cultural ideologies embedded in biomedical approaches to infant sleep in order to better reflect the full breadth of human infant evolutionary adaptations and biocultural infant care practices. The mismatch between western cultural family sleep expectations and the biological constraints of human babies exacerbates inequalities in infant development, undermines parental resilience, and compromises family well-being (Ball 2013, 2018). Addressing this mismatch is a matter of urgency not only for western parents and babies, but for ensuring that western assumptions embedded in globalizing biomedical research and guidelines do not further undermine interembodied infant care practices in non-western settings.

The development of an integrated anthropology of infant sleep has the potential to be culturally and scientifically transformational (Ball 2013, 2018). Greater dialogue and collaboration between sociocultural and biocultural approaches to infant sleep in both western and non-western settings is needed to achieve these aims. Additional research from archaeological anthropology (e.g. addressing the spatial organization of home sleep space and its associated material culture), and linguistic anthropology (e.g. on ideologies of infant personhood) could further illuminate the full history and complexity of human infant sleep. By exposing and evaluating historical and ethnocentric assumptions around sleep that have exerted heavy influence on clinical and parental practice, epidemiological and intervention studies, and public health guidance, anthropology is beginning to offer a social scientific counterpoint to currently mainstream medical and psychological views on parent-infant sleep. Integrated approaches to infant sleep not only present new opportunities for innovative cross-subfield research, but could help guide more effective and equitable approaches to maternal-infant health around the globe.

References

- Airhihenbuwa, C.O., J.I. Iwelunmor, C.J. Ezepue, N.J. Williams, and G. Jean-Louis. 2016. "I Sleep, Because We Sleep: A Synthesis on the Role of Culture in Sleep Behavior Research." *Sleep Medicine* 18 (February): 67–73. doi:10.1016/j.sleep.2015.07.020.
- Alexeyeff, K. 2013. "Sleeping Safe: Perceptions of Risk and Value in Western and Pacific Infant Co-Sleeping." In *Sleep Around the World: Anthropological Perspectives*, edited by Katie Glaskin and Richard Chenhall, 113–32. Palgrave Macmillan.
- Altfeld, S., Peacock, N., Rowe, H. L., Massino, J., Garland, C., Smith, S., & Wishart, M. 2017. Moving Beyond "Abstinence-Only" Messaging to Reduce Sleep-Related Infant Deaths. *Journal of Pediatrics*, 189, 207–212. <http://doi.org/10.1016/j.jpeds.2017.06.069>
- Asad, T. 1997. "Remarks on the Anthropology of the Body." In *Religion and the Body: Comparative Perspectives on Devotional Practices*, edited by S. Coakley. Cambridge, U.K.: Cambridge University Press. 42-52.
- Baddock, S. A., Purnell, M. T., Blair, P. S., Pease, A. S., Elder, D. E., & Galland, B. C. 2019. The influence of bed-sharing on infant physiology, breastfeeding and behaviour: A systematic review. *Sleep Medicine Reviews*, 43, 106–117.
- Ball, H. L., 2002. "Reasons to Bed-Share: Why Parents Sleep with Their Infants." *Journal of Reproductive and Infant Psychology* 20 (4): 207–21. doi:10.1080/0264683021000033147.
- . 2003. "Breastfeeding, Bed-Sharing, and Infant Sleep." *Birth* 30 (3): 181–88. doi:10.1046/j.1523-536X.2003.00243.x.
- . 2006a. "Caring for Twin Infants : Sleeping Arrangements and Their Implications." *Evidence Based Midwifery* 4 (1): 10–16.
- . 2006b. "Parent-Infant Bed-Sharing Behavior: Effects of Feeding Type and Presence of Father." *Human Nature* 17 (3): 301–18. doi:10.1007/s12110-006-1011-1.
- . 2007. "Together or Apart? A Behavioural and Physiological Investigation of Sleeping Arrangements for Twin Babies." *Midwifery* 23 (4): 404–12. doi:10.1016/j.midw.2006.07.004.
- . 2008. "Evolutionary Paediatrics: A Case Study in Applying Darwinian Medicine." In *Medicine and Evolution: Current Applications, Future Prospects*, edited by Sarah Elton and Paul O'Higgins, 125–50. London: Taylor & Francis. <http://dro.dur.ac.uk/4073>.
- . 2013. "Supporting Parents Who Are Worried about Their Newborn's Sleep." *BMJ* 346 (apr15 4): f2344–f2344. doi:10.1136/bmj.f2344.
- . 2017a. "Evolution-Informed Maternal–infant Health." *Nature Ecology & Evolution* 1 (3).

Macmillan Publishers Limited: 73. doi:10.1038/s41559-017-0073.

- . 2017b. The Atlantic Divide: Contrasting U.K. and U.S. Recommendations on Cosleeping and Bed-Sharing. *Journal of Human Lactation*, 33(4), 765–769.
http://doi.org/10.1177/0890334417713943
- Ball HL & PS Blair 2017. Health Professionals' Guide to *Caring for your baby at night*. A UNICEF UK Publication, London, England <https://www.unicef.org.uk/babyfriendly/wp-content/uploads/sites/2/2011/11/Caring-for-your-Baby-at-Night-A-Health-Professionals-Guide.pdf>
- Ball, H.L., E. Hooker, and P. J. Kelly. 1999. "Where Will the Baby Sleep? Attitudes and Practices of New and Experienced Parents Regarding Cosleeping with Their New-Born Infants." *American Anthropologist* 101 (1): 143–51. doi:10.1525/aa.1999.101.1.143.
- Ball, H.L, E. Hooker, and P. J. Kelly. 2000. "Parent-Infant Co-Sleeping: Fathers' Roles and Perspectives." *Infant and Child Development* 9 (2): 67–74. doi:10.1002/1522-7219(200006)9:2<67::AID-ICD209>3.0.CO;2-7.
- Ball, H. L., D. Howel, A. Bryant, E. Best, C. Russell, and M. Ward-Platt. 2016. "Bed-Sharing by Breastfeeding Mothers: Who Bed-Shares and What Is the Relationship with Breastfeeding Duration?" *Acta Paediatrica* 105 (6): 628–34. doi:10.1111/apa.13354.
- Ball, H. L., and Kristin Klingaman. 2007. "Breastfeeding and Mother-Infant Sleep Proximity: Implications for Infant Care." In *Evolutionary Medicine and Health*, edited by Wenda R. Trevathan, EO Smith, and J McKenna, James, 152–72.
- Ball, H. L., E. Moya, L. Fairley, J. Westman, S. Oddie, and J. Wright. 2012. "Bed- and Sofa-Sharing Practices in a UK Biethnic Population." *Pediatrics* 129 (3): e673–81. doi:10.1542/peds.2011-1964.
- Ball, H.L., E. Moya, L. Fairley, J. Westman, S. Oddie, and J. Wright. 2012. "Infant Care Practices Related to Sudden Infant Death Syndrome in South Asian and White British Families in the UK." *Paediatric and Perinatal Epidemiology* 26 (1). doi:10.1111/j.1365-3016.2011.01217.x.
- Ball, H.L., and C.K Russell. 2012. "Nighttime Nurturing : An Evolutionary Perspective on Breastfeeding and Sleep." In *Evolution, Early Experience and Human Development: From Research to Practice and Policy*, edited by D Narvaez, J Panksepp, A Schore, and T Gleason, 241–61. Oxford University Press.
- Ball, H. L., M P Ward-Platt, E Heslop, S J Leech, and K A Brown. 2006. "Randomised Trial of Infant Sleep Location on the Postnatal Ward." *Archives of Disease in Childhood* 91 (12): 1005–10. doi:10.1136/adc.2006.099416.
- Ball, H.L., M.P. Ward-Platt, D. Howel, and C. Russell. 2011. "Randomised Trial of Sidecar Crib Use on Breastfeeding Duration (NECOT)." *Archives of Disease in Childhood* 96 (7): 630–34. doi:10.1136/adc.2010.205344.

- Bartick, M, and L.J. Smith. 2014. "Speaking out on Safe Sleep: Evidence-Based Infant Sleep Recommendations." *Breastfeeding Medicine*. 9 (9): 417–22. doi:10.1089/bfm.2014.0113.
- Ben-Ari, E. 2008. "'It's Bedtime' in the World's Urban Middle Classes: Children, Families and Sleep." In *Worlds of Sleep*, L Brunt & B Steger (Eds).175–92. Frank & Timme GmbH.
- Blair, P. S, and H. L. Ball. 2004. "The Prevalence and Characteristics Associated with Parent-Infant Bed-Sharing in England." *Archives of Disease in Childhood* 89 (12): 1106–10. doi:10.1136/adc.2003.038067.
- Blurton Jones, N. 1986. "Bushman Birth Spacing: A Test for Optimal Interbirth Intervals." *Ethology and Sociobiology* 7 (2): 91–105. doi:10.1016/0162-3095(86)90002-6.
- Blurton Jones, N.G., and E. da Costa. 1987. "A Suggested Adaptive Value of Toddler Night Waking: Delaying the Birth of the next Sibling." *Ethology and Sociobiology* 8 (2): 135–42. doi:10.1016/0162-3095(87)90036-7.
- Borgerhoff Mulder, M. 1992. "Reproductive Decisions." In *Evolutionary Ecology & Human Behavior*, edited by Smith Eric A. Routledge.
- Browner, C. H., & Sargent, C. F. 2011. *Reproduction, globalization, and the state: New theoretical and ethnographic perspectives*. Duke University Press.
- Brunt, L. and B. Steger. 2008. *Worlds of Sleep*. Frank & Timme GmbH.
- Carpenter, R. G. 2006. The hazards of bed sharing. *Paediatrics and Child Health*, 11(June), 24–28.
- Chapin, B.L. 2013. *Childhood in a Sri Lankan Village: Shaping Hierarchy and Desire*. Rutgers University Press.
- Clutton-Brock, T. 1991. *The Evolution of Parental Care*. Princeton University Press.
- Cohen Engler, A., A. Hadash, N. Shehadeh, and G.Pillar. 2012. "Breastfeeding May Improve Nocturnal Sleep and Reduce Infantile Colic: Potential Role of Breast Milk Melatonin." *European Journal of Pediatrics* 171 (4): 729–32. doi:10.1007/s00431-011-1659-3.
- Crane, D., and H.L. Ball. 2016. "A Qualitative Study in Parental Perceptions and Understanding of SIDS-Reduction Guidance in a UK Bi-Cultural Urban Community." *BMC Pediatrics* 16 (1). doi:10.1186/s12887-016-0560-7.
- Crenshaw, J. T. 2014. "Healthy Birth Practice #6: Keep Mother and Baby Together— It's Best for Mother, Baby, and Breastfeeding." *The Journal of Perinatal Education* 23 (4): 211–17. doi:10.1891/1058-1243.23.4.211.
- Crittenden, A. N., Samson, D. R., Herlosky, K. N., Mabulla, I. A., Mabulla, A. Z., & McKenna, J. J. (2018). Infant co-sleeping patterns and maternal sleep quality among Hadza hunter-gatherers. *Sleep Health*, 4(6), 527-534.

- Cronin de Chavez, A., H.L. Ball, and M. Ward-Platt. 2016. "Bi-Ethnic Infant Thermal Care Beliefs in Bradford, UK." *International Journal of Human Rights in Healthcare* 9 (2). doi:10.1108/IJHRH-06-2015-0019.
- Drever-Smith, C, F Bogossian, and K New. 2013. "Co-Sleeping and Bed Sharing in Postnatal Maternity Units: A Review of the Literature and Critique of Clinical Practice Guidelines." *International Journal of Childbirth* 3 (1): 13–27. doi:10.1891/2156-5287.3.1.13.
- Edwards, RA, D Dee, A Umer, C G Perrine, KR Shealy, and LM Grummer-Strawn. 2014. "Using Benchmarking Techniques and the 2011 Maternity Practices Infant Nutrition and Care (mPINC) Survey to Improve Performance among Peer Groups across the United States." *Journal of Human Lactation* 30 (1): 31–40. doi:10.1177/0890334413515948.
- Ekirch AR. *At day's close: night in times past*, 2005 New York, NY W.W. Norton
- Feldman-Winter, L, and JP Goldsmith. 2016. "Safe Sleep and Skin-to-Skin Care in the Neonatal Period for Healthy Term Newborns." *Pediatrics* 138 (3).
- Fetherston, C.M, and J S.Leach. 2012. "Analysis of the Ethical Issues in the Breastfeeding and Bedsharing Debate." *Breastfeeding Review : Professional Publication of the Nursing Mothers' Association of Australia* 20 (3): 7–17.
- Fleming, P, and P Blair. 2006. "New Knowledge, New Insights, and New Recommendations." *Archives of Disease in Childhood* 91 (9): 799–801. doi:10.1136/adc.2005.092304.
- Fleming, P., Pease, A., & Blair, P. (2015). Bed-sharing and unexpected infant deaths: what is the relationship? *Paediatric Respiratory Reviews*, 16(1), 62–67.
- Fouts, H. N., B. S. Hewlett, and M.E. Lamb. 2005. "Parent-Offspring Weaning Conflicts among the Bofi Farmers and Foragers of Central Africa." *Current Anthropology* 46 (1): 29–50. doi:10.1086/425659.
- Gettler, L.T., T.W. Mcdade, and C. W. Kuzawa. 2011. "Cortisol and Testosterone in Filipino Young Adult Men: Evidence for Co-Regulation of Both Hormones by Fatherhood and Relationship Status." *American Journal of Human Biology* 23 (5): 609–20. doi:10.1002/ajhb.21187.
- Gettler, LT, and JJ. McKenna. 2010. "Never Sleep with Baby? Or Keep Me Close but Keep Me Safe: Eliminating Inappropriate 'safe Infant Sleep' Rhetoric in the United States." *Current Pediatric Reviews*, 71–77.
- Gettler, LT., and JJ. McKenna. 2011. "Evolutionary Perspectives on Mother-Infant Sleep Proximity and Breastfeeding in a Laboratory Setting." *American Journal of Physical Anthropology* 144 (3): 454–62. doi:10.1002/ajpa.21426.
- Gettler, LT, JJ. McKenna, TW McDade, SS Agustin, and CW Kuzawa. 2012. "Does Cosleeping Contribute to Lower Testosterone Levels in Fathers? Evidence from the Philippines." *PLoS One* 7 (9): e41559. doi:10.1371/journal.pone.0041559.

- Ginsburg, F., & Rapp, R. (1991). The politics of reproduction. *Annual Review of Anthropology*, 20(1), 311-343.
- Gordon, R. A., Rowe, H. L., & Garcia, K. (2015). Promoting Family Resilience Through Evidence-based Policy Making: Reconsidering the Link Between Adult-Infant Bed-sharing and Infant Mortality. *Family Relations*, 64(1), 134–152. <http://doi.org/10.1111/fare.12099>
- Gottlieb, A. 2000. "Where Have All the Babies Gone? Toward an Anthropology of Infants (and Their Caretakers)." *Anthropological Quarterly* 73 (3): 121–32.
- . 2004. *The Afterlife Is Where We Come From*. University of Chicago Press.
- Haig, D. 2014. "Troubled Sleep: Night Waking, Breastfeeding and Parent-Offspring Conflict." *Evolution, Medicine, and Public Health* 2014 (1): 32–39. doi:10.1093/emph/eou005.
- Hardyment, C. 1983. *Dream Babies* Oxford University Press.
- Hauck FR, Darnall RA, Moon RY. 2014. Parent-Infant Bedsharing Is Not Recommended. *JAMA Pediatr.* 2014;168(4):387. doi:10.1001/jamapediatrics.2013.5169
- Hewlett, B., & Roulette, J. 2014. Cosleeping beyond infancy. In *Ancestral landscapes in human evolution: Culture, childrearing and social wellbeing* (pp. 129–163).
- Hinde, K. 2014. "Essential Tensions in Infant Rearing." *Evolution, Medicine, and Public Health* 2014 (1): 48–50. doi:10.1093/emph/eou007.
- Holmes, A. V, A. Y. McLeod, and M. Bunik. 2013. "ABM Clinical Protocol #5: Peripartum Breastfeeding Management for the Healthy Mother and Infant at Term, Revision 2013." *Breastfeeding Medicine*: 8 (6): 469–73. doi:10.1089/bfm.2013.9979.
- Hooker, E., H. L. Ball, and P. J Kelly. 2001. "Sleeping like a Baby: Attitudes and Experiences of Bedsharing in Northeast England." *Medical Anthropology* 19 (3): 203–22. doi:10.1080/01459740.2001.9966176.
- Howel, D, and H. L. Ball. 2013. "Association between Length of Exclusive Breastfeeding and Subsequent Breastfeeding Continuation." *Journal of Human Lactation* 29 (4): 579–85. doi:10.1177/0890334413492908.
- Howse, M. 2017. Up all night. MSc project produced in partial fulfillment of MA Visual Anthropology, Freie Universitat Berlin http://www.visual-anthropology.fu-berlin.de/MA-Thesis-Projects/generation_7/Melody_Howse.html
- Illnerová, H, M Buresová, and J Presl. 1993. "Melatonin Rhythm in Human Milk." *Journal of Clinical Endocrinology & Metabolism* 77 (3): 838–41. doi:10.1210/jc.77.3.838.
- Jones, C. H. D., and H. L. Ball. 2012. "Medical Anthropology and Children's Sleep." In *Sleep: Multi-Professional Perspectives.*, edited by Green. & Westcombe, 86–103. London: J

Kingsley.

- Joseph, D, N W Chong, M E Shanks, E Rosato, N A Taub, S A Petersen, M E Symonds, W P Whitehouse, and M Wailoo. 2015. "Getting Rhythm: How Do Babies Do It?" *Archives of Disease in Childhood - Fetal and Neonatal Edition* 100 (1): F50–54. doi:10.1136/archdischild-2014-306104.
- Joseph, D. V. 2011. "The Development of Circadian Rhythms in Human Infants." University of Leicester. <http://hdl.handle.net/2381/9636> .
- Knutson, K. L. 2014. Sleep duration, quality, and timing and their associations with age in a community without electricity in Haiti. *American Journal of Human Biology* 26:80-86.
- Konner, MJ, and CM Super. 1987. "Sudden Infant Death Syndrome: An Anthropological Hypothesis." In *The Role of Culture in Developmental Disorder*, edited by C.M. Super, 95–108. San Diego: Academic Press.
- Laurent, C. 2011. "Influence de La Proximité Mère-Bébé Sur Le Sommeil Du Nouveau-Né et Celui de Sa Mère, et Sur L'allaitement. Quelle Proximité Recommander sans Mettre En Danger La Sécurité de L'enfant ?" *Revue de Médecine Périnatale* 3 (1): 25–33. doi:10.1007/s12611-010-0090-8.
- Lancy, D. F. [2008] 2014 (2nd edition). *The anthropology of childhood: Cherubs, chattel, changelings*. Cambridge University Press.
- LeVine, R.A., 2007. Ethnographic studies of childhood: A historical overview. *American Anthropologist*, 109(2): 247-260.
- Lock, M. M., and V.K. Nguyen. 2010. *An Anthropology of Biomedicine*. Malden, MA.: Wiley-Blackwell.
- Marasco L, Barger J. Cue feeding: wisdom and science. *Breastfeeding Abstr* 1999;18:28–9
- Mauss, M. [1935] 1973. "Techniques of the Body." *Economy and Society* 2 (1):70-88.
- McKenna, J. J. 1986. "An Anthropological Perspective on the Sudden Infant Death Syndrome (SIDS): The Role of Parental Breathing Cues and Speech Breathing Adaptations." *Medical Anthropology* 10 (1): 9–92. doi:10.1080/01459740.1986.9965947.
- McKenna, J. J., H. L. Ball, and L.T. Gettler. 2007. "Mother–infant Cosleeping, Breastfeeding and Sudden Infant Death Syndrome: What Biological Anthropology Has Discovered about Normal Infant Sleep and Pediatric Sleep Medicine." *American Journal of Physical Anthropology* 134 (S45): 133–61. doi:10.1002/ajpa.20736.
- McKenna, J. J., and L. T. Gettler. 2016. "There Is No Such Thing as Infant Sleep, There Is No Such Thing as Breastfeeding, There Is Only Breastsleeping." *Acta Paediatrica* 105 (1): 17–21. doi:10.1111/apa.13161.

- McKenna, J. J., W. Middlemiss and M. Tarshay. 2016. Potential Evolutionary, Neuro-physiological and Developmental Origins of the Sudden Infant Death Syndrome (SIDS) and Inconsolable Crying (Colic): Is It All About Controlling Breath? *Family Relations: International Journal of Applied Family Studies*, 65 (1): 239-258
- McKenna, J. J., and T. McDade. 2005. "Why Babies Should Never Sleep Alone: A Review of the Co-Sleeping Controversy in Relation to SIDS, Bedsharing and Breast Feeding." *Paediatric Respiratory Reviews* 6 (2): 134–52. doi:10.1016/j.prrv.2005.03.006.
- McKenna, J J, and S Mosko. 1993. "Evolution and Infant Sleep: An Experimental Study of Infant-Parent Co-Sleeping and Its Implications for SIDS." *Acta Paediatrica*. Suppl 3 (June): 31–36.
- McKenna, J J, S S Mosko, and C A Richard. 1997. "Bedsharing Promotes Breastfeeding." *Pediatrics* 100 (2 Pt 1): 214–19.
- McKenna, J, S Mosko, C Richard, S Drummond, L Hunt, M B Cetel, and J Arpaia. 1994. "Experimental Studies of Infant-Parent Co-Sleeping: Mutual Physiological and Behavioral Influences and Their Relevance to SIDS (Sudden Infant Death Syndrome)." *Early Human Development* 38 (3): 187–201.
- McKenna, J. J., and L E Volpe. 2007. "Sleeping with Baby: An Internet-Based Sampling of Parental Experiences, Choices, Perceptions, and Interpretations in a Western Industrialized Context." *Infant and Child Development* 16 (4): 359–85. doi:10.1002/icd.525.
- Mirmiran, M, and S Lunshof. 1996. "Perinatal Development of Human Circadian Rhythms." *Progress in Brain Research* 111: 217–26.
- Mitchell, E. A. 2007. Sudden infant death syndrome: should bed sharing be discouraged? *Archives of Pediatrics and Adolescent Medicine*, 161(3), 305. 5
- Montgomery, H. 2008. *An introduction to childhood: Anthropological perspectives on children's lives*. John Wiley & Sons.
- Moon, R. Y., & Task Force On Sudden Infant Death, S (2016). SIDS and other sleep-related infant deaths: Evidence base for 2016 updated recommendations for a safe infant sleeping environment. *Pediatrics*, 138(5), e20162940. <https://doi.org/10.1542/peds.2016-2940>
- Mosko, S, J McKenna, M Dickel, and L Hunt. 1993. "Parent-Infant Cosleeping: The Appropriate Context for the Study of Infant Sleep and Implications for Sudden Infant Death Syndrome (SIDS) Research." *Journal of Behavioral Medicine* 16 (6): 589–610.
- Mosko, S., C. Richard, and James J. McKenna. 1997. "Infant Arousals During Mother-Infant Bed Sharing: Implications for Infant Sleep and Sudden Infant Death Syndrome Research." *Pediatrics* 100 (5): 841–49. doi:10.1542/peds.100.5.841.

- Mosko, S, C Richard, and J McKenna. 1997. "Maternal Sleep and Arousals during Bedsharing with Infants." *Sleep* 20 (2): 142–50.
- Mosko, S, C Richard, J McKenna, and S Drummond. 1996. "Infant Sleep Architecture during Bedsharing and Possible Implications for SIDS." *Sleep* 19 (9): 677–84.
- Mosko, Sarah, Christopher Richard, James M, Sean Drummond, and David Mukai. 1997. "Maternal Proximity and Infant CO2 Environment during Bedsharing and Possible Implications for SIDS Research." *American Journal of Physical Anthropology* 103 (3): 315–28. doi:10.1002/(SICI)1096-8644(199707)103:3<315::AID-AJPA2>3.0.CO;2-P.
- Neville, M.C., and Jane Morton. 2001. "Physiology and Endocrine Changes Underlying Human Lactogenesis II." *The Journal of Nutrition* 131 (11): 3005S.
- Nunn, C. L., & Samson, D. R. 2018. Sleep in a comparative context: Investigating how human sleep differs from sleep in other primates. *American Journal of Physical Anthropology*, 166(3), 601–612. <http://doi.org/10.1002/ajpa.23427>
- Nunn, C. L., Samson, D. R., & Krystal, A. D. 2016. Shining evolutionary light on human sleep and sleep disorders. *Evolution, Medicine, and Public Health*, 2016(1), 227–43. <http://doi.org/10.1093/emph/eow018>
- Quinlan, R. J., and M. B. Quinlan. 2007. "Human Lactation, Pair-Bonds, and Alloparents." *Human Nature* 19 (1): 87–102. doi:10.1007/s12110-007-9026-9.
- Quinlan, R. J, M. B. Quinlan, and M. V. Flinn. 2003. "Parental Investment and Age at Weaning in a Caribbean Village." *Evolution and Human Behavior* 24 (1): 1–16. doi:10.1016/S1090-5138(02)00104-6.
- Rapley, G. 2002. Keeping mothers and babies together – breastfeeding and bonding. *Royal College of Midwives Magazine* October 2002 <https://www.rcm.org.uk/news-views-and-analysis/analysis/keeping-mothers-and-babies-together---breastfeeding-and-bonding>
- Richard, C, S Mosko, J McKenna, and S Drummond. 1996. "Sleeping Position, Orientation, and Proximity in Bedsharing Infants and Mothers." *Sleep* 19 (9): 685–90.
- Riordan, J. 2011. *Breastfeeding and Human Lactation* . Jones & Bartlett Publishers.
- Robinson, L. 2014. *The Impact of Mother-Infant Postnatal Proximity and Birth Intervention on Breastfeeding Outcomes*. Doctoral thesis, Durham University. <http://etheses.dur.ac.uk/9501/>
- Rudzik, A. E, L Robinson, HL Ball (2016) "Infant sleep duration and melatonin levels in exclusively breastfed and exclusively formula fed infants ." *American Journal of Human Biology* 28 (2): 294-294
- Salariya, E.M., PM Easton, and JI Cater. 1978. "Duration of Breast-Feeding after Early Initiation

and Frequent Feeding." *The Lancet* 312 (8100): 1141–1143.

- Samson, D. R., Crittenden, A. N., Mabulla, I. A., Mabulla, A. Z. P., & Nunn, C. L. (2017a). Hadza sleep biology: Evidence for flexible sleep-wake patterns in hunter-gatherers. *American Journal of Physical Anthropology*, 162(3), 573–582. <http://doi.org/10.1002/ajpa.23160>
- Samson, D. R., Crittenden, A. N., Mabulla, I. A., Mabulla, A. Z. P., & Nunn, C. L. (2017b). Chronotype variation drives night-time sentinel-like behaviour in hunter-gatherers. *Proceedings. Biological Sciences*, 284(1858). <http://doi.org/10.1098/rspb.2017.0967>
- Samson, D. R., Manus, M. B., Krystal, A. D., Fakir, E., Yu, J. J., & Nunn, C. L. (2017c). Segmented sleep in a nonelectric, small-scale agricultural society in Madagascar. *American Journal of Human Biology*, e22979. <http://doi.org/10.1002/ajhb.22979>
- Sellen, D. W. 2016. "Integrating Evolutionary Perspectives into Global Health and Implementation Science". In *Childhood: Origins, Evolution, and Implications*, 221.
- Sellen, D. W. 2001. "Of What Use Is an Evolutionary Anthropology of Weaning?" *Human Nature* 12 (1): 1–7. doi:10.1007/s12110-001-1010-1.
- Storey, A. E., D. E. Noseworthy, K. M. Delahunty, S. J. Halfyard, and D.W. McKay. 2011. "The Effects of Social Context on the Hormonal and Behavioral Responsiveness of Human Fathers." *Hormones and Behavior* 60 (4): 353–61. doi:10.1016/j.yhbeh.2011.07.001.
- Tahhan, D. 2013. "Sensuous Connections in Sleep: Feelings of Security and Interdependency in Japanese Sleep Rituals." In *Sleep Around the World: Anthropological Perspectives*, 61–78.
- . 2014. *The Japanese Family: Touch, Intimacy and Feeling*. Abingdon: Routledge.
- Task Force on Sudden Infant Death Syndrome. 2016. SIDS and other sleep-related infant deaths: Updated 2016 recommendations for a safe infant sleeping environment. *Pediatrics*, 138(5), e20162938. <https://doi.org/10.1542/peds.2016-2938>
- Thogmartin, J. R., Siebert, C. F., & Pellan, W. a. 2001. Sleep position and bed-sharing in Sudden Infant Deaths: An examination of autopsy findings. *Journal of Pediatrics*, 138(2), 218–223. <http://doi.org/10.1067/mpd.2001.110327>
- Thoman, E. B. 2006. "Co-Sleeping, an Ancient Practice: Issues of the Past and Present, and Possibilities for the Future." *Sleep Medicine Reviews* 10 (6): 407–17. doi:10.1016/j.smr.2005.12.001.
- Tomori, C. 2014. *Nighttime Breastfeeding: an American cultural dilemma*. New York: Berghahn.
- . 2017. Breastsleeping in four cultures: Comparative analysis of a biocultural body technique. In *Breastfeeding: New Anthropological Approaches*. Tomori, Cecilia, Palmquist, Aunchalee E.L. & Quinn, EA Oxon: Routledge. 55-68.

- . Changing Cultures of Nighttime Breastfeeding and Sleep in the U.S. In: Dowling, S, K Boyer, D Pontin (eds.) Social experiences of breastfeeding: building bridges between research, policy and practice. Pp. 115-130. 2018. Bristol: Policy Press.
- Tomori C, Boyer, K. in press. Domestic Geographies of Parental and Infant (Co-) becomings: home-space, night-time breastfeeding, and parent-infant sleep. *Annals of the American Association of Geographers*.
- Tomori C, Palmquist AEL, Dowling S. Contested moral landscapes: Negotiating breastfeeding stigma in breastmilk sharing, nighttime breastfeeding, and long-term breastfeeding in the U.S. and the U.K. *Social Science & Medicine*, 2016; 168: 178-185.
DOI: 10.1016/j.socscimed.2016.09.014
- Tomori, C, A.E.L. Palmquist, and EA Quinn. 2018. "Introduction: Towards New Anthropologies of Breastfeeding." In *Breastfeeding: New Anthropological Approaches*. Routledge. 1-25.
- Trevathan, W. R., and K. Rosenberg. 2017. *Costly and Cute: Helpless Infants and Human Evolution*. University of New Mexico Press.
- Tully, K. P., and H. L. Ball. 2012. "Postnatal Unit Bassinet Types When Rooming-In after Cesarean Birth: Implications for Breastfeeding and Infant Safety." *Journal of Human Lactation* 28: 495–505. doi:10.1177/0890334412452932.
- Tully, K. P., and H. L. Ball. 2013. "Trade-Offs Underlying Maternal Breastfeeding Decisions: A Conceptual Model." *Maternal & Child Nutrition* 9 (1): 90–98. doi:10.1111/j.1740-8709.2011.00378.x.
- Tully, K. P, and H. L. Ball. 2013. "Misrecognition of Need: Women's Experiences of and Explanations for Undergoing Cesarean Delivery." *Social Science & Medicine (1982)* 85: 103–11. doi:10.1016/j.socscimed.2013.02.039.
- . 2018. "Understanding and Enabling Breastfeeding in the Context of Maternal-Infant Needs." In *Breastfeeding: New Anthropological Approaches*, edited by Cecilia Tomori, Aunchalee E.L. Palmquist, and EA Quinn, 199–211.
- Tully, K. P., A. M. Stuebe, and S. B. Verbiest. 2017. "The Fourth Trimester: A Critical Transition Period with Unmet Maternal Health Needs." *American Journal of Obstetrics and Gynecology* 217 (1): 37–41. doi:10.1016/j.ajog.2017.03.032.
- UNICEF UK (2018) Cosleeping & SIDS: A health professionals guide
<https://www.unicef.org.uk/babyfriendly/wp-content/uploads/sites/2/2016/07/Cosleeping-and-SIDS-A-Guide-for-Health-Professionals.pdf>
- Volpe, L. E. E. 2010. "Using Life-History Theory to Evaluate the Nighttime Parenting Strategies of First-Time Adolescent and Adult Mothers." <http://etheses.dur.ac.uk/287/>.

- Volpe, L. E., & Ball, H. L. (2015). Infant sleep-related deaths: why do parents take risks? *Archives of Disease in Childhood*, 0(7), 603–604. <http://doi.org/10.1136/archdischild-2014-307745>
- Volpe, L. E., H. L. Ball, and J. J. McKenna. 2013. “Nighttime Parenting Strategies and Sleep-Related Risks to Infants.” *Social Science & Medicine* 79 (1): 92–100. doi:10.1016/j.socscimed.2012.05.043.
- Wailoo, M., H. Ball, P. Fleming, and M.W. Platt. 2004. “Infants Bed-Sharing with Mothers.” *Archives of Disease in Childhood* 89 (12). doi:10.1136/adc.2004.054312.
- Wessel, M A, J C Cobb, E B Jackson, G S Harris, and A C Detwiler. 1954. “Paroxysmal Fussing in Infancy, Sometimes Called Colic.” *Pediatrics* 14 (5): 421–35.
- Wolf-Meyer, MJ. 2012. *The Slumbering Masses: Sleep, Medicine, and Modern American Life*. University of Minnesota Press.
- Wolf, AW, B Lozoff, S Latz, and R Paludetto. 1996. “Parental Theories in the Management of Young Children’s Sleep in Japan, Italy, and the United States.” In *Parents’ Cultural Belief Systems : Their Origins, Expressions, and Consequences*, edited by S Harkness and C Super, 364–84. London: Guilford Publications.
- World Health Organisation. 2017. “Guideline: Protecting, Promoting and Supporting Breastfeeding in Facilities Providing Maternity and Newborn Services.” *World Health Organisation*. Licence: CC BY-NC-SA 3.0 IGO.
- Worthman, C. M., and R. A. Brown. 2013. Sleep budgets in a globalizing world: Biocultural interactions influence sleep sufficiency among Egyptian families. *Social Science & Medicine* 79:31-39.
- Worthman, C. M., and M. K. Melby. 2002. Toward a Comparative Developmental Ecology of Human Sleep, Pages 69-117 in M. A. Carskadon, ed. *Adolescent Sleep Patterns: Biological, Social, and Psychological Influences*. Cambridge, Cambridge University Press.
- Yetish, G., Kaplan, H., Gurven, M., Wood, B., Pontzer, H., Manger, P. R., ... Siegel, J. M. 2015. Natural Sleep and Its Seasonal Variations in Three Pre-industrial Societies. *Current Biology*, 25(21), 2862–2868. <http://doi.org/10.1016/j.cub.2015.09.046>