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## CHAPTER

## Breastfeeding and Maternal Mental and Physical Health

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## INTRODUCTION

Expectant mothers are inundated with information about the benefits of breastfeeding for their babies but are often poorly informed about the consequences breastfeeding has for their own mental and physical health. Women know about the potential benefits of breastfeeding for the baby's immune function and intellect (Kramer et al., 2001; Kramer et al., 2008), but mothers could also be asking themselves: What about me? A deep desire to breastfeed an infant is not shared by every mother. In fact, even before the advent of bottles and formula, many affluent women avoided breastfeeding altogether by paying poorer women to do it for them in an arrangement called *wet-nursing*. As the anthropologist Sarah Hrdy (1992) noted, "during the heyday of wet-nursing at the end of the 18th century . . . up to ninety percent of infants born in urban centers such as Paris and Lyon were nursed by women *other* than their biological mother" (p. 415).

Today, the World Health Organization (2009) recommends exclusive breastfeeding for the first 6 months postpartum and the use of breast milk as a supplementary form of feeding for up to 2 years in order to confer

optimal health benefits to the mother and child. Despite these guidelines, recent estimates are that while 70% of mothers initiate breastfeeding after the birth of their child, only 13.5% of infants in the United States are exclusively breastfed for 6 months (Centers for Disease Control and Prevention, 2011a).

Deciding how an infant will be fed is a complex decision involving various social, psychological, emotional, and environmental factors (Arora, McJunkin, Wehrer, & Kuhn, 2000). In order of importance, the top five reasons women give for deciding to breastfeed are (1) its benefits for the infant's health, (2) that it is "natural," (3) to strengthen bonding with their infant, (4) convenience, and (5) benefits for their own health (Arora et al., 2000). By contrast, the top five factors that discourage breastfeeding are (1) opposition by the baby's father, (2) concerns that the baby is not getting enough milk, (3) the need to return to work, (4) discomfort while breastfeeding, and (5) the misconception that breastfeeding will adversely change the appearance of the breasts (Arora et al., 2000). Given the level of commitment that breastfeeding requires, and the number of factors that mothers take into account when making this complex decision, it is important for mothers to

have good information about what breastfeeding can and cannot offer them in return.

This chapter presents the state of the evidence concerning the advantages and disadvantages of breastfeeding for mothers.<sup>1</sup> Questions addressed include: Does breastfeeding really help mothers bond with their infants? Are there health benefits of breastfeeding for mothers? Will breastfeeding change the appearance of the breasts? We use the term *breastfeeding* to refer to any amount of breastfeeding, whether it is the infant's sole nutritional source or only a supplemental form of feeding. We use *exclusive breastfeeding*, by contrast, to refer to when infants are only given breast milk and are not given any other liquid, solid, or vitamins (Labbok and Krasovec, 1990). This chapter starts with an overview of the biology of breastfeeding, which forms the basis of many of the consequences of breastfeeding discussed.

The core of the chapter summarizes the evidence suggesting that breastfeeding aids mothers in weight loss and reduces their risk for ovarian and breast cancers, along with a discussion of the influence of breastfeeding on maternal stress, postpartum depression, and maternal bonding. We approach many of these topics using the lenses of anthropology and comparative research, highlighting the ways that breastfeeding mothers are sometimes very similar and sometimes very different from their mammalian counterparts. The chapter also presents information on the physical, economic, and social costs associated with breastfeeding for mothers. Finally, we conclude by discussing

options women have in navigating the minefields associated with choosing an infant feeding method.

## THE BIOLOGY OF BREASTFEEDING

Background on the biology of breastfeeding is important for understanding how breastfeeding can have a widespread impact on maternal psychology and health. Here, we present a brief overview. For a more detailed account of the biological underpinnings of breastfeeding, see Riordan (2005).

The two most important hormones associated with lactation are oxytocin and prolactin (see Riordan, 2005). Oxytocin, named after the Greek word for "speedy birth," acts in the body as a smooth muscle contractor, facilitating contractions during labor and the release of milk during lactation. Prolactin is the primary hormone responsible for milk production. Prolactin levels increase slowly during pregnancy, triggering changes in the breast tissue that stimulate milk production. Oxytocin also increases during pregnancy, although more rapidly, quadrupling in volume to stimulate labor (Riordan, 2005). Before a breastfeeding session begins, the mother's body releases oxytocin into the blood stream to aid in milk ejection (White-Traut et al., 2009). Mothers separated from their infants before a feeding session do not show this prefeeding oxytocin release; therefore, it appears that infant cues drive this effect (McNeilly, Robinson, Houston, & Howie, 1983). During the feeding session, when tactile stimulation is received from the nipple, oxytocin and prolactin are released in pulsating patterns, controlled by nerve fibers linked to the hypothalamus (Gimpl & Fahrenholz,

<sup>1</sup> The majority of studies on the impacts of breastfeeding have been conducted in the United States; for this reason, studies discussed in this review were U.S.-based unless otherwise noted.

2001). Prolactin levels are generally heightened in women who are breastfeeding as compared to women who are not breastfeeding, although prolactin levels are proportionate to breastfeeding frequency and the infant's milk demands (Battin, Marrs, Fleiss, & Mishell, 1985).

Estrogen and progesterone are also suppressed during lactation, resulting in a period of postpartum infertility, called lactational amenorrhea. This natural form of birth control remains 98% effective throughout the first 6 months of exclusive breastfeeding, as long as breast milk is given to the child from the breast at least every 4 hours during the day and every 6 hours during the night (Peterson et al., 2000; Valdes, Labbok, Pugin, & Perez, 2000). Lactational amenorrhea becomes a less effective form of contraception (94.6%) if mothers use a breast pump or are separated from their infant for long periods (Valdes et al., 2000). This amenorrheic state has been observed to last years in malnourished populations seemingly because of elevated levels of prolactin (Lunn, Austin, Prentice, & Whitehead, 1984).

Until recently, scientists thought that the functions of oxytocin and prolactin were limited to birth and lactation, but they now recognize the impact these hormones have on psychological states. Oxytocin and prolactin circulate in the brain and act on their own receptors distributed widely across different brain regions (Freeman, Kanyicska, Lerant, & Nagy, 2000; Gimpl & Fahrenholz, 2001). Animal research has implicated oxytocin and prolactin in critical maternal behaviors such as grooming, protection, and sensitivity to infant cues (Freeman et al., 2000; Gimpl & Fahrenholz, 2001). As we discuss later, studies in humans have revealed that breastfeeding mothers experience lower levels of stress and negative

mood than do mothers who do not breastfeed, perhaps aiding in the transition to motherhood.

## PHYSICAL HEALTH BENEFITS OF BREASTFEEDING

A large research literature suggests that women who breastfeed experience an array of health benefits (Bernier, Plu-Bureau, Bossard, Ayzac, & Thalabard, 2000; Rea, 2004). In the short term, breastfeeding helps mothers lose weight gained during pregnancy (Garza & Rasmussen, 2000; Kramer & Kakuma, 2004) and helps the uterus contract after pregnancy (Negishi et al., 1999). Over the long term, breastfeeding is associated with reduced risk of reproductive cancers (Bernier et al., 2000), metabolic syndrome (Ford, Giles, & Dietz, 2002; Kramer & Kakuma, 2004), type 2 diabetes (Stuebe & Rich-Edwards, 2009), and cardiovascular disease (Schwarz et al., 2009). The literature linking breastfeeding to improved health has been reviewed elsewhere (Bernier et al., 2000; Rea, 2004). Here, we provide a general overview.

### **Weight Loss and Metabolic Syndrome**

Breastfeeding is calorically costly and is therefore associated with weight loss after pregnancy. Human mothers devote an estimated 525 to 625 calories per day producing the 750 mL of milk infants require daily over the first year of life (Garza & Rasmussen, 2000). A caloric shortfall is experienced in most breastfeeding women, who often do not report more hunger than nonbreastfeeding women (Heck & de Castro, 1993). In a study that followed more than 20,000 Danish women from pregnancy to

18 months postpartum, women who exclusively breastfed for the recommended 6 months after birth lost an additional 2 kgs (4.4 pounds) of pregnancy-related weight by 6 months postpartum than women who breastfed for shorter durations (Baker et al., 2008). In line with this result, a systematic review of 20 studies showed that exclusive feeding with breast milk for the first 6 months postpartum predicts significantly greater postpregnancy weight loss than with mixed forms of breastfeeding (breastfeeding while introducing other foods or liquids) (Kramer & Kakuma, 2004).

Studies have also shown that women with a history of breastfeeding have a reduced risk of developing metabolic syndrome, a combination of medical disorders, such as obesity, insulin resistance, and high blood pressure, which increases the risk of cardiovascular disease and diabetes (Ford et al., 2002). A cross-sectional analysis of 2,516 midlife women found a 20% reduction in the risk of developing metabolic syndrome for every additional year of breastfeeding women reported (Ram et al., 2008). The authors noted that, although weight loss associated with breastfeeding accounted for a significant portion of the reduced risk in their sample, breastfeeding was associated with reductions in metabolic syndrome risk above and beyond weight loss, even when health behaviors and sociodemographic variables were statistically controlled. These additional benefits could owe to the observation that breastfeeding primes the body to become more metabolically efficient. This idea, dubbed the “reset hypothesis,” proposes that breastfeeding reverses gestational increases in fat accumulation, insulin resistance, and lipid and tryglicerin levels more quickly and completely (Stuebe & Rich-Edwards, 2009).

According to the hypothesis, the reset process causes long-term positive impacts on women’s health, reducing the risk for metabolic syndrome, and, consequently, reducing the risk of type 2 diabetes and cardiovascular disease.

New research indicates that breastfeeding may reduce the risk of developing both type 2 diabetes and cardiovascular disease. For example, Schwarz and colleagues (2009) found that among 139,681 postmenopausal women, those who reported a lifetime history of breastfeeding of more than 1 year were less likely to develop postmenopausal diabetes, hypertension, and cardiovascular disease than women who never breastfed. Likewise, another large study found that women who breastfed over their lifetime for 2 years or more were 23% less likely to develop coronary heart disease than women who never breastfed, even after controlling for parental history, early adult adiposity, and various lifestyle factors (Stuebe et al., 2009). Interestingly, some evidence suggests that longer durations of breastfeeding the same child, rather than total time spent breastfeeding over one’s lifetime, has the greatest protective benefit against coronary heart disease (Stuebe, Rich-Edwards, Willett, Manson, & Michels, 2005).

A study that investigated the relationship between type 2 diabetes and breastfeeding in two cohorts of more than 70,000 women found that, although the total lifetime duration of breastfeeding was associated with reduced risk of type 2 diabetes, it was longer durations of breastfeeding involving the same child, as opposed to the combined duration of breastfeeding across multiple children, that conferred the greatest protective benefits (Stuebe et al., 2005). In this sample, a year of continuously breastfeeding one child was associated with a 44% decrease

in risk of developing later diabetes, while a year of breastfeeding spread across two children was only associated with a 24% decrease. Whether this finding can be attributed to the reset hypothesis is unclear, although it seems possible that women's bodies could require more than half a year of breastfeeding after any given pregnancy to completely reset metabolic action.

### **Breast and Ovarian Cancer**

Breastfeeding may also protect against breast and ovarian cancers by suppressing ovulation, and thus limiting lifetime estrogen exposure (Clemons & Goss, 2001; Key & Pike, 1988). Theoretically, reductions in total estrogen exposure may reduce the risk of breast cancer, because estrogen increases rates of breast cell proliferation and differentiation, giving more opportunities for mutations to occur and, when they do, fueling cancer growth (Clemons & Goss, 2001; Key & Pike, 1988). In support of this model, a meta-analysis of 23 case-control studies found a small protective effect of breastfeeding on breast cancer: Any lifetime history of breastfeeding, regardless of duration, yielded a benefit, although this effect was small compared to other known biological risk factors (Bernier et al., 2000). This effect was strongest in nonmenopausal women and in women who had breastfed for longer than 12 months.

Recent research has also begun to examine the impact of breastfeeding on women with hereditary predispositions to develop breast cancers, with mixed results. Jernström and colleagues (2004), for example, evaluated the role of breastfeeding in women who carried the genetic mutations BRCA1 or BRCA2, which are known to raise the lifetime risk of breast cancer by

approximately 80% (King, Marks, & Mandell, 2003). In this study, 685 carriers of BRCA1 and 280 carriers of BRCA2 were compared to 965 women with no history of ovarian or breast cancer. They found that cumulative breastfeeding for longer than a year reduced the risk of hereditary breast cancer in women with the BRCA1 mutation, but not the BRCA2 mutation. By contrast, neither Lee et al. (2008) nor Andrieu et al. (2006) observed an association between breastfeeding and breast-cancer risk in women with BRCA1 or BRCA2.

Studies suggest that the risk of ovarian cancer is reduced by breastfeeding behaviors as well. A review by Shoham (1994) revealed that 6 of 11 studies found that breastfeeding was related to reduced risk of ovarian cancer. More recently, researchers analyzed 391 cases of epithelial ovarian cancer among 149,693 women in the Nurses' Health Study (Danforth et al., 2007). They found that for each month of additional breastfeeding, the risk of epithelial ovarian cancer was reduced by 2%. Another study documented a similar 1.4% reduction in ovarian cancer risk for every additional month of breastfeeding (Jordan, Siskind, Green, Whiteman, & Webb, 2010), although the reduction in risk did not continue to accrue beyond the first 12 months. Breastfeeding has been found not only to reduce the risk of developing ovarian cancer, but also to improve the chances of surviving in women who do develop it. One study found that women diagnosed with ovarian cancer lived longer if they had ever breastfed than if they had never breastfed (Nagle, Bain, Green, & Webb, 2008). In this same study, there was no relationship between duration or frequency of breastfeeding and improved ovarian cancer outcomes.

Evidence continues to accumulate demonstrating an association between breastfeeding and reduced risk of ovarian and breast cancers, diabetes, and cardiovascular disease. Breastfeeding is a biologically complex phenomenon, involving changes in hormone levels that act on receptors throughout the brain and the body. Although the links to maternal health are not yet fully known, these hormone dynamics may exert long-term impacts on women's health. Reductions in diseases related to metabolic syndrome may owe, in part, to weight loss and improved metabolic function associated with breastfeeding. Breastfeeding also reduces lifetime estrogen exposure, potentially accounting for reduced risk of reproductive cancers among women with a history breastfeeding. Some studies find dose-response relationships between increased total duration of lifetime breastfeeding and better health outcomes.

## **MENTAL HEALTH BENEFITS OF BREASTFEEDING**

### ***Stress Regulation***

Being a new parent is as stressful as it is rewarding. Sources of maternal stressors range from worries about being a "good" mother (Mercer, 1986) to physical stressors, such as sleep deprivation, body changes, and sexual dysfunction (Gjerdingen, Froberg, Chaloner, & McGovern, 1993). New mothers struggle to find time for their baby while trying to meet the needs of partners, other children, and themselves (Gruis, 1977). The vigilance required to be a good parent is also a stressor for new mothers (Hahn-Holbrook, Holbrook, & Haselton, 2011). Given all the stressful demands and challenges parenthood

brings, it is perhaps unsurprising that approximately one in five women self-report depressive symptoms within the first year after birth (Gavin et al., 2005). However, nature may also have provided mothers with a stress-buffer: breastfeeding (Carter & Altemus, 1997; Groer, Davis, & Hemphill, 2002).

Only recently have scientists begun to recognize the ways that lactation alters a mother's stress responses (Groer et al., 2002; Lonstein, 2007; Mezzacappa, 2004). The earliest studies done on rodents revealed that lactating dams were remarkably resistant to stress. Lactating rodents exposed to stressors, such as electric shocks, fierce predators, or complex mazes, displayed fewer hormonal and cardiovascular signs of anxiety than their nonlactating female counterparts (see Neumann, 2001, for a review).

Corresponding research in humans has shown a similar association between breastfeeding and reduced stress. The first study conducted in humans showed that breastfeeding women had significantly lower hormonal stress responses (as evidence by lower cortisol and ACTH) during exercise stress than nonbreastfeeding mothers or women without children (Altemus, Deuster, Galiven, Carter, & Gold, 1995). Several follow-up studies have since examined women's cardiovascular and hormonal stress responses to the classic Treir Social Stress Task, which involves giving a public speech and doing difficult mental arithmetic in front of a critical audience. Although these studies tend not to find evidence of lower stress reactivity using hormonal markers of stress, such as cortisol, they consistently find that breastfeeding women have lower cardiovascular markers of stress than do formula-feeding women.

For example, one study detected lower cardiovascular markers of stress (as evidence

by lower basal systolic blood pressures, higher levels of cardiac parasympathetic control, and modulation of heart rate reactivity) during the task in breastfeeders compared with nonbreastfeeding mothers and women without children (Altemus et al., 2001). Another study found similar cardiovascular patterns for breastfeeding mothers during the anticipation of the public-speaking stressor (Light et al., 2000). It is possible that any stress-buffering effects of breastfeeding are more potent directly after the act. Mothers randomly assigned to breastfeed before this public-speaking stressor have blunted cortisol responses when compared to breastfeeding women who were instructed to hold their infants (Heinrichs et al., 2001).

The stress-reducing effects of breastfeeding may extend to other stressors as well. Mezzacappa, Kelsey, and Katkin (2005), for example, compared the cardiovascular responses to difficult mental arithmetic (verbal serial subtractions) and immersion of one's hand into ice water in four groups of women—those exclusively breastfeeding, exclusively formula-feeding, mixed feeding (breast and formula), and women without children. In response to the challenging mental arithmetic, mothers who breastfed exclusively displayed attenuated heart-rate reactivity and shortened pre-ejection period (PEP; an indicator of the reduced cardiac stress related to the sympathetic nervous system) compared to all other groups. Moreover, this study found a dose-response relationship between breastfeeding frequency and stress reduction. Women who breastfed more times per day had lower heart rates in reaction to doing the difficult mental arithmetic and reduced sympathetic reactivity to the cold water task than women who breastfed less frequently. In this study,

the stress buffering effects of breastfeeding appeared to fade as children grew older. Breastfeeding mothers with very young infants derived greater stress-buffering from breastfeeding than women who had 1-year-old children.

Preliminary research suggests links between breastfeeding and reduced stress in women's daily lives outside of the laboratory. Breastfeeding mothers are more likely to report positive mood states, less anxiety, and increased calm as compared to formula-feeding mothers (Altshuler, Hendrick, & Cohen, 2000; Carter & Altemus, 1997; Fleming, Ruble, Flett, & Van Wagner, 1990; Ford et al., 2002; Heinrichs et al., 2001). These differences between breastfeeding and formula-feeding mothers remain after controls for possible confounds, including maternal age, work status, income, and health behaviors (Mezzacappa, Guethlein, & Katkin, 2002; Mezzacappa, Guethlein, Vaz, & Bagiella, 2000; Mezzacappa & Katkin, 2002).

While studies in rodents indicate that the stress reduction associated with lactation is mediated by the hormones oxytocin (Neumann, Torner, & Wigger, 2000; Windle, Shanks, Lightman, & Ingram, 1997) and prolactin (Bole-Feysot, Goffin, Edery, Binart, & Kelly, 1998; Freeman et al., 2000), data in humans are more limited. We do know that women with higher plasma oxytocin and prolactin in the early postpartum period report less anxiety than do women with lower levels of these hormones (Nissen, Gustavsson, Widstrom, & Uvnas-Moberg, 1998; Uvnas-Moberg, Widstrom, Werner, Matthiesen, & Winberg, 1990). Furthermore, breastfeeding women who release more oxytocin during infant suckling have lower levels of cortisol than women who release less

oxytocin during infant feedings (Chiodera et al., 1991). In addition, breastfeeding women with higher oxytocin show reduced markers of stress while preparing for a public-speaking stressor relative to those with lower oxytocin (Light et al., 2000).

Research in humans and other species has shown that physiological responses to stressors are reduced among lactating relative to nonlactating females. In studies with human mothers, the stress-buffering effects of breastfeeding appear to be stronger in the early postpartum period and soon after a feeding session. Cardiovascular measures of stress, which tap into sympathetic and parasympathetic nervous system activity, are more likely to reveal differences in stress reactivity between breast- and formula-feeding women than hypothalamic-pituitary-adrenal (HPA) axis hormones like cortisol. Breastfeeding mothers also report less perceived stress in their daily lives than formula-feeding mothers. The stress-buffering effect of lactation appears to result from the hormones oxytocin and prolactin in nonhumans, although direct evidence in humans is lacking. Collectively, nonhuman and human evidence strongly suggests that breastfeeding is an important regulator of maternal stress in the postpartum period.

### ***Postpartum Depression***

Although the birth of a child typically conjures images of joy and fulfillment, many women experience feelings of hopelessness and despair instead. Postpartum depression is a devastating mental illness affecting approximately 13% of women worldwide within the first 12 weeks after giving birth (O'Hara & Swain, 1996), and roughly one in five women within the first postpartum year (Gaynes et al., 2005). Postpartum depression

is distinct from other postpartum mood disorders like the common and transient "postpartum blues," which affects 50% to 80% of mothers worldwide (Pitt, 1973; Yalom, Lunde, Moos, & Hamburg, 1968), or the very serious, although rare, occurrence of postpartum psychosis (Herzog & Detre, 1976). The effects of postpartum depression are insidious because they can disrupt parenting behaviors (Field, 2010), resulting in long-term negative consequences on the cognitive, emotional, and behavioral development of children (Grace, Evindar, & Stewart, 2003). Because of the serious negative consequences of this disorder, there has been much research identifying predictors of postpartum depression.

A recent systematic review identified 12 studies that reported that breastfeeding women had lower rates of postpartum depression in comparison to formula-feeding women (Dennis & McQueen, 2009). However, there is an important question that few studies explicitly address: Does less breastfeeding lead to more depression, or does more depression lead to less breastfeeding? The vast majority of research on this topic to date has focused solely on the ways that depression can lead to less breastfeeding.

It is easy to imagine why depression might interfere with breastfeeding. Symptoms of depression commonly include decreased motivation, increased anxiety, and, for new mothers, avoidance of the infant (Beck, 1992). Breastfeeding is an intimate behavior demanding sustained periods of direct mother-infant contact, which many depressed mothers may find difficult. Formula-feeding then might seem the more attractive option for depressed mothers, because it can be performed by other caregivers. Furthermore, anxiety associated with

depression can interfere with the maternal milk supply (Riordan, 2005), leading depressed mothers to feel that they have insufficient milk and need to switch to formula to ensure that their infant receives adequate nutrition. Finally, many antidepressant medications are not recommended for breastfeeding mothers, because the active ingredients can be transferred to the baby through breast milk and could have adverse impacts on infant development (Riordan, 2005). It is not surprising, then, that studies find depressed mothers are less likely to breastfeed.

Depressed mothers commonly report more difficulties with breastfeeding (Edhborg, Friberg, Lundh, & Widstrom, 2005; Tamminen, 1988), lower levels of breastfeeding self-efficacy (Dai & Dennis, 2003), and more failed breastfeeding attempts (Ferguson, Jamieson, & Lindsay, 2002). One study found that depressive symptoms seven weeks after delivery predicted higher rates of weaning by 24 weeks postpartum (Galler et al., 1999). Similarly, another study found that women who were depressed at 2 weeks postpartum were more likely to wean before 2 months postpartum than women who were not depressed at 2 weeks postpartum (Taveras et al., 2003). Researchers have found that women who experience depression in pregnancy are less likely to initiate breastfeeding (Seimyr, Edhborg, Lundh, & Sjögren, 2004). These studies show that decreased breastfeeding behavior follows depression during pregnancy and in the early postpartum period. However, the existence of this relationship does not preclude the possibility that breastfeeding may also exert protective effects against postpartum depressive symptoms.

There are reasons to think that breastfeeding could protect mothers against depression. The act of breastfeeding releases

oxytocin, which has been found in lower levels in depressed mothers than in nondepressed mothers (Skrundz, Bolten, Nast, Hellhammer, & Meinschmidt, 2011). Women currently using both breastfeeding and formula-feeding methods report lower levels of negative mood if they are randomly assigned to breastfeed their infant in the laboratory than if they are randomly assigned to formula-feed (Mezzacappa & Katlin, 2002), perhaps from the oxytocin released by breastfeeding. Breastfeeding is also associated with reduced stress (Mezzacappa, 2004), and because stress is one of the strongest risk factors in the development of depression (Hammen, 2005), breastfeeding could buffer women against depression. Breastfed infants tend to have easier temperaments (Jones, McFall, & Diego, 2004) and fewer health problems over the long term (Ip et al., 2007), which could also have positive downstream consequences for maternal mental health. Taken together, these findings suggest that breastfeeding could confer protective benefits against depression.

Very few studies have investigated the possibility that breastfeeding might be protective against postpartum depression. Two studies found that never having breastfed versus having breastfed was associated with subsequent postpartum depression (Chaudron et al., 2001; Hannah, Adams, Lee, Glover, & Sandler, 1992), and one study found that discontinuing breastfeeding versus continuing to breastfeed was also associated with subsequent depression (Nishioka et al., 2011). Critically, however, none of these studies controlled for baseline levels of depression during pregnancy, leaving open the possibility that women who engaged in breastfeeding were simply less depressed from the outset.

Only one published study was identified that explicitly set out to test the hypothesis that breastfeeding is protective against the development of postpartum depression (Dennis & McQueen, 2007). This study found that women who exclusively breastfed at one week postpartum were equivalently likely to become depressed at 4 or 8 weeks postpartum as women who exclusively formula-fed (Dennis & McQueen, 2007), suggesting that there is no protective benefit of exclusive breastfeeding at one week against the development of depressive symptoms at 4 and 8 weeks postpartum. Importantly, however, this study may have been limited in its ability to detect the mental health benefits of breastfeeding, because the mothers in the sample had only been breastfeeding for a very short time. Furthermore, the time frame within which depression was assessed (between 1 and 8 weeks postpartum) may have been too narrow to detect the downstream effects of breastfeeding on depression.

Breastfeeding is clearly related to postpartum depression; however, the nature of that relationship remains somewhat unclear. On the one hand, much research has shown that depression predicts lower rates of breastfeeding initiation and shorter durations of breastfeeding. These effects likely result from the increased problems depressed women encounter while breastfeeding. On the other hand, very little research has assessed the possibility that breastfeeding might also be protective against postpartum depression. Given the theoretical reasons to think that breastfeeding might be protective against depression, further research using longitudinal or experimental designs is clearly needed before conclusions can be drawn about whether the relationship between depression and breastfeeding is

bidirectional (depression leading to less breastfeeding and less breastfeeding leading to depression) or simply unidirectional (depression leading to less breastfeeding).

### **Maternal Bonding**

Conventional wisdom holds that breastfeeding helps mothers bond with their babies. In fact, one of the most common reasons given by women for wanting to breastfeed is the opportunity to bond with their children (Arora et al., 2000). In the scientific literature as well, breastfeeding is often assumed to aid in maternal–infant attachment, without necessarily giving reference to direct evidence (for examples, see Jansen, Weerth, & Riksen-Walraven, 2008). Given this, it is surprising that only a few studies have actually tested this hypothesis in humans, and even fewer have found significant results. Here, we review the small literature on the impact of breastfeeding on the mother–child bond (for a more in-depth review, see Jansen et al., 2008). Although the mother–infant relationship is bidirectional—in that the mother can bond with the infant and the infant can bond with the mother—our primary focus is maternal bonding. Briefly, however, we found no studies with evidence that breastfed infants are more securely attached to their mothers than formula-fed infants (see Jansen et al., 2008, for a review). Like the data linking lactation and stress, most of what we have learned about breastfeeding and bonding comes from animal studies.

Lactation is critical for inciting maternal behaviors in many mammalian species, because it releases the hormones oxytocin and prolactin, which facilitate maternal behavior (see Kendrick, 2000, for a review). For example, female rats will suddenly

display maternal behaviors if oxytocin (Pedersen, Caldwell, Peterson, Walker, & Mason, 1992) or prolactin (Bridges, DiBiase, Loundes, & Doherty, 1985) is injected into their brains. If a chemical that blocks the actions of oxytocin or prolactin is injected into the brain of a rat shortly after birth, a rodent's mothering behavior is significantly impaired (Bridges, Rigerio, Byrnes, Yang, & Walker, 2001; van Leengoed, Kerker, & Swanson, 1987). In nonhuman primates, however, hormonal changes linked to lactation play a smaller role in the onset of maternal behaviors, with early learning and social experience making up the difference (Pedersen, 2004). For example, administration of an oxytocin antagonist into the brain of a female rhesus monkey reduces certain caregiving behaviors, while leaving others fully intact (Boccia, Goursaud, Bachevalier, Anderson, & Pedersen, 2007). Years of observations by primatologists also tell us that maternal behaviors routinely emerge in female primates without the influence of lactation. For example, female primates who do not have offspring of their own often seek out caregiving opportunities, such as carrying and grooming infants (Hrdy, 1999).

Breastfeeding is certainly not necessary for parental bonding to occur in humans, as adoptive mothers, formula-feeding mothers, and fathers can attest. However, might breastfeeding give mothers, especially if they are reluctant or are experiencing mothering challenges, extra incentives to care for their infant?

Recent studies in humans suggest that oxytocin is important for maternal bonding. For instance, plasma oxytocin levels during pregnancy and the postpartum period predict more maternal bonding behaviors, such as eye gaze, vocalizations, positive affect, and

affectionate touch, and more attachment-related thoughts (Feldman, Weller, Zagoory-Sharon, & Levine, 2007). Also, mothers who provide high levels of affectionate touch during a play session with their children have higher levels of oxytocin after the encounter than mothers who provide low levels of affectionate touch (Feldman, Gordon, Schneiderman, Weisman, & Zagoory-Sharon, 2010). Given this evidence, one might predict breastfeeding, which gives women extra bursts of oxytocin, would lead to greater levels of maternal bonding.

Three out of four studies investigating whether breastfeeding promotes maternal bonding have found supportive evidence (see Martone & Nash, 1988, for the null result). In the largest study on the topic, mother-infant interactions were observed at 4 and 12 months postpartum in women who had either breastfed for at least a week ( $n = 439$ ) versus women who had not initiated breastfeeding ( $n = 94$ ) (Else-Quest, Hyde, & Clark, 2003). The researchers found that mothers who had breastfed for at least 1 week showed higher-quality interactions with their babies at 12 months, but not at 4 months postpartum. In another study of 405 women, mothers who were supplying over half of their infant's diet through breastfeeding at 5 months postpartum reported that they were more emotionally bonded to their infant at that time than women who were supplying less than half of their infant's diet through breast milk or were not breastfeeding at all (Nishioka et al., 2011).

Similarly, Britton, Britton, and Gronwaldt (2006) found that mothers who were breastfeeding at 3 months reported that they felt they were more sensitive to their child's needs than women who were not currently

breastfeeding. The findings of the previous two studies should be interpreted with caution, however, because maternal behavior was not rated by objective observers. In fact, Britton, Britton, and Gronwaldt (2006) found women who intended to breastfeed in pregnancy also reported higher sensitivity toward their infants at 3 months, suggesting that women who choose to breastfeed may just be more sensitive (or report being more sensitive) from the outset. In fact, other studies suggest that the quality of the maternal–infant bond predicts a mother’s willingness to breastfeed. A study found that better bonding behavior 48 hours after birth predicted higher rates of exclusive breastfeeding at 6 months in a sample of more than 500 women (Cernadas, Noceda, Barrera, Martinez, & Garsd, 2003).

At this early stage of the research, it is too soon to tell whether breastfeeding increases bonding between mothers and infants as compared to other forms of feeding. This topic deserves additional research attention with prospective or experimental designs and objective measures of bonding, especially given that many women worry that not breastfeeding will interfere with their ability to bond with their babies. One important observation in the largest of the studies noted (Else-Quest et al., 2003) was that women who had never breastfed at all exhibited maternal sensitivity well within the normal range defined by clinicians. Oxytocin could still facilitate maternal bonding for mothers who do not breastfeed. For example, direct skin-to-skin contact with the infant and affectionate touch likely increases maternal oxytocin levels (Uvnäs-Moberg, 1998). These alternative mechanisms may be partly responsible for bonding in mothers of adopted infants, fathers, and other caretakers.

## **POTENTIAL MATERNAL COSTS OF LACTATION**

Breastfeeding has many possible benefits for mothers, but it can also clash with other goals for women, such as having a full-time career. Some of the costs associated with breastfeeding are probably overstated, like sagging breasts, whereas others are likely understated, for example, the social stigma associated with breastfeeding in some societies. Breastfeeding can also be problematic for women with certain physical or health conditions. Furthermore, many women find breastfeeding very difficult because of work constraints or physical pain. Here, we review the potential physical, economic, and social costs associated with breastfeeding for mothers.

### **Physical Costs**

Breastfeeding does have some physical costs for women. Most mothers will have some nipple discomfort during the first 10 days of breastfeeding (Riordan, 2005). If pain is prolonged, a medical assessment by a lactation consultant or nurse is usually required to identify the source of the problem. The most common causes of severe nipple pain are nonideal positioning of the infant at the breast or poor suckling technique on the part of the infant (Morland-Schultz & Hill, 2005). Both of these can usually be identified and remedied by a trained lactation consultant or nurse (Riordan, 2005). Severe nipple pain can sometimes be a sign of a more serious breastfeeding-related infection. Common infections include mastitis, a usually benign infection that is easily treatable by increasing breast milk expression and antibiotics, and candidiasis (or thrush), a yeast infection transferred from the baby’s

mouth into the nipple that is treatable with antifungal medications (Riordan, 2005). Women can reduce their risk for these and other breastfeeding-related infections by employing good positioning and latching techniques, and by massaging their breasts to facilitate milk flow (Riordan, 2005).

Beyond the potential for discomfort, breastfeeding restricts the types of medications a mother can take. A Scandinavian study found that up to 25% of women took some form of medication while they were breastfeeding, and uncertainty regarding the drug's safety was a major reason for the discontinuation of breastfeeding (Matheson, Kristensen, & Lunde, 1990). There are often alternative forms of a drug within the same drug class (e.g., antibiotics, selective serotonin reuptake inhibitors, oral contraceptives) that are safe for breastfeeding women. For example, a woman who requires medication to treat depression but who also wants to breastfeed could talk to her doctor about taking Paxil (paroxetine) instead of Prozac (fluoxetine) or Trilafon (perphenazine) instead of Nardil (phenelzine), both of which are considered safe for breastfed infants (Riordan, 2005). Mothers and healthcare professionals can find advice about the safety of medications for breastfeeding mothers online at LactMed (<http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?LACT>), the U.S. National Library of Medicine's drugs and breastfeeding database (U.S. National Library of Medicine, 2001).

Nutrients to synthesize breast milk are often mobilized from maternal stores at the mother's expense (Dewey, 1997). To offset these costs, the body generally has mechanisms in place that help the mother rebound from the nutritional stores used during breastfeeding. For example, by producing 600 to 1,000 mL of breast milk per day, a

mother loses 200 mg of calcium daily (Rea, 2004); however, calcium absorption becomes more efficient during pregnancy and after weaning often resulting in net calcium gains over the long term (Riordan, 2005). However, in women who are malnourished or immunologically compromised, the nutrients required for breastfeeding can overwhelm the mother's body and lead to health problems. For example, a randomized clinical trial found that breastfeeding among HIV-infected women increased maternal death by three-fold at a 2-year follow-up as compared to formula feeding (Nduati et al., 2001). The investigators postulated that the nutritional demands posed by breastfeeding may be too great for HIV-infected women. With the exception of malnourished women or women with HIV, the nutritional costs of breastfeeding can usually be met by simply increasing caloric intake of nutrient-rich foods by 200 to 700 calories per day, depending on the frequency of breastfeeding (Riordan, 2005). Mothers are often advised to take a multivitamin with 100 mg of iron, along with a calcium and omega-3 fatty acid supplement, to ensure proper nutrition for the mother and breastfed infant (Riordan, 2005).

A common reason that women give for not breastfeeding is the belief that it will adversely affect the appearance of the breasts (Arora et al., 2000). Fathers also commonly worry that breastfeeding will have these effects, leading some men to discourage their partners from breastfeeding (Bar-Yam & Darby, 1997). These concerns, however, are not supported by empirical evidence. For example, a study of 93 women who were seeking plastic surgery to improve the shape of their breasts found no significant relationship between objective ratings of

breast ptosis (drooping or sagging) and breastfeeding initiation or duration (Rinker, Veneracion, & Walsh, 2008). The notion that breastfeeding makes breasts sag likely stems from the fact that pregnancy does lead to changes in breast tissue. This same study found that number of pregnancies, along with age, body mass index, larger pregnancy bra cup size, and smoking history were positively related to breast ptosis. Similarly, a prospective Italian study found that mothers frequently reported that the size and the shape of their breasts had changed after childbirth, but these changes were not different as a function of infant feeding behaviors (Pisacane & Continisio, 2004).

Breastfeeding appears to have some clear physical costs for mothers, although these are usually transitory, and most can be ameliorated by proper breastfeeding techniques and nutrition during breastfeeding. With the exception of women with HIV or severely malnourished women, there is little evidence for any long-term physical costs associated with breastfeeding.

### **Labor and Economic Costs**

Breastfeeding can place a burden on women's time and freedom from childcare responsibilities. A woman providing breast milk exclusively to her child has to breast-feed her child or express milk approximately 8 to 12 times per day during the first 6 months of exclusive breastfeeding (U.S. Department of Health and Human Services' Office on Women's Health [OWH], 2011). Each breastfeeding or expression session takes approximately 15 to 20 minutes, meaning that women will spend an estimated 2 to 4 hours per day breastfeeding (OWH, 2011). Actual time spent feeding is lessened by formula-feeding because the

infant drinks milk from a bottle more quickly and formula is digested more slowly; therefore, feedings can be performed faster and less frequently. In addition, because feeding responsibilities can be shared by other caregivers, feeding with formula may also give the mother more freedom.

The time commitment associated with breastfeeding can place a burden on women in the workplace. A breastfeeding mother needs to allocate approximately 45 to 75 minutes per workday to express breast milk (Mohler, 2011). In addition, breastfeeding women need a private place to express milk, a place to store breast milk, and the ability to take several breaks per day. It is also possible that women who need to make these arrangements are perceived as less serious about their jobs, or are stigmatized by co-workers who are uncomfortable with breastfeeding (Smith, Hawkinson, & Paull, 2011). Given the burden that pumping breast milk at work places on women, it is not surprising that women who return to work within 12 weeks after birth wean sooner than those who do not return to work within 12 weeks (Callen & Pinelli, 2004).

In a cross-cultural comparison, the United States was found to have the lowest breastfeeding initiation rates compared to other industrialized nations such as Canada, Sweden, and Australia (Callen & Pinelli, 2004), a fact that may be related to American maternity leave policies (Guendelman et al., 2009). In the United States, the Family and Medical Leave Act allows mothers only 12 weeks of unpaid maternity leave. Compare this to Sweden, where parents are entitled to approximately 16 months of paid leave after the birth of a child (Galtry, 2003). As a result of this, approximately one-third of American women return to work within 3 months of giving birth, as compared to in Sweden,

where only about 5% return to work within 3 months (Klerman & Leibowitz, 1999). It should not be surprising that breastfeeding initiation is nearly universal in Sweden (97% of mothers), with approximately 40% of infants still breastfeeding exclusively at 6 months (Galtry, 2003). The possible link between breastfeeding rates and maternity leave policies highlights the role of structural factors in shaping infant feeding decisions, which are normally thought to simply reflect personal choices.

Recently, the U.S. government has taken steps that might increase rates of breastfeeding initiation and its duration. In 2010, President Obama signed the Patient Protection and Affordable Care Act, which includes a provision requiring employers to provide a place other than the bathroom and reasonable break time for female employees to express breast milk for the first year after a child's birth. Some employers are exempted, however, because they have fewer than 60 employees or because allowing breaks would cause an unreasonable burden for the business.

Although breastfeeding does require substantial time commitments for the mother, which may reduce the time available for work, there may be some economic benefits of breastfeeding. The increased cost of formula as compared with breastfeeding is between \$1,000 and \$4,000 per year per baby (Mohler, 2011). Additional indirect cost savings include the possibility that there will be fewer medical bills related to infant illness and fewer absences from paid work time for doctor visits with sick infants (Mohler, 2011). Because there are possible health benefits of breastfeeding, such as reduced risk of type 2 diabetes in mothers (Stuebe & Rich-Edwards, 2009) or reduced risk of gastrointestinal infection in infants (Kramer

et al., 2001), breastfeeding is associated with reductions in medical costs (Mohler, 2011). Breastfeeding also does not require environmental waste from formula production and packaging. Furthermore, breastfeeding women may save some time that would otherwise be spent preparing formula and sterilizing bottles.

Breastfeeding poses significant burdens on women's time and freedom during the postpartum period. Feeding with formula allows mothers more freedom, because other caregivers can care for the infant more readily. Pumping breast milk for feedings when the mother is absent is also not feasible for many women who do not have access to adequate support. These costs, however, may be offset to some extent by the fact that breastfeeding is less expensive than formula-feeding, and may lead to considerable reductions in healthcare costs and time taken from work because of child and maternal illness over the long term. Future research might address whether women gain equivalent health benefits from breast pumping and breastfeeding, given that this question has important implications for women who are in the workforce and need to pump regularly.

### **Social Costs**

Breastfeeding can have some social costs for women. For example, women often feel embarrassed about breastfeeding in public, although it is legal in 45 states in the United States. A study found that low-income pregnant women in Missouri felt that discreetly breastfeeding in one's home in front of visitors was acceptable, but that it was less acceptable to breastfeed in public, especially if people were embarrassed by it or if the breastfeeding was not discrete (Libbus &

Kolostov, 1994). Similarly, women often reported feeling “vulnerable” while breastfeeding in public and expect to receive negative attention for it (Sheeshka et al., 2001). These feelings can lead women to remain housebound or restrict their movements during exclusive breastfeeding to avoid the social stigma of breastfeeding in public (Sheeshka et al., 2001).

In cultures where breastfeeding is widely accepted, women often have more freedom to breastfeed in public places. For example, Dettwyler (1995b) asserts that in places such as Mali or Nepal, women are able to breastfeed their infants in public freely and without stigmatization. Dettwyler (1995b) argues that the sexualization of the breast in many Western cultures accounts for much of the taboo surrounding breastfeeding in public, noting that in Mali and Nepal, where breastfeeding in public is completely socially acceptable, breasts do not have the same sexual connotation for men or women that they do elsewhere in the world. In cultures where the primary function of the breast is thought to be sexual, the sight of a woman breastfeeding is often considered “perverted” or “obscene.” For example, the popular social networking website, Facebook, officially banned pictures of women breastfeeding their infants, claiming that these photos violated their decency code by showing an exposed breast (Worthman, 2009). Women who breastfeed in cultures where breastfeeding is taboo often face continual pressure from friends and family to use formula, have low breastfeeding confidence, feel intense stigma around breastfeeding in public, and have very little access to breastfeeding information outside of medical professionals (Scott & Mostyn, 2003).

The social acceptability of breastfeeding varies by culture and ethnicity, which has

implications for breastfeeding rates (see Kelley, Watt, and Nazoo, 2006, for a review). Women who immigrate to the United States from cultures where breastfeeding is more common have higher rates of breastfeeding than the U.S. population. For example, Black women who immigrate to the United States from West Indian Countries—where breastfeeding is the norm—are more likely to intend to breastfeed exclusively after birth than are African American women (Bonuck, Freeman, & Trombley, 2005). Among Puerto Rican women, length of residence in the continental United States is inversely associated with breastfeeding initiation (Pérez-Escamilla et al., 1998), indicating that living in a culture like the United States where breastfeeding is less common than in Puerto Rico can alter breastfeeding practices.

There is also variation across cultures in beliefs about the appropriate age to wean a child. Women who violate their local norms can face social stigma. Although the average duration of breastfeeding in traditional societies is approximately 2.5 years (Dettwyler, 1995a), many women in the United States report that they receive negative reactions from others if they breastfeed past the first few months postpartum (Kendall-Tackett & Sugarman, 1995). In a survey conducted in the United States, the percentage of mothers citing “social stigma” as a negative aspect of breastfeeding was strongly related to the age of the child: 29% of women breastfeeding past 6 months and 61% of women breastfeeding past 24 months reported feeling stigma as a result of breastfeeding (Kendall-Tackett & Sugarman, 1995).

Recent research also suggests that breastfeeding women face social stigma in the United States regardless of where or how long they choose to feed their infants. In a

series of studies conducted with college students, breastfeeding mothers were rated as less competent and less likely to be hired for a hypothetical job compared to mothers who were not breastfeeding or women without children (Smith et al., 2011). In this research, the negative effects of breastfeeding were comparable, in terms of the negative perceptions evoked in the minds of both male and female students, to a woman's decision to purposefully sexualize her breasts (Smith et al., 2011). These results suggest that although breastfeeding may have many benefits for the mother, mothers who choose to breastfeed may also suffer social costs.

Moving into the private realm, mothers may also be concerned that breastfeeding will have negative consequences for their social relationships. Breastfeeding is an intimate experience between a mother and her child that can sometimes lead the other parent to feel left out. Fathers sometimes report that breastfeeding interrupts their ability to form a relationship with the new infant (Bar-Yam & Darby, 1997). Even when fathers are supportive of their partners' breastfeeding, many also admit to feelings of jealousy at their inability to contribute during the feeding process (Rempel & Rempel, 2011). In-depth interviews with fathers suggest that these feelings can lead fathers to postpone the forming of a relationship with the child until after the infant is weaned or to compensate by becoming more involved in other aspects of caring for the infant (i.e., baths, diapers) (Gamble & Morse, 1993). Presumably, the feeling of being left out of the parenting process can also extend to families in which two women co-parent, but only one breastfeeds the baby.

Families can sometimes alleviate these negative feelings in co-parents by framing breastfeeding as a team effort, discussing with

co-parents the benefits of breastfeeding for their child, involving co-parents in breastfeeding decisions, and having co-parents provide instrumental support (like helping with chores or entertaining company) (Gamble & Morse, 1993). Additionally, co-parents may participate in infant feeding directly if breastfeeding mothers use a breast-pump to express milk that can be fed to the infant in a bottle.

Another factor that can lead partners to have negative attitudes toward breastfeeding is its impact on women's sexuality (Rempel & Rempel, 2011). Breastfeeding lowers women's estrogen levels in the early postpartum period (Battin et al., 1985), which can lead to decreases in sexual desire and cause vaginal dryness for a subset of women, making sex painful (Brown & McDaniel, 2008). For example, breastfeeding women report more vaginal pain during intercourse at 3 months postpartum than formula-feeding women, although there was no difference at 6 months postpartum (Connolly, Thorp, & Pahl, 2005). Another study found that breastfeeding at 3 months (but not 6 months) was related to reduced frequency of sex, sexual desire, and sexual satisfaction as compared to women who were not breastfeeding (Judicibus & McCabe, 2002). Overall, women perceive that breastfeeding has a slightly negative impact on the physiological aspects of sexuality; however, most report that it does not greatly affect the sexual relationship with their partner (Avery, Duckett, & Frantzich, 2000). In one study, the majority of women (60.3%) perceived that the baby's father thought breastfeeding made them neither more nor less sexually desirable than before pregnancy, while 12.7% thought it made them less sexually attractive, and 27% thought it made them more attractive to their partner.

Although there are social costs associated with breastfeeding for mothers, there can also be social costs associated with *not* breastfeeding (Hauck & Irurita, 2003). Because of the widespread beliefs about the positive effects of breastfeeding on a child, women sometimes feel extensive social pressure to breastfeed. Although most mothers (approximately 96%; Simopoulos & Grave, 1984) are physically capable of breastfeeding, other barriers—just as real—can make breastfeeding nearly impossible. If women do not have access to accurate information regarding proper breastfeeding techniques, they may not produce enough milk to support the needs of their infant or may develop physical problems that make breastfeeding painful. Furthermore, many mothers must work to financially support the needs of their children and are not allowed convenient or flexible breaks to breast pump, nor are they given the space necessary to pump and store their breast milk.

Whatever the reasons behind the decision not to breastfeed, many women feel that this decision will lead to the perception that they are “bad mothers” (Ladd-Taylor & Umansky, 1998). As one mother recounts, “I was feeling very guilty [for stopping breastfeeding] and I didn’t know what to do” (Hauck & Irurita, 2003, p. 70). There have even been select reports of medical professionals pushing the “breast is best” message, regardless of the mother’s circumstances and choices, leading some mothers to report they are breastfeeding “just to keep the nurses happy” (Bauer, 2000, p. 15). These overt instances of pressure from health professionals are likely extreme, rare examples. For many years, physicians, breastfeeding consultants, nurses, and clinical experts have been aware that encouraging mothers to breastfeed by supporting them is helpful,

but that pressuring them or creating guilt for lack of success is not (Dillaway & Douma, 2004). Nonetheless, even when healthcare professionals are sensitive in their approach, family, friends, and even strangers share their advice about best practices for breastfeeding initiation, duration, and weaning. Interviews with new mothers have revealed that when the expectations of others do not match the choices of the mother, mothers can often feel guilt (Hauck & Irurita, 2003).

Breastfeeding is associated with some social costs. Mothers can become socially restricted by breastfeeding because they do not feel comfortable breastfeeding in public places. Furthermore, breastfeeding mothers are stigmatized and perceived as less competent than nonbreastfeeding mothers, a fact that could have negative consequences for women in the workplace or for women who breastfeed for periods beyond the cultural norm. Finally, some women find that breastfeeding reduces their sex drive for a time or makes their partners feel left out of the childcare experience. There are, however, also social costs associated with not breastfeeding, such as being branded a “bad mother” or being made to feel guilty.

## CONCLUSIONS

This chapter reviewed the scientific research on the benefits and costs associated with breastfeeding for mothers. Many studies point out that breastfeeding is associated with many health benefits for mothers, including reduced risk for metabolic syndrome and certain reproductive cancers. Furthermore, evidence suggests that breastfeeding could buffer women against biological and psychosocial stressors during the postpartum period. Little evidence is

available examining whether breastfeeding reduces the risk of postpartum depression or increases maternal bonding to the infant. More research is needed in each of these areas.

Although research has often focused on the benefits of breastfeeding for mothers, there is also evidence of substantial costs associated with breastfeeding. Mothers must devote several hours per day to breastfeeding if it is the sole feeding method, and some mothers feel confined to their homes because they are uncomfortable breastfeeding in public. Breastfeeding mothers also face significant logistical and professional challenges in the workplace. Finally, the majority of women will experience some discomfort during breastfeeding, particularly early in the postpartum period, which can sometimes develop into painful conditions requiring medical attention.

More studies are needed to evaluate these many trade-offs in the benefits and costs of breastfeeding at both the population and individual level. Even if studies demonstrate that the benefits of breastfeeding outweigh the costs for women as a group, decisions for individual mothers need to be made based on their personal circumstances, which will vary in the many complex and multifaceted trade-offs described in this chapter. Because of the growing evidence of the health benefits of breastfeeding for infants and their mothers, it makes sense for social policies to attempt to reduce barriers to breastfeeding. Policy makers and healthcare professionals have made strides in breastfeeding promotion in recent years (Centers for Disease Control and Prevention, 2011b). Educating mothers, partners, families, and communities about the health benefits of breastfeeding, along with how to overcome the challenges, have proven to be particularly effective (Centers for Disease

Control and Prevention, 2011b). However, policy makers and medical professionals should also realize that variation in mothers' circumstances—both personal and structural—affect whether breastfeeding is the best choice for a particular woman and her child.

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