

The Development of Design Requirements for Breastfeeding Apparel:
A User-Oriented Product Development Approach

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Abstract

Despite the extraordinary benefits of breastfeeding for both mother and child, the modern day woman faces numerous psychosocial barriers to breastfeeding, as well as emotional and physical challenges (Lawrence & Lawrence, 2011; US Department of Human Health & Safety, 2011). There is great potential for the development and improvement of apparel products for breastfeeding mothers. The purpose of this study was to determine the needs, preferences, and use of apparel products by breastfeeding mothers. Ultimately, by identifying user needs and design characteristics of breastfeeding apparel, this information can be used to design products that facilitate and encourage breastfeeding.

Rosenblad-Wallin's (1985) user-oriented product development (UPD) model was used to help guide the literature review and focus the research on principles of human factors. This study took a qualitative approach to research by collecting data through individual interviews, observation of the interview setting, analysis of the participants' apparel, and field notes. The criteria for participant selection was that the mothers had given birth to a child within one year, were currently feeding their child breast milk (either through nursing or pumping) and were working mothers. An interpretive lens and grounded theory methods guided the data collection, as well as a rigorous analysis of data.

The review of literature and the mothers in this study suggest that breastfeeding mothers use a variety of apparel products ranging from nursing bras to tank-tops to nursing covers. Themes that surfaced through the analysis of the data related to the functional and symbolic property needs within nursing products, the needs of

breastfeeding apparel within working environments, and the specific value of nursing apparel within a nursing mothers' life. The results of this study showed that the products available on the market for nursing mothers are not easy to use, do not adequately aide or alleviate breast and nipple pain, and do not allow the mother to achieve the flexible lifestyle they are accustomed to prior to breastfeeding. The data indicates that there is a real market for breastfeeding apparel and mothers are in need of better products.

Design criteria were developed from themes that emerged through the careful analysis of the literature, the interviews, and design knowledge. Criteria were developed around the themes of ease-of-use, comfort, layering systems, ease of care, size and fit, and symbolic representation. The user-oriented design criteria developed within this research can guide designers towards successful breastfeeding apparel and products.

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CHAPTER 1: INTRODUCTION

The breastfeeding apparel market within the US has grown substantially over the last twenty years, as evident by the increased amount and variance of products offered to breastfeeding mothers, increased rates of breastfeeding, and market statistics (US Department of Health and Human Services (DHHS), 2011; PRWEB, 2010). Nursing apparel is a segment of the maternity apparel market, and the market is growing significantly. A report by Global Industry Analysts indicates that the maternity apparel market within the US is projected to reach over \$4.8 billion by 2015 (PRWEB, 2010; Sohn & Bye, 2012). There is great potential for the development and improvement of apparel products for breastfeeding mothers. The purpose of this study was to determine the needs, preferences, and use of apparel products by breastfeeding mothers. Ultimately, by identifying user needs and design characteristics of breastfeeding apparel, this information can be used to design products that facilitate and encourage breastfeeding.

Justification of Research

There are numerous ways to feed an infant. A mother may choose to feed her breastfeed, pump breastmilk and bottle-feed, bottle-feed infant nutritional formula, bottle-feed animal milk, bottlefeed breastmilk from another mother, or a combination of these methods (Stevens, Patrick, & Pickler, 2009). The most common methods of feeding an infant are by breastfeeding and infant formula feeding (Stevens, Patrick, & Pickler,

2009). Chemist Justus von Liebig developed the first infant formula made available to the public in 1865 (Radbill, 1981). Over time, infant formula improved, research supported its nutritional efficiency, and it was marketed to physicians and consumers (Fomon, 2001). During the 1940s and 1950s, consumers and physicians in the United States began to see infant formula as an acceptable substitute to breastfeeding, and breastfeeding rates have declined since the 1970s (Fomon, 2001). While some mothers are unable to breastfeed and choose not to breastfeed their child due to physical, social, or environmental reasons, infant formula is not as responsive to the nutritional needs of the baby as breastfeeding and has been linked to long-term health issues such as atopy, diabetes mellitus, and childhood obesity (Stevens, Patrick, and Pickler, 2009).

There is strong evidence to support the World Health Organization's (WHO) recommendation for women to breastfeed infants exclusively for the first six months of life (Lawrence & Lawrence, 2011). Breastfeeding is beneficial to both postpartum mothers and their babies. Studies have found that breastfeeding protects babies from gastrointestinal, respiratory, ear, and urinary tract infections in their first three years and has been associated with reduced risk of asthma, allergies, and obesity throughout childhood (Riordan & Wambach, 2010; US DHHS, 2011). Breastfeeding improves nutrition, growth, development, health, and ultimately the survival of infants and children (US DHHS, 2011).

For the mother, breastfeeding cues the postpartum body to release important hormones that encourage the body to heal after childbirth, facilitates weight loss, reduces the risk for post-partum depression, and promotes bonding between the mother and child

(Riordan & Wambach, 2010; Pollard, 2011). The alternative not breastfeeding and feeding the infant formula has been shown to have major long-term health consequences for the mother. There is evidence that mothers who do not breastfeed are more likely to develop future health problems such as osteoporosis, premenopausal breast cancer, and ovarian cancer (Labbok, 2001; US DHHS, 2011).

According to the Center for Disease Control (CDC), between 2006-2010, the majority of mothers giving birth in the United States were between the ages of 15 and 44 years of age, with the median age of 23 years old. 59.7% of mothers are married when a child is born, with 23.4% cohabitating and 16.9% unmarried and not cohabitating (US DHHS, 2011). Most mothers have two children.

Despite the extraordinary benefits of breastfeeding for both mother and child, the modern day woman faces numerous psychosocial barriers to breastfeeding, as well as emotional and physical challenges (Lawrence & Lawrence, 2011; US DHHS, 2011).

Regarding breastfeeding influences and problems in the US it has been said:

Many mothers in the United States want to breastfeed, and most try. And yet within only three months after giving birth, more than two-thirds of breastfeeding mothers have already begun using formula. By six months postpartum, more than half of mothers have given up on breastfeeding, and mothers who breastfeed one-year olds or toddlers are a rarity in our society. All too often, mothers who wish to breastfeed encounter daunting challenges. (US DHHS, 2011, p. v)

Fatigue, pain, lack of sleep, and leaking breasts are just a few of the major deterrents that mothers face on a daily basis (Lawrence & Lawrence, 2011; Riordan & Wambach, 2010; Pollard, 2011).

The current Surgeon General of the United States, Regina Benjamin, has called upon researchers to “take on a commitment to enable mothers to meet their personal

goals for breastfeeding” (US DHHS, 2011, p v). As she stated in the U.S. Department of Health’s *Call to Action to Support Breastfeeding* (2011):

Mothers are acutely aware of and devoted to their responsibilities when it comes to feeding their children, but the responsibilities of others must be identified so that all mothers can obtain the information, help, and support they deserve when they breastfeed their infants. From a societal perspective, many research questions related to breastfeeding remain unanswered, and for too long, breastfeeding has received insufficient national attention as a public health issue. (p. v)

The United States government has made breastfeeding a priority through initiatives with the CDC (US DHHS, 2011). Since 2007, the CDC has been tracking breastfeeding practices, influences and progress throughout the United States (Table 1). The CDC has set up specific objectives for the percentage of mothers that breastfeed and for the length of time that they breastfeed, along with encouraging hospitals to employ lactation consultants, supporting organizations such as La Lech League International, and providing accessible breastfeeding information for mothers-to-be (US DHHS, 2011).

U.S. National Average	Ever Breastfed %	Breastfeeding at 6 months %	Breastfeeding at 12 months %	Exclusive breastfeeding at 3 months %	Exclusive breastfeeding at 6 months %
2008	74.2	43.1	21.4	31.5	11.9
2012	76.9	47.2	25.5	36.0	16.3
2020 Objectives	81.9	60.6	34.1	46.2	25.5

Table 9. CDC Breastfeeding Report Card: US Breastfeeding Statistics and Objectives (US CDC, 2012)

With the support of the U.S. government and the Surgeon General, the percentage of mothers who choose to breastfeed is on the rise (US DHHS, 2011). An increase in breastfeeding mothers will result in the increased use of breastfeeding products and

apparel. To align with the goals of the CDC, products and apparel should be developed with the needs of the breastfeeding mother in mind.

User-Oriented Product Development and Needs Assessments

When designing apparel, understanding the human body is a critical component of the design process. Ergonomics and human factors, disciplines anchored on scientific data, place the human body at the center of research. These disciplines offer “various forms of support to applying universal design in apparel product development” (Soares et al. 2012, p. 4733).

In order to gain an in depth understanding of how a mother’s ability to breastfeed is affected by her apparel and the environment, a framework is needed to help organize and guide this research. Researchers have proven the effectiveness of user-oriented product development to study the complex interaction of variables related to the human and the designed product from a human factors/ergonomics perspective, therefore Rosenblad-Wallin’s (1985) user-oriented product development (UPD) model was chosen to guide this study. The implementation of research using ergonomics and principles of human factors has the potential to lead to greater understanding of how the garment and body interact when in use (Soares, et al, 2012).

Rosenblad-Wallin's (1985) UPD method places the user at the center of the process and emphasizes the use of the specific product being developed. When examining the objective of clothing, the author distinguishes the importance of the incorporation of both functional and symbolic value within a product. The author states:

The objective of a product can be divided into functional and symbolic values. The value of a product is created in relation to man and the environment. The functional values are formed in a relation between man, the product, and the actual environment, while the symbolic or non-material values arise from a relationship between man, the product, and the socio-cultural environment. The symbolic values originate in man's emotional judgement of a product. (p. 280)

Figure 1 represents the connection between objective, values, and properties of a product within user-oriented product design.

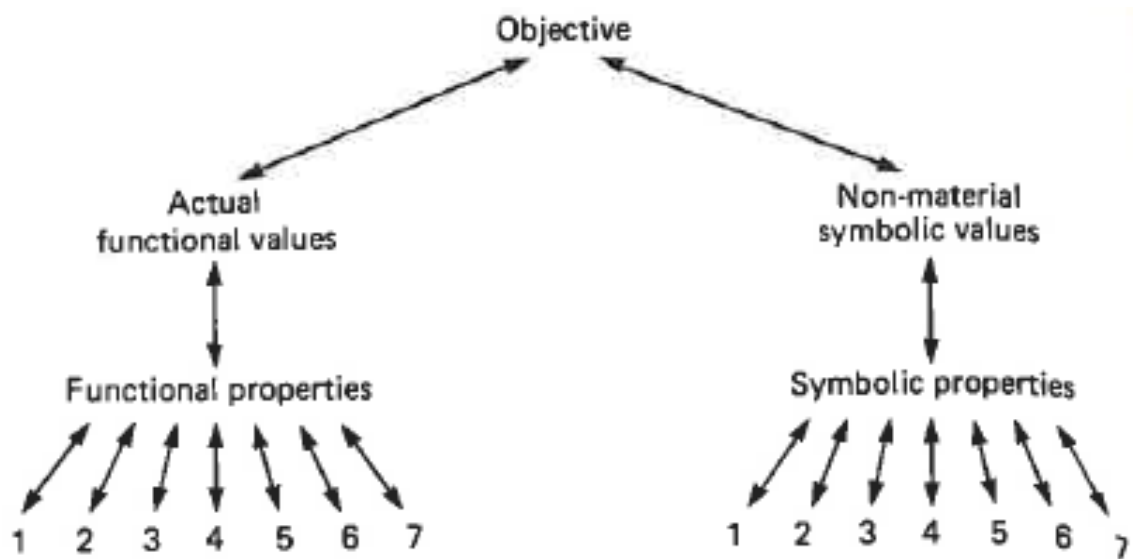


Figure 1. The Connection between Objective, Values, and Properties of a Product (Rosenblad-Wallin, 1985, p. 280)

Functional values of an apparel product are most often related to concepts of protection and comfort (Rosenblad-Wallin, 1985). Functional properties within apparel include components of fit, material comfort, visibility of design features, thermal balance, ease-of-use, mobility, and donning/doffing (Lamb & Kallal, 1992; Rosenblad-Wallin, 1985). Symbolic values of clothing are found in the clothing's ability to reflect the user's belief system from a socio-cultural perspective. Symbolic properties include aesthetic elements such as line, form, color, texture and pattern utilized in the design to create beauty (Lamb & Kallal, 1992), as well as design properties that reflect self-esteem, group membership, gender, etc. Specific functional and symbolic properties combine to form value within each category. The properties of an object are used in the evaluation of user demands and the development of design requirements (Rosenblad-Wallin, 1985).

A key characteristic of Rosenblad-Wallin's (1985) UPD method is a "systematic analysis of the relation between user, product, task, and environment," (Kaulio, 1998, p. 144). This analysis can lead to the development of design requirements and user demands by gathering a variety of evidence through research inquiries that include literature reviews and interviewing users (Rosenblad-Wallin, 1985).

Rosenblad-Wallin's UPD (1985) method has been used in a diverse range of research, including the development of clothing for disabled users (Thoren, 1996), the design and evaluation of military footwear (Rosenblad-Wallin, 1988), the development of design requirements for surgical apparel (May-Plumlee and Pittman, 2002), and other functional and technical apparel research. Furthermore, Rosenblad-Wallin's UPD model

has been used as a source for other apparel product development models such as Lamb and Kallal's (1992) Function-Expressive-Aesthetic Consumer Needs model.

A crucial aspect of product development and Rosenblad-Wallin's UPD method is an assessment of the current products that are being examined. While determining user needs, it is necessary to define and measure deficiencies in products against the users' ideal of those product/s. This process is also known as a needs assessment (Unruh & Unruh, 1984; Rouda & Kusy 1995; Mullet, 1984) and is a common method utilized in the evaluation of apparel products. Needs assessments have been successfully used by apparel researchers when designing apparel for special user groups (Chae & Schofield-Tomschin, 2010; Bye & Hakala, 2005; Dickson & Pollak, 2000). Because of the lack of research on breastfeeding products, it is necessary to investigate if there is a gap between breastfeeding apparel in the current market and the ideal apparel desired by breastfeeding mothers.

Research Questions

A deeper understanding of breastfeeding mothers, the types of apparel products they used, and how they used the apparel products was the focus of the research. Breastfeeding apparel currently on the market ranges from nursing bras to nursing covers. For the purpose of this study, any product worn on the body for the purpose of facilitating breastfeeding or to reduce problems associated with breastfeeding will be considered breastfeeding apparel. Nursing covers, nursing pads, breastfeeding bras, nightgowns and

tops are a few examples of products that can be used to examine design characteristics and identify user needs.

This research posed the following questions:

- What are the issues affecting mothers' breastfeeding experience at home, work and in public?
- What breastfeeding apparel are mothers using and how do these products affect breastfeeding?
- How does the use of apparel encourage or discourage breastfeeding?

CHAPTER 2: LITERATURE REVIEW

This chapter provides an overview of the current market of breastfeeding apparel, problems associated with breastfeeding and breastfeeding apparel, contextual influences of breastfeeding, and a summary of the literature review based on a human factors analysis of breastfeeding and breastfeeding apparel.

Current Market of Breastfeeding Apparel

Breastfeeding apparel and products have existed within the US for over 150 years. In the US, the first evidence of apparel developed specifically to aid in breastfeeding is illustrated with the acceptance of H. Wolf's patent for the Nursing Chemise in 1872 (Figure 2), which featured access to the breast via a moveable flap.

H. WOLF.

Improvement in Nursing-Chemise.

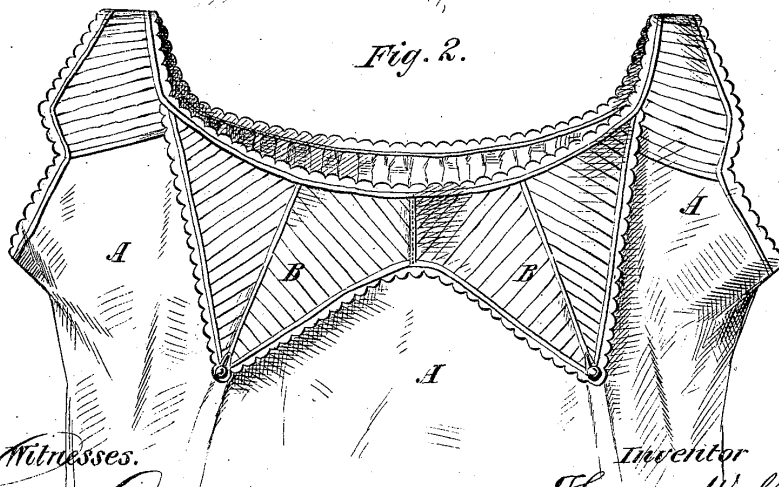
No. 132,613.

Patented Oct. 29, 1872.

Fig. 1.



Fig. 2.



Witnesses.
Suzanne Dietrich.
Alex. F. Roberts

Inventor
Henry Wolf
 Per *Wm. M. Roberts*
 Attorneys.

Figure 2. Example of 1872 Nursing Chemise (Wolf, 1872)

Over time, breastfeeding design details that allowed the wearer access to the breast for breastfeeding slowly progressed and developed into nursing bras (Figure 3). Throughout

April 6, 1943.

A. A. GLASSER

2,315,614

NURSING BRASSIERE

Filed June 14, 1941

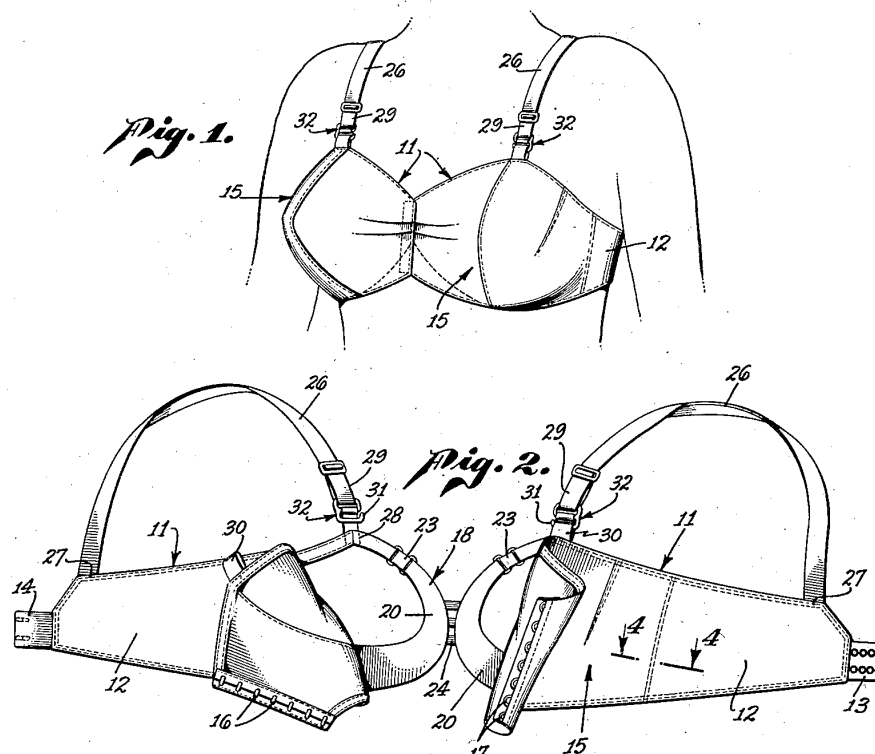
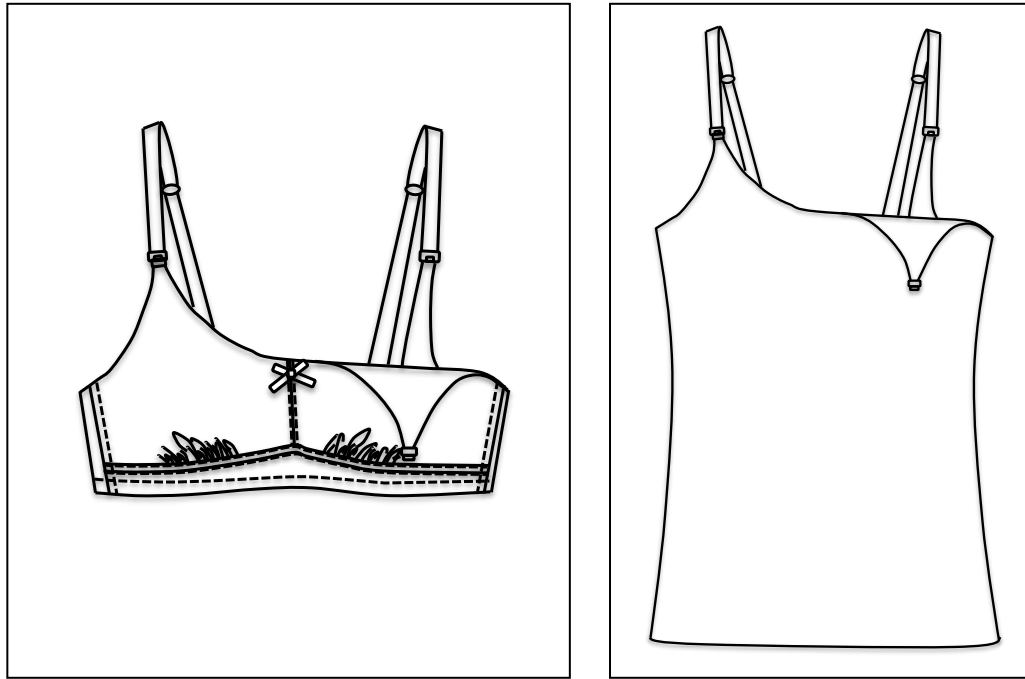


Figure 3. Example of 1943 Nursing Bra (Glasser, 1943)

the last century and a half, the type of apparel with breastfeeding design features available to mothers has grown to include an array of products such as nursing bras and tanks (Figures 4 and 5), breastfeeding covers (Figures 6 and 7) used by some mothers

when nursing in the presence of others, nursing sleepwear, nursing tops, blouses and dresses, and wearable products that aid in the use of breast pumps (Figure 8).



Figures 4 and 5. Sketch of a Modern Nursing Bra and Tank with Strap Clip

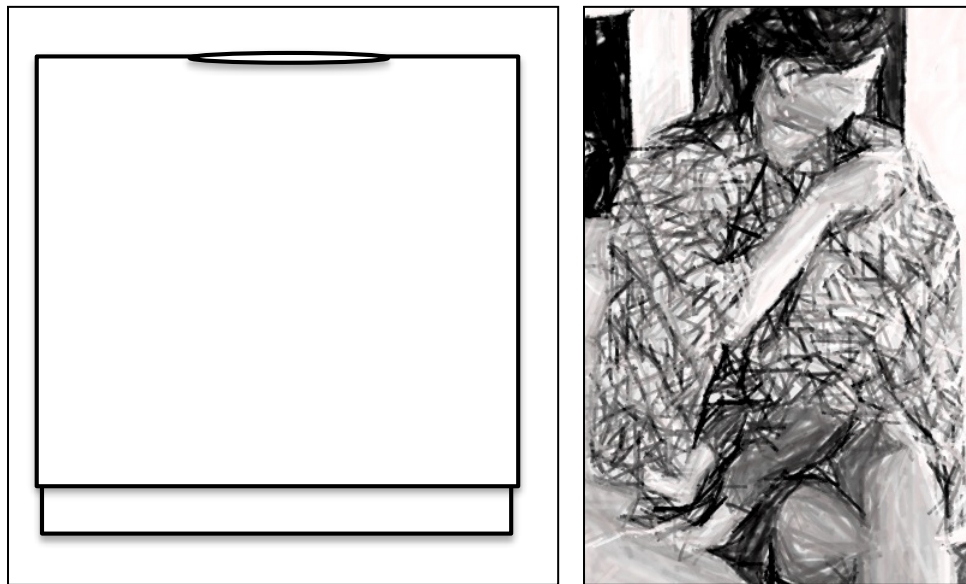


Figure 6 and 7. Sketch of Common Poncho-Style Nursing Cover and Illustration of the Nursing Poncho's Use

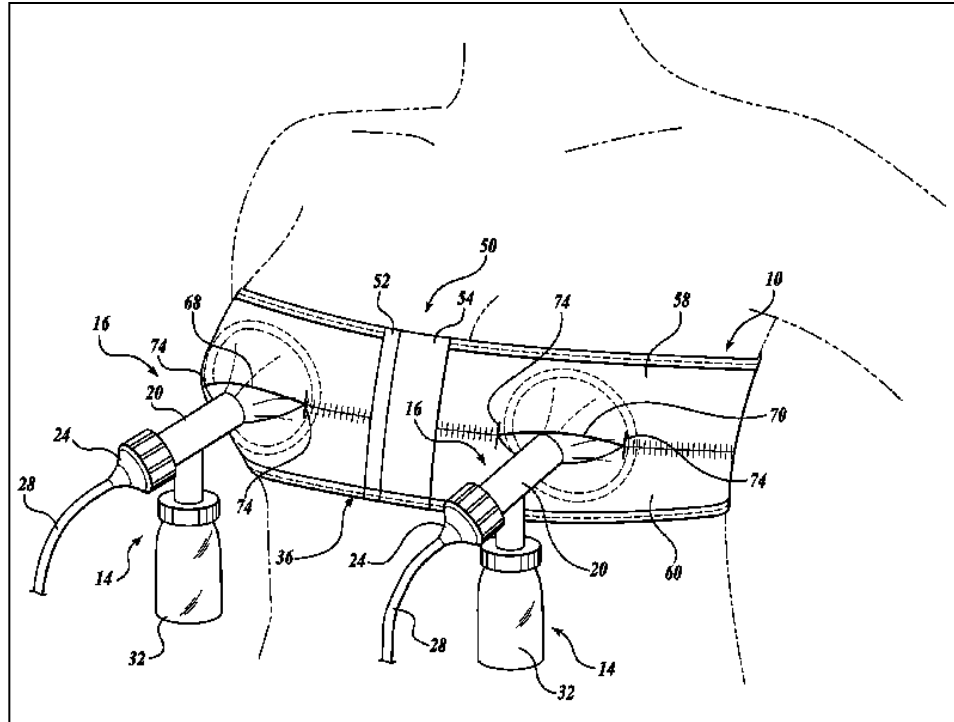


Figure 8. Breast Pump Support Wearable Product (Bell, 2012)

Features of modern breastfeeding apparel include ease-of-use elements such as clips on bras, materials, and neckline shape. Specialized clips on the straps of bras and tanks that can be undone to allow access to one or both breasts at a time are one of the most common features found in breastfeeding apparel. Specialty stretch knits made from natural and synthetic fibers are usually used in breastfeeding apparel because they can allow for breast size change and can be supportive without constricting the breast. Necklines are an important feature of breastfeeding apparel in tops, dresses, tanks and bras. Scoop, V-neck and cross-over necklines are typical because they allow easy access for breastfeeding by simply pulling the garment down or up depending on the apparel

feature. Many tanks, tops and blouses have built-in bra features that allow the mother to reduce the number of garments that need to be moved or removed for breastfeeding.

While different types of apparel do exist that are designed specifically for breastfeeding mothers such as bras, tops, blouses, and dresses, there is not a lot of variance in design and color on the market. Most nursing bras sold in stores, for example, are only offered in white, nude, and black, and the functional features are the same across styles and brands. Clothing offerings to mothers appear to be limited. These findings were verified by nursing mothers in a pilot study conducted in April, 2012. The participants had great difficulty finding products that met their needs. Both online and in-store selection is very limited, especially in the bra category. One participant stated: “No matter where I go, no matter what, it’s all the same product... The bras are horrible (Mother of 2, 32 years of age).”

The functional properties of the nursing bra have not changed significantly since its inception. However, recent trends in the maternity and nursing apparel market are adding a combination of functionality and sex appeal to bras. Notably, the New York Times featured an article in 2011 entitled “Nursing Bras That Show Mothers in More Than ‘Work Mode’,” (Saint Louis, 2011). Within the last five years, a few companies have begun providing new mothers with feminine and somewhat provocative nursing lingerie (Figure 9). This trend embodies more than just aesthetics, because it targets the consumer’s expressive needs such as identity and sexuality. By adding elements of femininity to nursing bras, the product becomes more about the woman wearing the bra than about being a nursing mother.



Figure 9. Examples of feminine nursing bras (Saint Louis, 2011).

The desire for feminine and sexy lingerie was a discussion topic for the women interviewed in a 2012 pilot study. Adding feminine touches to nursing bras are a growing trend, however, the women interviewed settled for what was readily available. The most readily available nursing apparel, online and in retail stores, is a single color (white, nude, and black), made of stretch material with minimal detailing. They desired feminine and womanly touches added to their nursing apparel, but they were not willing to ‘search’ for these style features.

Despite limited research existing that examines specific apparel needs of breastfeeding women, two research studies and an examination of medical manuals offer insights into functional and symbolic properties within breastfeeding apparel.

In terms of functional properties within nursing apparel, Jeon and Kim (2000) researched maternity-wear for breastfeeding mothers and found fit and comfort to be important factors in the satisfaction of apparel products. Several wearers from their study commented on the fabric rubbing on their already sensitive nipples when testing a garment and bra with slits for nursing (Jeon & Kim, 2000). Further functional aspects were discovered in regards to thermal comfort. Another study of breastfeeding garments found that breastfeeding apparel caused discomfort, with many of the subjects stating that their bras were not able to absorb perspiration (Choi, H., Choi, J., & Kim, S., 2000).

A mother has to breastfeed often throughout the day and apparel needs to be very easy to use (Lawrence & Lawrence, 2011). The functional aspect of 'ease-of-use' was addressed within Jeon and Kim's (2000) study, when the subjects complained that it was inconvenient to open and close the bra when needing to access the breast to breastfeed.

Fit and support were identified as functional concerns of participants in Choi, H., Choi, J., and Kim's (2000) research. Due to the constantly changing size and shape of mothers' breasts throughout the day, the research showed that some bras were not able to adequately support the breast (2000).

Choi, H., Choi, J., and Kim, S. (2000) questioned 105 nursing mothers in Korea to determine if the current market of nursing bras was suitable in terms of size, shape, and ease-of-use. They found that there was great room within the market for the improvement of nursing bras. Their results indicated that there were deficiencies in the sizing system, the fasteners were inadequate and should be redesigned for comfort and

ease-of-use, and that a wider variety of nursing bras should be available to consumers in order to fulfill the aesthetic and functional requirements of breastfeeding mothers.

In reviewing breastfeeding manuals and guides for mothers, some researchers briefly mention criteria for selecting breastfeeding apparel or allude to apparel in regards to methods for preventing infection. *In Breastfeeding: A practical guide*, Vera alludes to the need for nursing apparel and bras, and makes the recommendation that the clothing needs to be functional with the use of one hand (1982). Authors Riordan and Wambach (2010) discuss apparel in relation to how infections such as Candidiasis, a common yeast infection of the lactating breast, can be avoided and/or healed if breast pads (typically worn by women who experience leaking breasts) are removed as soon as they become moist.

Researchers have not examined symbolic properties within breastfeeding apparel; however it is well known that pregnancy and childbirth can be a stressful transition with respect to the physical body and to a women's changing social roles (Riordan & Wambach, 2010). The emotional and interpersonal stresses of breastfeeding, the social role of a breastfeeding mother, as well as her desire to maintain her individual identity, need to be adequately researched and examined in order to determine the desired symbolic properties of breastfeeding apparel.

Problems Associated with Breastfeeding

Leaking breast milk, breast and nipple pain associated with breastfeeding, muscle pain caused by supporting a baby, and lack of skin-to-skin contact between a mother and

her baby are a few associated problems that apparel products should address. Because this research aims to obtain information regarding the user, it is necessary to examine breastfeeding in terms of human factors principles such as anatomy and physiology, frequency of breastfeeding, and the ergonomics of holding a child while breastfeeding. A thorough literature review reveals major physiological and contextual problems associated with breastfeeding that should be considered when designing breastfeeding apparel.

The mammary gland, or breast, is very complex and the problems associated with the gland throughout breastfeeding are multifaceted (Lawrence & Lawrence, 2011). The anatomy and physiology of a lactating mother, as well as medical issues that arise while breastfeeding, could play a role in how a designer approaches the process of designing apparel for breastfeeding women. For instance, contributing factors of an obstructed milk duct include constrictive clothing such as bra with an underwire, as well as fatigue, stress, and inadequate drainage owing to a change in feeding frequency or duration (Prachniak, 2002). Symptoms of an obstructed milk duct include localized tenderness, an area of redness on the breast, and possibly a palpable lump (Prachniak, 2002).

Two other medical problems affecting the breast of lactating mothers that could affect the design of apparel are breast engorgement and breast mastitis. Hard, lumpy, painful breasts with taut skin demonstrate breast engorgement; the mother may also be feverish (Prachniak, 2002). Mastitis refers to breast soreness, fever, and flulike symptoms that may develop any time during lactation (Prachniak, 2002). The National Health

Services from the United Kingdom stated the following in regards to mastitis and the effects of apparel:

It is thought that most cases of non-infectious mastitis are caused by milk stasis. Milk stasis occurs when the milk is not properly removed from your breast. Milk stasis can be caused by pressure on your breast, for example, from tight-fitting clothing, an over-restrictive bra or sleeping on your front. Milk stasis can cause milk ducts in your breasts to become blocked (National Health Services, 2012).

As evident from literature, added pressure to the breast by clothing and bras can have health consequences for nursing mothers. Because breast soreness and sensitive skin are symptoms of these two problems, further research into material comfort of breastfeeding apparel is necessary.

Breast and nipple pain are common problems linked with breastfeeding. Nipple pain is usually the result of improper position, incorrect latch-on technique of the baby or both (Prachniak, 2002). Cracked, painful nipples are one of the most common reasons for mothers to stop breastfeeding (Pollard, 2011). There are products on the market that can alleviate some of these symptoms, such as creams, but apparel can exacerbate the pain if not designed with the user needs in mind (Jeon & Kim, 2000). Breast pain, while complex and associated with many causes, has been associated with pressure from poorly fitted bras which prevents blood circulation and leads to shooting breast pains (Prachniak, 2002).

When a breast is full of milk, it can lead to leaking breast milk, one of the most common negative effects of breastfeeding (Riordan & Wambach, 2010; Pollard; 2012; Lawrence & Lawrence, 2011). There are a number of reasons why womens' breasts leak in between feedings, however, the most common explanation is that the breast is simply

too full. There are a few products on the market, such as breast pads, that attempt to protect a mothers' clothing from leaking breasts.

Candidiasis is a fungal infection that causes sore and inflamed nipples, as well as radiating pain from the axilla (Riordan & Wambach, 2010). There are a variety of causes, but the use of breast pads and subsequently leaving them in place after they become wet from leaking milk has been known to increase chances of this fungal infection of growing (Riordan & Wambach, 2010). Designers and researchers should consider this type of infection as they are choosing materials for breastfeeding products.

The frequency of breastfeeding a baby is dependent upon the baby's age, the mother's breast size, and other physiological factors. As illustrated in Table 2, some women have to breastfeed up to 18 times a day. Because a mother cannot control the time and space in between breastfeeding, it can lead to stress and fatigue, as well as discontinuous sleep patterns (Quillin, 1997; Riordan & Wambach, 2010).

Baby's Age	Amount of Breast Milk Needed	Frequency of Breastfeeding per day
At birth:	Up to 5ml	First Breastfeed
Within 24 hours:	7-123ml/day	3-8 breastfeeds
Between 2-6 days:	395-868 ml/day	5-10 breastfeeds
One month:	395-868 ml/day	6-18 breastfeeds
Six months:	710-803 ml/day	6-18 breastfeeds

Table 10. Milk Volumes and Breastfeeding Frequency (Pollard, 2011)

The breast will change size throughout the day depending on breast milk fullness (Pollard, 2011; Wambach & Riordan, 2010). Breastfeeding apparel needs to address this

ever-present change through flexible fit. The Australian Breastfeeding Association recommends the following in regards to choosing a bra that allows for breast size change:

Many women prefer underwire fashion bras and are confused when told these are not recommended during pregnancy or lactation. The reason for this is, once again, your changing breast shape. When breastfeeding, the breasts can increase and decrease in size during the day, as milk is produced and removed. Retained fluid in late pregnancy can also cause the breast to swell. Although only a slight change in size is occurring, a rigid underwire may put pressure on the breast when it is fuller. Such pressure can lead to blocked milk ducts or mastitis and it is for this reason inflexible underwire bras are not recommended. However there are now nursing bras available that have a flexible plastic support, similar to an underwire, designed to flex and change position with your changing shape. These are less likely to cause problems. (Australian Breastfeeding Association, 2012)

Apparel and bra selection for nursing mothers is very important for a nursing mother and finding non-constricting apparel is a component to healthy breastfeeding.

Breastfeeding is a very physical process and requires the baby to be held throughout (Gjerdingen et al., 1993). There are four common holds utilized during breastfeeding (Pollard, 2011). The cradle hold (and variations), the cross-over hold, the clutch or football hold, and the reclining position are the most commonly cited breastfeeding positions (Pollard, 2011; Riordan & Wambach, 2010). All of the holds have specific ergonomical problems associated because of weight bearing. Backache and tension on the shoulders, neck, arms, and wrist during breastfeeding are known to cause the mother fatigue, and in some cases pain (Gjerdingen et al., 1993). Designers of breastfeeding products and apparel should consider how the baby is being held when implementing functional properties into the product such as ease-of-use, as well as the development of wearable products that could reduce the mother's weight-bearing load of the child.

The lack of skin-to-skin contact between mother and child, especially in the first month after birth, has been shown to affect breastfeeding (Pollard, 2012). Skin to skin contact immediately after birth can stimulate the mother's onset of milk production (Pollard, 2012; Lawrence & Lawrence, 2011). If the mother and child are not united after birth, the hormonal change required to initiate breastfeeding could be prolonged, therefore delaying breast milk for the baby. Furthermore, skin-to-skin contact is known to improve the likelihood of the baby to latch on and latch on well, stabilize the baby's temperature, heart rate, and blood pressure, as well as calm the baby and lessen the likelihood that they will cry (Newman, 2005). If products do not encourage or facilitate skin-to-skin contact, the baby and mother could lose the benefits of their breastfeeding efforts.

A mother's body undergoes many changes after birth and while breastfeeding a child. Over the course of six months to one year post-partum, the mother's body shape and size will attempt to return to its pre-partum shape (Riordan & Wambach, 2010). Breastfeeding encourages this process through hormonal release and the increase in energy expenditure (Lawrence & Lawrence, 2011). Breastfeeding apparel products need to adapt to this significant body change over the course of time.

While breastfeeding and hormonal release are often associated with positive results, breastfeeding can also cause hormone problems for mothers. The imbalance can cause a multitude of problems for the nursing mother, including hot flashes (Gjerdingen et al. 1993), which in turn could influence design factors such as the functional need of thermal balance.

Contextual Influences of Breastfeeding

Breastfeeding is influenced by society and has grown in and out of favor within the United States since the early 1900s when baby formula was introduced onto the market (US DHHS, 2011). A number of human factors influence a woman's decision to breastfeed or not: infrastructure, socioeconomics, education, social environment, family environment, psychological state, and other factors such as the mother and baby's health (US Dep't of Health, 2011). Dennis (2002) "found that factors influencing breast feeding practices included personal characteristics, attitudinal and intrapersonal factors, health professional and informal support, hospital policies, and intrapartum events" (Manhire, 2007). These factors continuously affect a postpartum mother's decision to breastfeed. Knowledge of the contextual influences of breastfeeding can allow the designer a deeper understanding of the nursing apparel user's socio-cultural influences. These influences on the mother can play a role in the development of symbolic properties within nursing apparel products. Figure 10 Outlines the major contextual influences associated with a mother's decision to breastfeed.



Figure 10. Context of Breastfeeding (US DHHS, 2011; Flacking, R., Nyqvist, H. & Ewald, W., 2007; Lawrence, A. & Lawrence, M., 2011)

Infrastructure factors affect the mothers' decision to breastfeed her child. If a hospital has employed a lactation specialist, or the obstetrician informs the new mother about breastfeeding before birth, mothers are more likely to breastfeed their babies at the early stage (Pollard, 2012; CDC, 2011). Also, the continued guidance from hospital staff immediately after the baby is born has been shown as integral to the mother's breastfeeding decision (CDC, 2011). If a mother gives birth in a facility labeled Baby-

Friendly, a label given to hospitals that exhibit a specific birthing criteria set forth by the CDC, she has a much higher chance of actually breastfeeding, as well as receiving continued support and information about breastfeeding, products to help alleviate pain related to breastfeeding, and apparel such as the proper bra (CDC, 2011).

The social environment surrounding a breastfeeding mother, as well as her socio-economic status, significantly affects a mother's decision to breastfeed (Flacking, et al., 2007). Influences such as her lifestyle, employment situation, and social influence will impact her underlying opinion of breastfeeding (Flacking et al. 2007). A supportive family environment is also known to affect to a mother's breastfeeding decision, especially if the mother is planning on returning to work soon after giving birth (Lawrence & Lawrence, 2011).

A mother's access to education about breastfeeding, as well as her actual knowledge, is important (US CDC, 2012). If a mother does not have access to information about breastfeeding prior to birth, as well as immediately after giving birth, then she is not as likely to breastfeed her baby (US CDC, 2012).

A breastfeeding mother's psychological status has an effect on her decision making process. A crucial element in the ability to breastfeed after birth is that the mother is relaxed (Pollard, 2011; Lawrence & Lawrence, 2011). Giving birth is a huge stress on the body, however, if the mother is nervous or stressed after birth, it is much more difficult for the body to start the formation of milk. Stress and nerves continue to play a role in a mother's ability to breastfeed throughout the first six months or more. Another aspect of a mother's psychological state involves the mother's self-perception of

breastfeeding. If a mother thinks that breastfeeding violates her identity, emotion, or sexuality, she is not likely to breastfeed her baby (Andrew & Harvey, 2009).

More and more mothers are choosing to continue breastfeeding their infant after they return to work. Historically, “more new mothers are part of the work force within the US than ever before” (Ryan, Zhou, & Arensberg, 2006, p. 243). Work place acceptance and encouragement of breastfeeding varies greatly and a woman’s continuation of breastfeeding after they return to work is significantly affected by workplace conditions. Studies have shown that the percentage of mothers who continue to breastfeed after returning to work full-time is significantly lower than mothers who work part-time or stay at home (Ryan, Zhou & Arensberg, 2006; Ogbuani et al. 2011).

Finally, a mother and baby’s health, physiology, and anatomy will play major roles in whether or not a baby is breastfed. These factors include, but are not limited to, having a cesarean delivery because it typically takes a mother’s body longer to produce milk (Lawrence & Lawrence, 2011; Pollard, 2012); breast and nipple shape such as inverted nipples which cause the baby to have difficulty latching on (Riordan & Wambach, 2010); and artificial breasts (Lawrence & Lawrence, 2011).

The health problems associated with breastfeeding in the previous section are all factors that can ultimately affect the mother’s decision to continue breastfeeding. Manhire (2007) found that “a mother's interpretation of this [breastfeeding] experience will determine her feelings of satisfaction and confidence and a desire to persevere and commit to an often challenging journey” (p. 374). Apparel products should be designed

with these influences in mind. If designers can produce products addressing these social and health influencing factors, perhaps a mother's choice to breastfeed can be prolonged.

Human Factors Analysis of Breastfeeding and Breastfeeding Apparel

A summary of common problems associated with breastfeeding and breastfeeding apparel in relation to human factors can be found in Table 3. Use-Scenarios for breastfeeding at home and at work have been developed using Rosenblad-Wallin's user-oriented product development model and are based on literature and a pilot study performed in the Spring of 2012. The use-scenario for breastfeeding at home can be found in Appendix A and the use-scenario for breastfeeding at work can be found in Appendix B. A table of human factors requirements based on the literature review has been developed and can be found in Appendix C.

Human factors	Problems	
Anthropometrics	- Bra and gown do not fit body (Jeon, J. & Kim, Y., 2000; Choi, H., Choi, J., & Kim, S. 2000)	
	- Changing breast size throughout the day, depending on breastmilk fullness (Wambach & Riordan, 2008) - Change in body shape and size post-partum (Lawrence & Lawrence, 2011)	
Ergonomics (Biomechanics of task) There are 4	Weight Bearing Load (Major problems caused by holding a baby)	- Backache and Tension on the shoulder, neck, arm, and wrist during breastfeeding (Gjerdingen et al.1993) - Hand numbness and tingling – Breastfeeding is a very physical process and requires the baby to be held throughout (Gjerdingen et al. 1993).
	Four major positions of breastfeeding	Brief explanation, requirement, and load bearing part
	1.Cradle hold	- Extend a mother's forearm and hand down her back to support her body.

common holds utilized during breastfeeding. All of the holds have specific ergonomic/biomechanical problems associated		<ul style="list-style-type: none"> - Requirement: chair - Baby weight bearing load: back, arms, wrist, hand, crook, and neck
	2. The cross-over hold	<ul style="list-style-type: none"> - Uses a mother's hand and arm to hold the baby. - Requirement: chair - Baby weight bearing load: back, arms, wrist, hand, crook, and neck
	3. The clutch or football hold	<ul style="list-style-type: none"> - Tuck baby under a mother's arm (on the same side that a mother is nursing from) like a football or handbag. - Requirement: chair, - Baby weight bearing load: back, arms, wrist, hand, crook, and neck
	4. Reclining position	<ul style="list-style-type: none"> - Nurse while lying on bed - Requirement: bed - Baby weight bearing load: none (But possible muscle tension on arms and neck)
Physiology	<ul style="list-style-type: none"> - Fatigue, poor appetite, hair loss and dizziness due to the increased energy consumption from breastfeeding (Gjerdingen et al. 1993). 	
	<ul style="list-style-type: none"> - Breastfeeding could cause a hormone imbalance which can cause hot flashes and other symptoms (Gjerdingen et al. 1993). 	
	<ul style="list-style-type: none"> - Leaking milk (Lawrence & Lawrence, 2011). 	
	<ul style="list-style-type: none"> - Engorgement is demonstrated by hard, lumpy, painful breasts with taut skin; the mother may be feverish (Prachniak, 2002). 	
	<ul style="list-style-type: none"> - Obstructed milk duct- Symptoms include localized tenderness, an area of redness on the breast, and, possibly, a palpable lump. Contributing factors include constrictive clothing, fatigue, stress, and inadequate drainage owing to a change in feeding frequency or duration (Prachniak, 2002). 	
	<ul style="list-style-type: none"> - Mastitis - Acute non-epidemic mastitis refers to breast soreness, fever, and flulike symptoms that may develop any time during lactation (Prachniak, 2002). - Pressure from apparel and bras is thought to be a cause of mastitis (National Health Services, 2012). 	
	<ul style="list-style-type: none"> - High temperature of breast: Breastfeeding mothers use 25% of total food energy intake to make milk for a baby. Thus the temperature of breast is higher than other parts of body. This high temperature breast makes breastfeeding mothers feel uncomfortable (Riordan & Wambach, 2008). 	
	<ul style="list-style-type: none"> - Nipple pain is usually the result of improper position, incorrect latch-on technique of the baby or both (Prachniak, 	

	<p>2002).</p> <ul style="list-style-type: none"> - Painful nipples are one of the most common reasons for mothers stopping breastfeeding (Pollard, 2011).
Anatomy and Physiology	<ul style="list-style-type: none"> - Breast pain – Pressure from poorly fitted bras prevents blood circulation and leads to shooting breast pains (Prachniak, 2002).
Tactile	<ul style="list-style-type: none"> - Request for more skin contact with a baby (Newman, 2005).
	<ul style="list-style-type: none"> - Rubbing of fabric on sensitive nipples (Jeon & Kim, 2000).
Emotion & Cognition	<ul style="list-style-type: none"> - Interpersonal Stress - Pregnancy and childbirth are periods of stressful transition with respect to the physical body and to women's social roles (Riordan & Wambach, 2008).
	<ul style="list-style-type: none"> - Modesty- Breastfeeding in public can cause emotional stress (Rubin, 1984).
Stress & Work load	<ul style="list-style-type: none"> - Discontinuous sleep pattern for breastfeeding (Quillin, 1997).
	<ul style="list-style-type: none"> - The breastfeeding frequency changes as the baby ages. Mothers cannot always control the time and space of breastfeeding. Breastfeeding can cause a mother to feel stressed and fatigued (Riordan & Wambach, 2008). - Volumes of breast milk and frequency of breastfeeding is different depending individual variations between women and the age of baby (Riordan & Wambach, 2008).
Function of designed objects	<ul style="list-style-type: none"> - Bra is not able to absorb the perspiration (Choi, H., Choi, J., & Kim, S. 2000).
	<ul style="list-style-type: none"> - Some bras are not able to support the breast (Jeon & Kim, 2000; Choi, H., Choi, J., & Kim, S. 2000).
	<ul style="list-style-type: none"> - Inconvenient to open and close the bra to breastfeed (Jeon & Kim, 2000; Choi, H., Choi, J., & Kim, S. 2000).
	<ul style="list-style-type: none"> - Skin to skin contact has the following positive effects on the baby: <ul style="list-style-type: none"> o Are more likely to latch on o Are more likely to latch on well o Have more stable and normal skin temperatures o Have more stable and normal heart rates and blood pressures o Are less likely to cry. (Newman, 2005)
	<ul style="list-style-type: none"> - Products for breastfeeding mothers should be one handed (Vera, 1982; Choi, H., Choi, J., & Kim, S. 2000).
	<ul style="list-style-type: none"> - Bra should not contain an underwire because it restricts the expansion of the breast and it may put pressure on the milk ducts (Jeon & Kim, 2000; Choi, H., Choi, J., & Kim, S. 2000).

Table 11. Human Factors Problem Analysis of Breastfeeding and Breastfeeding Apparel Based on Review of Literature

CHAPTER 3: METHOD

This study took a qualitative approach to research by collecting data through individual interviews, observation of the interview setting, analysis of the participants' apparel, and field notes. An interpretive lens and grounded theory methods guided the data collection, as well as a rigorous analysis of data.

Research Design

LaBat & Sokolowski (1999) examined commonly used design processes within architecture and environmental design, engineering, industrial product design and clothing design. They found that there were major over-lapping characteristics across the processes that could be summarized within three major phases: 1) Problem Definition and Research, 2) Creative Exploration, 3) Implementation. The research contained herein represents the examination of the user through the problem definition and research phase of the design process.

Rosenblad-Wallin's (1985) user-oriented product development (UPD) model was used to help guide the literature review and focus the research on principles of human factors. A central element of UPD is understanding the user and their use of specific products (Rosenblad-Wallin, 1985). The Rosenblad-Wallin (1985) UPD method requires the designer to obtain user demands through gathering evidence in the form of the user's

“capacity and limitations, problems, needs and wishes, conditions, and actual resources,” (p. 281). User data can be collected through a variety of proposed methods including questioning methods such as qualitative interviews (Rosenblad-Wallin, 1985). This research consisted of exploratory qualitative research with the use of interviewing participants in an effort to understand breastfeeding mothers’ experiences with nursing and the products they use with the goal of developing design criteria.

Recruitment and Selection of Participants

The criteria for participant selection was that the mothers had given birth to a child within one year, were currently feeding their child breast milk (either through nursing or pumping) and were working mothers. The reason for interviewing currently nursing mothers was to ensure that the process of breastfeeding and interaction with breastfeeding products was an integral part of their everyday lives and that they were answering the questions based on current experience. The perspective of working mothers was sought because they face unique, everyday challenges that can provide additional insight into their needs for breastfeeding wearable products.

A criterion sampling strategy was used to recruit the participants and participants were found based on word-of-mouth. Participants were initially recruited through personal and professional connections. Recruiting also occurred on private, new-mother groups on Facebook and babycenter.com. Access to the private, new mother groups were granted through these personal connections and an IRB approved recruitment flyer was

posted on these site. All potential participants were sent a recruitment email that was approved by the Institutional Review Board (IRB) of the University of Minnesota. This email described the purpose of the research and briefly described the procedures of data collection. The goal was to interview eight to ten participants.

If the participant agreed to be a part of the study, the location of the interview was determined. The participant determined the location of the interview. Some interviews were held in the participants' homes, while others were held via video conference call. If the participant was not from the Twin Cities area, it was requested that she allow the interview to be held through video conference call at her home and for her apparel to be available in case specific questions arose regarding the product's features.

Participant Description

Eight participants were interviewed for this study. The participants for this study were between 30-40 years of age and Caucasian. Six of the participants were first time mothers who are currently working. Two of the participants have more than one child and are no longer working, however they were selected because they have experience breastfeeding while working with their older children. Table 4 summarizes pertinent participant information including the age of the baby and location of interview.

Pseudonym	Baby's Age at time of interview	Location of Interview	Where they Live	Profession
Sarah	11 months old, First child	Participant's Home	Minneapolis, MN	Middle School Teacher
Lisa	3 months old, First child	Participant's Home via Skype	Abu Dhabi, United Emirates (originally from Olsburg, KS)	University Admissions Counselor
Claire	6 months old, First Child	Participant's Home	Minneapolis, MN	Journalist
Jane	3 months old, First child	Participant's Home via Skype	Columbus, OH	Entrepreneur
Ashley	7 months old, First child	Participant's Home via Skype	Washington, DC	Photographer
Jolene	7 months old, three children	Participant's Home	Edina, MN	Former Social Worker
Dara	2 month old twins, three children	Participant's Home	Minneapolis, MN	Former Librarian
Molly	4 months old, First child	Participant's Home via Skype	Harrison, NY	Art Dealer; Business Owner

Table 4. Summary of Participant Information

Development of Questions

Questions were developed based on the literature review and market research. Initially, the questions focused on the environment in which the mothers breastfed, design characteristics of breastfeeding wearable products used by the mothers, and their perspectives on breastfeeding their baby while continuing to work. A pilot study was conducted in the spring of 2012 with two nursing mothers. These interviews helped inform the development, inclusion and exclusion, and overall focus of the questions.

Phrasing of the questions was further developed with the help of two design professionals with experience in conducting user-based interviews. Questions focused around three themes of exploration:

- What is the mother's current breastfeeding routine?
- What are some the challenges that the nursing mother faces?
- What type of breastfeeding apparel does the mother use?

The first two themes of exploration for the interview were developed based on Rosenblad-Wallin's (1985) user-oriented product development process. The process indicated that when developing products for specific users, it is important to understand demands that arise from the "use-situation" (p 281). The questions included under the topic of exploring the mother's breastfeeding routine and challenges that she faced were developed in an effort to allow the participants to provide environmental and use context for the apparel that the mother used.

Questions within the third theme of exploration regarding breastfeeding apparel were developed in order to gain an in depth understanding of the types of apparel the mothers wore, specific functional and aesthetic characteristics of the apparel, and areas for improvement within the breastfeeding apparel.

The interview questions used for this study may be found in Appendix D.

Interviews

In an effort to preserve the integrity of the study and the rights of the participants, this study went through a proposal system and received approval from the Institutional

Review Board (IRB) of the University of Minnesota as an exempt study. The participants were given a detailed description of the study prior to the interview so that they understood the purpose and nature of the research. Informed consent forms were signed prior to the start of the interviews and confidentiality was ensured. The participants were told at the start of the interview that they could opt out of answering any questions that made them uncomfortable and could terminate the interview at any time.

Semi-structured interviews were conducted in February 2012 and lasted between 25 to 100 minutes. All interviews were recorded with a digital recording device. The interviews took place in locations recommended by the participant. The participants were asked to bring three examples of wearable products or apparel to the interview that they currently used and represented their favorite and least favorite product.

Data Analysis

Interviews were transcribed verbatim by the transcription service, Rev.com. Upon receiving the transcribed interviews from rev.com, they were reviewed against the original recording for errors or missing dialogue. Filler language, such as ‘um’ and ‘like’, was removed from the transcripts in effort to improve readability.

While Rosenblad-Wallin’s (1985) UPD model was used to guide the literature review and development of questions, the overall interpretation of this data was inductive due to the grounded theory method of the study. The goal of grounded theory “is to generate theory from the data,” and this strategy of inquiry “integrates categories into a

theoretical framework that specifies causes, conditions and consequences of the studied process” (Bloomberg & Volpe, 2008, p. 11).

The data for analysis was a combination of the participants’ own words, pictures and written description of products that the participants’ brought in to the interview, and field notes taken by the interviewer. The participants were asked to bring in three apparel products that they used while breastfeeding. Detailed pictures of the products were taken, and a description of their physical properties was written and included in the field notes. Field notes were also taken during the interview that described the environment in which the interview was performed, as well as notes regarding the interview itself.

Triangulation is an important concept in the design of qualitative research because it helps establish the rigor and validity of the research presented (Richards, 2009). In this study, triangulation was completed through the use of word comparisons from the interviews, the pictures of the participants’ apparel products, in-depth field notes describing the products, and the environment.

The data from this study was analyzed and coded according to a “systematic procedure” presented by Bloomberg and Volpe (2008). This procedure required all of the data to be reviewed and explored, including transcriptions, field notes and photographs, in an effort to identify the big ideas or themes. The next step that Bloomberg and Volpe (2008) recommended was to reread and examine the data. This step allowed either the acceptance or rejection of the themes found in the first round of data analysis. Once themes were solidified, the data was dissected and classified, in-depth coding was performed, and the data was placed into categories. Data summary charts and journaling

were used in an effort to gain insight into the information that was discovered throughout the coding process.

CHAPTER 4: RESULTS

Overview of Interpretation

When a mother discovers she is pregnant, she has nine months to prepare for the birth of her new child. Most of this preparation is centered on taking care of her body, preparing for the delivery, and learning about what to expect when the baby arrives. The eight mothers interviewed for this study discussed at great length the difficulties they faced as they began to take on new social roles, especially the role of being a nursing mother. Jen described her feelings of being unprepared and the anxiety she felt when she first started breastfeeding her newborn:

This is something that I've struggled with so much at the beginning. When I was pregnant I read so many books, on labor, on childbirth, I focused on that so much. I was like, "Oh, breastfeeding? Sure, there was a class for it, but that's the most natural thing in the world, and I'll figure that out." Oh, my gosh! I wish that I had learned more up front.

The mothers who were interviewed knew that they wanted to commit to breastfeeding prior to giving birth, but many were simply ill-equipped to deal with the changes it created in their lives; changes that ranged from the significant time commitment to the physical pain felt. Jolene, a mother of three, said the following:

I think women aren't given nearly enough information and we don't have a culture of togetherness. No one is really exposed to breastfeeding and it's like you don't have any idea. I think in general the pain, whether it's pain from that initial latch that they may not be used to or the pain from the social criticism or the pain from the clothes, causes a lot of anxiety. People just want to make the pain stop.

Sarah spoke in a similar mode and said that one of the reasons she believes women quite breastfeeding so early is because, "you don't really have anyone telling you its going to

get easier and there's so much information that does not get shared with women, especially in terms of products that might be helpful.”

The function and purpose of apparel changes significantly for breastfeeding mothers. Just as many of the mothers interviewed were ill-prepared for the changes that breastfeeding created in their lives, the mothers all faced uncertainty of their apparel needs and underestimated the significance of apparel and its value. Molly, a new mother, in an emotionally charged statement, had the following to say about the significance of apparel within her breastfeeding journey:

You just don't need another distraction, you don't need another complication, you don't need another issue. The truth of the matter is I spent the first three weeks of my child's life topless because that was just the easiest way to do it. That makes it really hard to have people come and visit you, especially your father-in-law, your own father, these people who very much want to be present in your life and you are a slave to breastfeeding. It's a very vulnerable time for everybody. The clothing is a critical, critical piece of breastfeeding, because if you're fumbling with your clothing, you are just a mess. It's a nightmare. It's a total nightmare.

The importance of breastfeeding products and apparel is undeniable. Because mothers spend so much time breastfeeding, it is crucial that designed products specifically address issues facing breastfeeding mothers. This chapter summarizes the themes that surfaced related to breastfeeding apparel and products. Themes regarding the detailed functional and symbolic property needs within nursing products, the needs of breastfeeding apparel within working environments, and the specific value of nursing apparel within a nursing mothers' life are discussed in the following sections.

Functional Value and Properties within Nursing Apparel

Ease-of-Use

Many women expressed that the most important element of their nursing apparel was its ease-of-use. The interviews revealed that most of the mothers breastfed or pumped breast milk every 2.5 to 3 hours and it took them approximately 20 to 30 minutes each session. Because of the time commitment involved in breastfeeding, the mothers communicated that they were all busy and did not have time to fuss with clothing. Specific functional properties that they spoke about in regards to the value of ease-of-use were that apparel needed to be operated with one-hand, allowed for easy and quick access to the breast, as well as versatile in the function of the garment.

The clasp is a common feature found in many bras and tank-tops. Lisa said, “with the clasp it just needs to be the easiest thing possible and it should be something that you try to do with one hand.” There are several different types of clasps on the market. Some clasp latches require only vertical movement and others require both vertical and horizontal movement to undo. Molly describes her favorite and least favorite latch system:

This Bravado latch is the best one, because it’s just an easy on, easy off, and nothing interferes with that latch. It’s like a two-latch system. I have a few that are side latches, and they are much harder because you can’t ...You need two hands for them, whereas the top latch [Bravado style] you really can just do with up and down.

The three most common options for gaining access to the breast in nursing apparel are through un-latching from the shoulder and pulling down, moving a scoop

neck, v-shape or cross-over-shaped neckline down and to the side of the breast, and pulling the garment up from the bottom and over the breast. Participants Jolene and Dara said that they liked pulling t-shirts and tank tops down in order to gain breast access.

Molly discussed the V-neckline and how she accessed her breast for breastfeeding:

The fact that it's got this V-neck here and it's just soft and I just pull down and across as needed is great... but that V-neck slightly crossed over shape is really good.

Jane mentioned that she preferred scoop-neck tops and used different methods of moving the garment when breastfeeding:

Usually my stuff is a scooped-neck type thing, anyway. That works pretty well. But if it's too tight or restrictive to pull down, I'll just hike my shirt up.

Lisa, however, did not have very good luck with scoop or v-shaped necklines in terms of access to the breast. She said it was more work for her than other types of garments that featured clasps at the shoulder:

What I have seen, is even in the breastfeeding clothes, they will have things that have a v-neck, but unless that v-neck really opens down to about your waist, it's not comfortable to get your breasts out. You need some space to maneuver. With v-necks, I'm constantly pulling it tight, and stretching it at the neck, taking my arm further out... If I want to breastfeed when wearing a v-neck, I end up pulling my top clear up from the bottom. I have the same problem with another maternity dress with a scoop neck. I would like to wear it because it's comfortable, but I can't. Because again, it doesn't stretch enough. It looks like they tried to make it doable, but it just doesn't work.

Several of the mothers preferred to find clothing that could be pulled up, rather than pulled down like the garments with clasps or low neckline shapes. Claire said she "bought a very cheap shirt at H&M which is a dark purple sparkly thing because it's easy

to just pull it up.” Claire stated the benefits of pulling the bra or shirt up because you reduce the chances of getting breast milk on your clothing:

This one you pull up and that way if she dribbles or something, no big deal--it doesn't get on the bra. Usually, when I'm using my nursing pad, I will just wipe it off really quick. But if your bra goes down it just soaks it up right away.

There was little consensus among the mothers as to how they preferred to gain access to the breast, but it was clear that the mothers had found through trial-and-error what worked best for them.

The concept of ease-of-use was contemplated in terms of garments either having too many or too few features to help make breastfeeding easier. Lisa discussed that it was hard to find a garment that was flattering, simple, and easy to use. She felt many of the garments in her wardrobe could improve substantially with more thoughtful consideration of the design elements that they incorporate. She illustrated her point when discussing a poncho-style cover-up that she wears when breastfeeding in public or when pumping:

This one is really good. My only complaint with it lately is, okay so now you've got it opened and its great, but to get it closed its got 10 snaps! That's excessive. I typically don't snap all 10 snaps or what I end up doing is I just snap the top one, the middle one and the bottom one then I go. Things like ... the snaps could be made easier. This is a really great design I think, and because it's long it's flattering. But it could definitely be improved.

Other mothers talked about their struggles with too many product components when breastfeeding and how they wished that the apparel could do more things. Leaking breasts was a major area of discussion and it was clear that there is currently no simple solution. The majority of mothers had to wear breast pads at some point while breastfeeding their child and they all had similar complaints. Ashley expressed:

They're supposed to help if you are leaking and prevent the leaking as well, but the problem with those, I love them and I think they would be great, it's just if I needed to nurse in public I can't just take out these nasty clear things and put them away. Sometimes I would find, in the beginning when he was nursing every two to three hours, there wouldn't necessarily be a bathroom to go into to do that. Sometimes I would lose one of them. They are kind of a pain, but it's a great idea if there is some way to have it stick to the bra or something. That way you don't have to take them off.

Several mothers offered ideas and solutions to improve versatility and the ease-of-use within their garments. Jane thought it would be beneficial if the nursing pad could be incorporated into the bra so that you could avoid removing them in public. Lisa mentioned that she did have one bra with a small pocket in the front nipple area and stated, "I would say this one is pretty good actually, because it holds the pad." Jolene went further when discussing features that she would like to see in nursing apparel that would make a garment more versatile:

It would be interesting if there was a magic nursing shirt that had built in thick pads in that area (in lieu of nursing pads), built in fabric extra here [the shoulder] for burping baby and all of that, like if there was some magic shirt you wear only at home it would have all of that.

Ease-of-use was also a concept related to material properties. All of the mothers discussed the importance of a garment being easy to care for in terms of launderability, the ability to hide stains from breastmilk and a garment's ability to hold its shape throughout the course of the garment's lifespan.

Ease-of-use is a critical element of nursing apparel. Nursing apparel needs to allow easy and quick access to the breast, have efficient design features that do not hinder breastfeeding time, be versatile in its function, and be easy to launder.

Comfort

Most of the mothers, when searching for nursing apparel, would seek out apparel products that were comfortable and soft. Concepts of comfort varied between the mothers based on their personal experience with breast pain, but materials, constriction, the design shape of the product, and their desire for products that were ‘easy’ played a role in determining the types of products they desired.

From the literature review, it became clear that breast and nipple pain were closely associated with most mothers’ breastfeeding experience. All of the mothers interviewed confirmed that they experienced breast and nipple soreness while breastfeeding. The mothers described their breast and nipple pain extremely vividly and used terms such as ‘on fire’ to describe what it chapped nipples felt like and ‘so raw it resembled ground up meat’ to describe cracked and bleeding nipples. The pain associated with breastfeeding caused the mothers to pay particular attention to the comfort of the apparel that they chose. Molly explained,

Basically in the beginning you want it to be as soft as soft can be. I was susceptible to being very bruised, cracked, sore or whatever. I couldn’t get out of the shower without my breasts hurting terribly. We have relatively soft towels and my breasts were so sore that after I showered I could only blot and I let my breasts air-dry because I couldn’t physically touch anything to them. Only the softest cotton bra was all that would work ... I was in pain, winced to get it over my breast. The too tight bands that I was telling you about was brutal in the beginning, because inevitably you would scrape the nipple area and it was just like ... I can’t even explain how painful it was.

For all of the mothers, comfort and softness were crucial elements of any product that came in contact with their breasts.

The majority of the mothers interviewed eventually found a few wearable products that provided relief for their nipple and breast pain. Jane described a wearable product that provided comfort and relief that was recommended by her lactation consultant:

One thing that the lactation consultant gave me were soft shells. Basically, it gives you an inch of space or a half inch of space so that the bra doesn't rub up against [your nipple] and it allows it to heal. It was super-useful for me. If there was another bra that was made for when you're having trouble, that had that built in, oh my God. I would have spent \$100 on that.

Other products that the mothers mentioned providing comfort for their painful breasts were cooling gel pads and nipple shields. Designers can improve the overall comfort of an apparel product by incorporating features that emphasize relieving nipple and breast pain.

In terms of materials, the mothers often mentioned jersey cotton knit as one of the most comfortable options for breastfeeding apparel. Materials also needed to be stretchable. Comfort was related to the stretchability of a material in terms of donning and doffing the apparel as illustrated by Molly's comment regarding getting the bra over her breasts without touching them, as well as the product's ability to allow for the changing breast size throughout the day. Jane had the following to say:

Going out is the only thing that's tricky, because if I'm going like four hours without nursing, at the end I'm pretty full. I wouldn't want to wear something that was really tight or constricting because it would be pretty uncomfortable by the end. I try to just keep that in mind. I think stretchability and wearing super stretchy knits is an easy way to avoid this [discomfort].

It is well known that design elements such as underwire in bras are not recommended for breastfeeding mothers for health reasons; however, many of them

mentioned that they began to stop wearing underwire bras towards the end of their pregnancy for comfort reasons. Lisa said, “that is when my boobs got really sore. Anything kind of underwire or something harsh, was going to hurt. So, I stopped wearing my underwire bras at about five months [pregnant].” Ashley also mentioned that she would not even consider wearing a bra with underwire because they simply were too constricting and placed too much pressure on the breast area.

The design shape of garments was an important element of comfort. The mothers discussed a number of different design features that lacked comfort. Lisa purchased a bra in which the inner-bra design caused difficulties. She described the bra and said,

It’s got this hole on the inside that the nipple goes through and it’s also made out of sports bra material. I find that strange. It gets tight yes, and then I will have marks on my breast from this, because this circle doesn’t expand enough and it cuts into you.

Another design shape that caused discomfort was in size and shape of the bra cup. Jane described some difficulties that she had with a demi-cup nursing bra that she wore in which the upper portion of the bra cups exposed the upper half of her breast. She said,

...the edge of the bra is just too close to the nipple, and these things are monstrous so if they don’t pop out, they shift. My nipples were really cracked and bleeding and sore, if air brushed against it I would cry. It hurt so badly. It felt like it was on fire. For [my breast] to pop out of my bra and then have my shirt rub against it, oh my God. That was horrible. I like the ones that just have more coverage, where it’s not cutting in too close.

Elements of breast coverage and constriction need to be closely considered by designers of nursing apparel products.

While breast and nipple pain were the main reason why the mothers described comfort as being a key property of nursing apparel, some discussed comfort in more

general terms. Many mothers wanted their clothing to be comfortable because breastfeeding was such a stressful time in their lives. Claire expressed this by saying,

Well, breastfeeding is such a pain. But I mean, it's a special time and anything that can make you feel more comfortable I think is good. It's my goal to get more stuff that makes me feel comfortable.

Layering Systems

Systems of layering apparel for ease-of-breastfeeding and for modesty was a theme that appeared. A specific article of nursing apparel that was examined within this theme was the tank top. The women mentioned that they bought tank tops because they were easy-to-use and layered well underneath other garments. Ashley wore tank-tops as part of a layering system for modesty. Ashley said the following:

Yes, little tank tops I'll wear under things. This shirt I have on right now doesn't button down, but I will wear a tank top underneath it, lift the shirt and pull the tank top up.

Ashley said this type of layering was fairly common for her when she was dressing because she didn't always like to be confined to the home. When she started dressing in this manner, it gave her more mobility and the flexibility to leave the house without having to think what she was wearing because she was confident that it worked. Jane further communicated the reasons behind why she wears a system of layers:

I'm finding what works the best, especially in the winter, is to have on two layers of clothes similar to what I'm wearing now--where there is something tighter underneath and then sort of thin but looser sweater over the top. For a couple of reasons: the loose layer over the top really helps so that if I'm breast feeding, this can come up and this can come down and it just creates a very small window where the head is, so then I'm still covered here. No one's seeing my stomach. I'm not doing this where it's like half the boob is hanging out. It's really very discreet to do it this way from my experience.

Molly also preferred dressing in layers as a means for breastfeeding in the presence of others because it allowed her better visibility of her baby and her breast:

I hate nursing covers, so I wear a tank top or shirt and a sweater. Most nursing covers and stuff are just ... they are just too much. They're too much work. I have always had to find a private spot so that I could be concealed, because I needed to have my breast out in order to see the baby, see that I got it in his mouth and see that we're all good. Especially in the beginning, you really need to see what you are doing in order to make contact with the baby.

A system of layering worked for Lisa with tank-tops and with other garments because it was easy and comfortable:

Well, when I get home I immediately change into a robe, because it's the easiest thing. Right now, I have my nightgown under it, but I would open it and then just pull my nightgown down and across to clear [my breast] out.

The system of clothing layering played an important role when breastpumping at work and is discussed later in this chapter.

Fit and sizing

Common sizing and fit issues apparent in regular ready-to-wear extend into nursing apparel. Many of the mothers had difficulty understanding the current sizing system for nursing apparel and experienced numerous issues related to fit with their apparel products. Online shopping, time constraints, and a changing body contributed to the mothers' frustration with finding well-fitting nursing apparel.

Ways in which individuals shop for apparel has changed significantly over the last twenty years. Shopping online was a common method for the mothers in this study to

obtain their breastfeeding apparel. This method, however, presented the mothers with a new problem: what size were they? Molly stated,

I think the sizing is huge. That is a really big deal because new moms don't have time to go shopping. Online shopping is huge, or just buying and running is huge. There is not a lot of, "Oh, let me try this on." You need that confidence in your sizing.

Molly and other mothers mentioned that they faced challenges when trying to find apparel that was the right size and that there was little consistency in how sizing worked between brands.

The sizing is definitely an issue for me. Most maternity clothes seem pretty evolved in the fact that ... I was typically a size 8/10 before I was pregnant and so I would buy an 8/10 in maternity size. You buy the same size. Clearly they have figured out how big the stomach grows and changes that way. It's very weird for me that I need to size up in nursing, because I just assumed that there would be the same sophistication within nursing apparel sizes.

When discussing the issue of sizing, the mothers did admit to the issue of body uncertainty and size change after giving birth. Jolene had the following to say:

The truth of the matter is you need different sizes immediately after birth than you do three months after birth because you are losing weight constantly but immediately after you need a little more forgiveness. I have actually been wearing the same things since the beginning and I just deal with them being bigger on me now or tighter then. Some were suffocating then, and that was awful.

The development of a sizing system in breastfeeding apparel and products that is understandable to the mother and incorporates her changing body after childbirth is an area of apparel design that needs careful consideration and improvement.

Symbolic Value and Properties within Nursing Apparel

The mothers interviewed for this study struggled to find apparel products with sufficient symbolic properties incorporated. Aesthetics and fashion elements were two of the most important properties missing from the apparel that the nursing mothers used. Most of the breastfeeding specific products that were discussed were described as “ugly,” “boring,” “clunky,” “nasty,” and “dowdy”.

The mothers articulated that they wanted their nursing apparel to say more about them and their identity. They tended to resist wanting to look like a ‘mother’ all the time. Jolene described her desire to look cuter and said, “It would be nice to have the functionality with something cuter on the outside but not so we’re covered in the word ‘baby’ like a lot of things seem to be”. Claire communicated something similar when voicing her frustrations in balancing being a mother while maintaining her individual identity through clothing. She said,

You just get sick of wearing the most boring stuff. I don’t want to be dowdy all the time like this. I wish I could feed my daughter healthy breastmilk and still manage to avoid looking like a bum. Today I am wearing a pair of leggings, a cheap, extra-long, button-up [shirt] from the thrift store, and a fancy belt - the last of which represents my clinging to the vestiges of dignity.

The women interviewed thought more feminine features were needed in nursing apparel, especially in the bras. Nearly all of the mothers tended to prefer bras that combined both functional and aesthetic properties. Molly described one of her favorite bras and said, “this little piece of lace here, it’s really nice. That makes a big difference. You can’t lose function, but you start to want something that’s a little bit nicer looking.”

Another mother, Ashley, rejoiced when she found a product line that blended function with aesthetics. She said the following about her favorite bra:

My bra, I'm obsessed with it. I love it because it's not like hideously ugly. I have it in black. It has sheer lining on the top that I like, because when I'm wearing it, it just looks a little more elegant. It doesn't look like a clunky, nasty nursing bra.

Many of the mothers discussed the shape of garments and expressed the lack of garments that were flattering and fit well. Most of the apparel and bras that the mothers found made them feel "fat" and "disgusting". Some mothers did eventually find garments that made them feel better about their bodies. Jolene and Sarah both really liked tank-tops and shirts that held their tummy. Ashley continued to describe her bra in terms of its flattering design elements by saying,

The best part about it is it has a really long extension, and then it has a very thick part that goes around your back fat area, so it doesn't give back fat. Yes, this is my favorite one thus far.

While a few of the mothers found products that incorporated functional and symbolic elements, many said that this type of garment was nearly impossible to find. The accessibility of quality nursing apparel is discussed later in this chapter.

Work Apparel and Environmental Considerations

A number of themes emerged pointing to the difficulty of breastpumping at work, apparel, time constraints, and the environment. The quote below, from personal correspondence from Claire, illustrates the difficulty of balancing being a mother and breastfeeding at work, while still continuing to look professional:

For what it's worth, I'm obsessed with fabrics and professional attire right now. When I'm at home, I just wear crappy clothes from H&M - no problem if I spill or leak. At work, however, I would like to maintain a modicum of professionalism. The problem is our "mother's room" is a [awful], with no table or desk to hold my breastpump and its many accoutrements. Imagine me balancing pumping equipment on my knees, or sprawling out on the unvacuumed floor (which is why I usually opt to balance stuff on my kness). In the past few weeks, I have spilled expressed breastmilk (which stains) on a Narcisco Rodriguez pencil skirt and a vintage Givenchy silk dress. This really [irritates] me!
(Claire , Personal Correspondence, January 29th, 2013)

Breastpumping at work was often associated with feelings of vulnerability. Many of the women described their environments as not being equipped with some of the most basic items such as a door lock, sink, table, or chairs. These environmental conditions caused many of them to question the reason why they were breast pumping and made them feel like less of a professional, especially when the mothers discussed their apparel. All of the mothers described the importance of symbolic properties when describing their work attire. They faced great difficulties finding apparel that functioned when trying to breastpump and maintained a certain level of professionalism.

Time constraints affected all of the mothers' breastfeeding routines at work. Some faced great barriers in finding the time to breastfeed due to the nature of their work. The time constraints of pumping also placed added importance to the types of apparel that the mothers chose for work. Sarah discussed the difficulties of breastpumping in less than ideal work environments and the time constraints that were placed on her as a teacher:

They had me in the gym, like a locker room. Also, where my classroom is and where the locker room is, it was so far away. With teaching, you only have five minutes of passing time. So I really could only pump on my prep. Our classes are only 45 minutes long. By the time I got all the way down there, if I was

wearing something like this [cardigan and dress], I just didn't have enough time. That was my big challenge.

Feelings of vulnerability, time constraints and less-than ideal environments that the mothers had when pumping at work created anxiety and stress for all of the mothers interviewed. Claire described her overall experience with pumping at work and the balance placed between looking professional and the need for speed:

It just made me so stressed out because I felt like my milk supply wasn't as high as what she was going to want and I was in that stupid nursing room constantly and had to hash out this breastfeeding equipment in front of all these dudes. And then, when you go to pump you're already taking so long to do that, so anything that slows you down like your shirt or a stain from spilling milk is ... You have to doubt, 'am I'm looking professional' or is it all stuff that slows you down too much? Even if you have the support of your employer like I do, it still sucks. The ideal situation would be a room with a refrigerator, a desk or a table and a sink, but obviously that's kind of a hard thing to pull off. That's my little soap box on pumping. I hate pumping.

Many of the mothers interviewed discussed the types of apparel that they wore to work. Some key features of that apparel included easy/quick access to the breast or easy/quick donning and doffing, clothing that did not wrinkle, and clothing that hides stains from spilled milk or allows for easy cleaning. Claire showed a beautiful, black pleated polyester dress that allows for easy donning and doffing and is wrinkle free. She states:

It's gorgeous and it doesn't wrinkle. That's my most convenient pumping dress for work because ... I'm always, always, always spilling. And one day I spilt like half the milk that I had just pumped. When I'm pumping at work it's best to just take the whole thing off so if you do spill on it you could still look okay afterwards. So this [dress] with a jacket or scarf, I feel I look somewhat professional and I can just throw it off and throw it back on without worry about it getting wrinkled.

Claire did not mention vulnerability in de-robing while pumping, however, many of the mothers did not feel comfortable being completely exposed. Sarah said:

So when you're in these places where you're nervous that someone might walk in, it's really uncomfortable. It was just kind of nice if I did wear that black top, then you could wear a blazer or something over. You could move [the garment], pump and then still have security in being somewhat clothed.

Sarah and many of the other mothers developed a system for dressing at work that included layering garments so that she would not feel so exposed if someone walking into the room while she was pumping. Or as in Claire's case, the jacket or scarf could possibly hide any leaks or spills.

The challenges that the mothers faced while continuing to breastfeed when they returned to work were daunting. Finding apparel with specific functional and symbolic properties played a central role in the working mothers' daily routine at work. The functional properties that mothers' discussed were ease-of-use, easy donning/doffing or easy access to the breast, and launderability. The symbolic properties that were important to the working mothers included making sure the apparel allowed them to fit-in and feel like a professional. These functional and symbolic apparel properties will be important design requirements for future nursing apparel and product designers.

Value

Price and accessibility were very important to the mothers. Most of the mothers had great difficulty in finding products that met their needs and said that both online and in-store selection is very limited. Despite the mothers' desire to find nursing apparel that

was easy to use and comfortable, nearly all of the mothers easily accepted the status quo. Dara said, “There’s really not that much available and basically I’m really cheap in terms of buying maternity clothes or nursing clothes.”

Because the mothers are not likely to use breastfeeding products for more than one year, the value of a product influences both their decision to purchase and their ultimate satisfaction. The mothers tended to be more satisfied with a product if it cost them less, despite a product’s deficiencies. Molly described her feelings towards breastfeeding and how the current market didn’t really offer anything that was worth spending a significant amount of money on. She said,

The truth is, my feeling about it is that it’s a fleeting time and so I would rather buy something inexpensive. It’s usually not something gorgeous. My favorite bra, which is just totally functional, is this Bravado bra. It cost \$50 and I had to swallow deep in order to buy it. I knew that it was going to be the right thing, despite not being gorgeous.

Even though the mothers expressed their desire for the apparel to be cheap, most of them still emphasized that they recognized the value in such products. Jane said:

My ideal amount would be very cheap. I’m not going to use it forever. I’m not going to use it after I’m done nursing. I had a hard time buying maternity clothes, too, for that reason.. But I know these clothes and bras are definitely very useful, so I don’t want to go super cheap.

The mother’s changing body also played a role in a mother’s decision to purchase breastfeeding clothing. All eight participants mentioned their reluctance to invest in apparel because of their body. Ashley said,

To be honest, I still haven’t lost a lot of the weight. I haven’t really had time to work out or focus on that, and I haven’t wanted to invest much in my wardrobe because of that, so I’ve just made do with things I have. I borrowed some of my mom’s old things. I haven’t focused much on my fashion.

There was disparity in the mother's desire to have a product that met all of their needs and their statements regarding the price they were willing to spend on a specific product. Interestingly, the majority of the women purchased on average between 5 and 10 nursing bras in search of something that fit their needs. Therefore, the mothers are in fact spending money on apparel because they are still searching for products that work. Despite having approximately eight different nursing bras, Lisa expressed that she had difficulties finding bras at common shops and was still in search of a bra that was 'perfect'.

In seeking clues to see if the mothers were interested in the longevity of their nursing apparel, most could not imagine wanting to wear their current wardrobe of maternity and nursing clothing for any longer than needed. Molly stated,

I don't need it to be functional, like lasting forever. I definitely would want to just throw it out and start over when I'm done, because by that point you are just like, let me just be done with that phase of my life. Let me treat myself and let me just go get new non-maternity, non-baby related, totally about me underwear and clothing.

This statement reflects the impact of symbolic properties within nursing apparel. On the one hand, most women want apparel that functions and aids them in the task of breastfeeding. On the other hand, the majority of nursing apparel offered does not reflect the individual's identity beyond that of a breastfeeding mother. Perhaps if nursing apparel did reflect more of a mothers' self-identity, the products could hold more value in the mothers' life, thus improving their acceptance.

The data showed evidence that there is a genuine need for breastfeeding apparel products to be not only well-designed but also affordable and accessible. Even though the mothers were reluctant to spend a great deal of money on breastfeeding apparel and

products, many went to great lengths to find products that fit their breastfeeding needs.

The mothers, however, faced difficulties in finding solutions and unfortunately were met with products that fell short of their demand.

CHAPTER 5: DISCUSSION AND DESIGN REQUIREMENTS FOR BREASTFEEDING APPAREL

The review of literature and the mothers in this study suggest that breastfeeding mothers use a variety of apparel products ranging from nursing bras to tank-tops to nursing covers. A thorough investigation into the issues affecting a mother's breastfeeding experience in varying environments, the types of apparel that mothers are wearing, and how a mother's apparel affects her breastfeeding on a daily basis uncovered a significant gap in designed products' ability to facilitate and encourage breastfeeding. The products available on the market for nursing mothers are not easy to use, do not adequately aide or alleviate breast and nipple pain, and do not allow the mother to achieve the flexible lifestyle they are accustomed to prior to breastfeeding.

Discussion

Breastfeeding requires a time commitment and a drastic lifestyle change for many mothers. Not only is the mother caring for a new infant, she is also feeding the infant breast milk, which requires her to be near the baby or near a breastpump every two to four hours on a daily basis. The inflexibility of daily routine conflicts with the modern on-the-go lifestyle that many mothers are accustomed to prior to giving birth. Evidence shows that the majority of mothers stop breastfeeding within the first three to six months post-partum (US DHHS, 2011). The mothers interviewed for this research emphasized

the struggles they faced in terms of being unprepared for the challenges, the pain associated with breastfeeding, and the lack of products available to aide their breastfeeding.

While emphasis is placed on how society affects a mother's decision to breastfeed and how long she breastfeeds in literature, there is a disconnect between the day to day issues that the mothers spoke about during the interviews and the influences documented in literature. Current literature and research do not truly capture the conflict between lifestyle change before and after childbirth. Daily schedule, mobility, activity, social interaction, and available time are all impacted when a mother chooses to breastfeed her child. Even with previous experience nursing an older child, the time commitment involved in breastfeeding a newborn and the inflexibility of her day-to-day schedule is daunting.

Mothers are not being prepared for the task of breastfeeding. Much of the literature indicates that there is a problem with providing accessible information to mothers before and after giving birth. The mothers in this study indicated that they all felt ill-equipped for the task of breastfeeding. Beyond the lifestyle change and time commitment involved in breastfeeding a child, the information available to women about breastfeeding is limited. While it is clear that the government and organizations such as La Leche League are disseminating resources and knowledge about this topic, more accessible information regarding breastfeeding and breastfeeding products are essential to prolonging a mother's decision to breastfeed.

Literature points to specific medical problems associated with breastfeeding such as mastitis and breast engorgement, and there is some discussion surrounding breast and nipple pain in medical journals. The results of this research, however, suggest a much larger problem surrounding the nature of breast and nipple pain, and the products that are available to help alleviate the pain. Literature describes the nipple pain as closely related to words such as tender, chapped, or bruised, which are common and relatable types of pain. The participants, however, vividly described their nipple pain as being on ‘fire’ and so raw that they resembled ‘ground meat’. The breast and nipple pain, as well as medical complications, which the interviewed mothers experienced, are unfamiliar experiences that had not been felt prior to breastfeeding.

The difficulty with breast and nipple pain is that it is not easy to heal the breasts once symptoms occur because of the frequency of breastfeeding. Modern approaches to pain management for common ailments would normally have a person stop or lessen whatever they are doing that is causing the pain until symptoms clear up. This approach does not work when a woman is exclusively breastfeeding her child (as is recommended by the government), and the products available to help alleviate the pain do not appear to be sufficient or helpful.

The mothers interviewed hypothesized about why other mothers stopped breastfeeding, and there was an overwhelming consensus that they believed other mothers simply did not realize that breastfeeding would ‘get better’ and ‘easier’. Even with the knowledge that their breasts would heal and ‘get better’, the interviewed women that experienced breast and nipple pain said that their symptoms lasted three to four

weeks. When a mother is breastfeeding up to eighteen times a day, everyday, enduring that type of pain for three to four weeks can seem like an eternity.

Current products on the market to help alleviate pain include nipple creams, cooling gel pads, and nipple guards. Very few of the women interviewed were satisfied with the products that they purchased and some felt that their bras exacerbated the problem. Improving breast and nipple pain needs to be a focus for designers. Interdisciplinary research and design among medical and design professional teams could be useful to further understand this phenomena. Innovative products need to be developed to combat breast and nipple pain during lactation and are necessary to ease the task of breastfeeding for mothers.

A woman's breasts are typically associated with positive feelings and symbolize femininity and softness. This breast symbolism transitions and changes for women as the lactating breast functions as source of nutrition for their child. The women interviewed expressed that their previously positive feelings towards their breasts began to change as they felt pain, discomfort, or pressure. The physical and emotional changes that breastfeeding women experience are not addressed by the majority of products on the market and the products lack the touch of femininity that mothers are accustomed to in their intimate apparel. If a nursing mother feels supported through the products or apparel she uses, perhaps her breastfeeding experiences will be more positive.

Before pregnancy and the birth of a child, the process of dressing oneself has been practiced for an individual's whole life. Social norms for dressing and the function of everyday articles of clothing are understood. A woman knows what garments work for

her on a daily basis, and will have developed a routine for dressing that requires very little thought with a wardrobe that suits her lifestyle. During pregnancy, a mother learns to dress herself according to her changing body size and for added comfort, however, the rules and function of dress do not change significantly during pregnancy.

The process of dressing and the purpose of apparel changes considerably for women while breastfeeding. When a mother is breastfeeding, especially a first time mother, her routine and typical thought process of dressing herself is disrupted. Daily dressing now requires a mother to develop a new way of dressing for the purpose of breastfeeding, with new functional and social rules. A mother has to contemplate whether or not her garment allows access to her breasts, provides support without being too restrictive, provides camouflage for leaks and spills, provides a comfortable amount of coverage when breastfeeding in public, and provides comfort for painful nipples and breasts. In terms of social rules, the mother needs to find apparel that is versatile within environments that range from at home to the workplace and represent her as an individual. It took many of the mothers several months of frustrating trial and error and critical thinking in order to figure out garments that worked for breastfeeding.

Many of the mothers interviewed expressed frustration with the apparel options that they are currently offered. From the results of this study, it is apparent that mothers face breastfeeding barriers from their clothing from both social and functional perspectives. If dressing challenges discourage social interaction it could be very isolating for the mothers and could further exacerbate medical risks, including postpartum depression. Functionally, breastfeeding is a difficult process and the mothers

found that many of their apparel options did not allow easy access to the breast. Furthermore, breastfeeding can be associated with pain and the apparel offered to the mothers does not adequately comfort or aid in alleviating this pain. Many of the mothers interviewed also had difficulties finding breastfeeding apparel that fit their changing bodies. All of the mothers considered giving up breastfeeding at one time or another because of the barriers they faced on a daily basis. Apparel should not be a barrier to a woman's decision to breastfeed.

Overall, it is crucial that designers begin developing products for this generation of mothers that incorporate elements of ease of use, comfort, support, and versatility. The challenge facing the designer of breastfeeding apparel and products is to develop products that lessen the decision-making process involved in dressing for breastfeeding and ease the stress for the mother. Designers need to design products that make dressing and nursing easier from the start of a mother's breastfeeding journey. Design criteria, based on the user, can guide designers towards successful breastfeeding apparel and products.

Overview of Method

The user-oriented product development method guided the development of design criteria based on the user and the use-situation (Rosenblad-Wallin, 1985). The design criteria listed in this section should be used in conjunction with the requirements listed in Appendix C, and Table 3, Human Factors Problem Analysis of Breastfeeding and Breastfeeding Apparel, both based on the literature review.

Design criteria were developed from themes that emerged through the careful

analysis of the literature, the interviews, and design knowledge. Criteria were developed around the themes of ease-of-use, comfort, layering systems, ease of care, size and fit, and symbolic representation. The design criteria for breastfeeding apparel and products pertain to all breastfeeding products regardless of the setting that the product is worn.

Design Criteria for Breastfeeding Apparel and Products

Design Criteria	Description and Purpose
<i>Ease-of-Use</i>	
Easy access to breast: -one-handed operation -minimize dexterity needs	-Products should function easily for breastfeeding
Features should be easily distinguishable and understandable	-Mothers should be able to understand and use the features of a design. -If a product has multiple design features, each element of function needs to be distinguishable and understandable.
Features should be simple	-Designs should use the fewest components necessary for the product to function.
Design should be easy to don-doff	-Mothers should be able to get in and out of products quickly and efficiently.
<i>Comfort and Material</i>	
Design should not irritate breasts, and should not cause abrasion	-Breast and nipple pain are common for mothers. -Products should not exacerbate already sensitive breasts.
Design should allow for the expansion of breast and changing breast	-Breast size changes throughout the day, therefore products need to allow for maximum expansion and contraction.

size/shape over time	
Design should provide breast support	-Because components such as underwires constrict the expansion of the breast and block milk-ducts, support should be incorporated through the material, design shape, and structure of the design.
Design should not constrict the breast	-Constricting the breast can cause medical problems such as mastitis, and clogged milk ducts. -If breast is constricted when it expands, the product can become uncomfortable for the wearer.
Design should not place excessive pressure on breast	-Excessive pressure on the breast from clothing and other products can cause medical problems such as mastitis and clogged milk ducts. -Breasts and nipples can become irritated from too much pressure.
Design should cover nipple and breast completely	-Design should reduce the chance of material irritation by covering the nipple and breast completely.
<i>Layering System</i>	
Design should interface with other products	-Products should be easily used in conjunction with other products to create specific use-systems -Products should not interfere with the function of other designed products
Design should support interaction with baby	-Products should allow the mother to see her breast and baby -Visibility allows the mother to see if the baby is latched on to the nipple properly
Design should provide coverage for the wearer	-Preference for the amount of coverage varies among mothers -All mothers requested coverage that allowed them to maintain a comfortable level of modesty. -Products should be designed in terms of keeping the minimum amount of skin exposed that is necessary for breastfeeding or pumping to occur

<i>Ease of Care</i>	
Design should hide stains from breastmilk	-Breast leaking and spillage occur often for some mothers. -Material fiber content should be taken into consideration. Materials that stain easily and materials that stain permanently should not be used.
Wrinkle-Free	-Apparel should not wrinkle when accessing the breast or donning and doffing for breastfeeding or breastpumping. -Materials and material finishes should be considered by designers
Washable	- Because breast leaking and spillage is common, products need to be easily washable by hand or machine. -Leaks and spills should be easily concealed
<i>Sizing and Fit</i>	
Sizing system should be understandable	-The current nursing apparel sizing system is not relatable to sizing systems found in ready-to-wear and maternity garments.
Design fit should allow for body shape change	-The post-partum body dramatically changes over the course of one year. -Breastfeeding apparel should adapt to a mothers' changing body size and shape
<i>Symbolic Representation</i>	
Design should be aesthetically pleasing	-Mothers want and need products that are beautiful and feminine.
Design should reflect wearer's identity	-Mothers want products to be a reflection of their whole identity -Current products tend to only reflect a woman's role as a breastfeeding mother

Table 5: Design Criteria for Breastfeeding Apparel

CHAPTER 6: SUMMARY AND FUTURE WORK

Summary of Method

The purpose of this study was to determine the needs, preferences, and use of apparel products by breastfeeding mothers. Rosenblad-Wallin's (1985) user-oriented product development (UPD) model was used to help guide the literature review and focus the research on principles of human factors. The research consisted of exploratory qualitative research through the use of interviewing methods in an effort to determine problems with current breastfeeding apparel and develop design criteria.

Eight participants were interviewed for this study. The criteria for participant selection was that they had given birth to a child within one year, were currently feeding their child breast milk (either through nursing or pumping) and were working mothers.

A criterion sampling strategy and word of mouth was used to recruit the participants. The location of the interview was determined by the participant. Some interviews were held in the participants' homes, while others were held via video conference call. If the participant was not from the Twin Cities area, it was requested that she allow the interview to be held through video conference call at her home and for her apparel to be available in case specific questions arose regarding the product's features.

Questions were developed based on literature review and market research. A pilot study was conducted in the spring of 2012 with two nursing mothers. These interviews helped inform the development, inclusion and exclusion, and overall focus of the questions.

Semi-structured interviews were conducted in February 2012 and lasted between 25 to 100 minutes. The data of this study was analyzed and coded according to a “systematic procedure” presented by Bloomberg and Volpe (2008). Once themes were solidified, the data was dissected and classified, in-depth coding was performed, and the data was placed into categories. Data summary charts and journaling were used in an effort to gain insight into the information that was discovered throughout the coding process.

The user-oriented product development method guided the development of design criteria based on the user and the use-situation (Rosenblad-Wallin, 1985). The design requirements were developed based on themes that emerged through the careful analysis of the interviews and design knowledge. A rating system of the design requirements was developed based on how many times the concept or property was mentioned in the data, with added influence from the review of literature.

Summary of Themes

The eight participants interviewed for this study were between 30-40 years of age and Caucasian. Six of the participants were first time mothers who are currently working. Two of the participants have more than one child and are no longer working, however they were selected because they have experience breastfeeding while working with their older children.

Themes regarding the detailed functional and symbolic property needs for nursing products, the needs of breastfeeding apparel in working environments, and the specific value of nursing apparel in a nursing mothers' life were discussed.

Many of the participants expressed the most important element of their nursing apparel was its ease-of-use. The interviews revealed that most of the mothers breastfed or pumped breast milk every 2.5 to 3 hours and it took them approximately 20 to 30 minutes each session. Because of the time commitment involved in breastfeeding, the mothers communicated that they were all busy and did not have time to fuss with clothing. Ease-of-use was a critical element of nursing apparel in the eyes of the mothers interviewed. According to the participants, nursing apparel needs to allow easy and quick access to the breast, have efficient design features that do not hinder breastfeeding time, be versatile in its function, and be easy to launder.

The mothers interviewed for this research sought apparel products that were comfortable and soft. Concepts of comfort varied between the mothers based on their personal experience with breast pain, but materials, constriction, the shape of the product, and their desire for products that were 'easy' played a role in determining the types of products that were desired

A system of layering apparel for ease-of-breastfeeding, and for modesty, was a theme that emerged. Some mothers preferred dressing in layers for breastfeeding in the presence of others because it allowed better visibility of baby and breast. Systems of layering gave the mothers more mobility and the flexibility to leave the house without having to think what she was wearing because she was confident that it worked.

The participants had difficulty understanding the current sizing system for nursing apparel and experienced numerous issues related to fit with their apparel products. Online shopping, time constraints, and a changing body contributed to the mothers' frustration with finding well-fitting nursing apparel.

The mothers interviewed for this study struggled to find apparel products with sufficient symbolic properties incorporated. Aesthetics and fashion elements were two of the most important properties missing from the apparel that the nursing mothers used. Most of the breastfeeding specific products that were discussed were described as “ugly,” “boring,” “clunky,” “nasty,” and “dowdy”.

Another theme that emerged from the data was related to work and the work environment for breastfeeding mothers. All of the mothers emphasized the importance of symbolic properties when describing their work attire. They faced great difficulties finding apparel that functioned when trying to breastpump while maintaining a certain level of professionalism.

The challenges that the mothers faced while continuing to breastfeed when they returned to work were daunting. Finding apparel with specific functional and symbolic properties played a central role in the working mothers' daily work routine. The functional properties that mothers discussed were ease-of-use, easy donning/doffing or easy access to the breast, and launderability. The symbolic properties that were important to the working mothers included making sure the apparel allowed them to fit-in and feel like a professional. These functional and symbolic apparel properties will be important design requirements for future nursing apparel.

Price and accessibility were very important to the mothers who participated in this research. Most of the mothers had great difficulty finding products that met their needs, and said that both online and in-store selection was very limited. Despite the mothers' desire to find nursing apparel that was easy to use and comfortable, nearly all of the mothers easily accepted the status quo.

Limitations

The size and type of research prevent generalization of the results to any segment of the population, as well as transferability. Time and resources also present limitations in how many participants were interviewed, as well as how the data was analyzed. Ideally, more time would have been needed to ensure the research incorporated adequate checks and balances within the data analysis process.

The research and results of this study are strongly influenced by my experience as a designer. As a designer of apparel products, my background and interests could have influenced the interpretation and analysis of results. Precaution to limit my bias as a designer was minimized through the use of the user-oriented product development framework (Rosenblad-Wallin, 1985). This framework contributed to focusing the research on the user throughout the research and analysis.

Recommendations for Future Work

The emerging themes from this study show there is a great need for improved breastfeeding apparel and wearable products that are accessible and address symbolic and functional values. Designers can use this information as a starting point when developing new products for breastfeeding women. The data indicates that there is a real market for breastfeeding apparel and mothers are in need of better products.

Despite the wealth of information contained in this study, further research is necessary to develop and expand on the identified themes. Future research with a larger sample would add more depth to the understanding of the topic.

A mixed methods study of exploratory sequential design would expand understanding of breastfeeding mothers. The data from this study could be used to develop a questionnaire to be distributed to a larger, more diverse population. This would allow for broader generalization, transferability, and would inform the design process for developing breastfeeding garments.

Another addition to the research could come in the form of utilizing the 3D scanner to quantitatively measure the nursing mother's body change after child birth. This data would be incredibly useful in determining breast-size change throughout the day, as well as aid in the development of a more understandable sizing system. Furthermore, collecting anthropometric data of breastfeeding mothers can help improve the fit of nursing apparel and wearable products.

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APPENDIX A: USE-SCENARIO FOR BREASTFEEDING AT HOME

- ① **Who:** Postpartum mothers who are breastfeeding their babies and wear a nursing bra
- ② **When:** At any time (Day and night)
- ③ **Where:** Home
- ④ **What:** Breastfeeding a baby

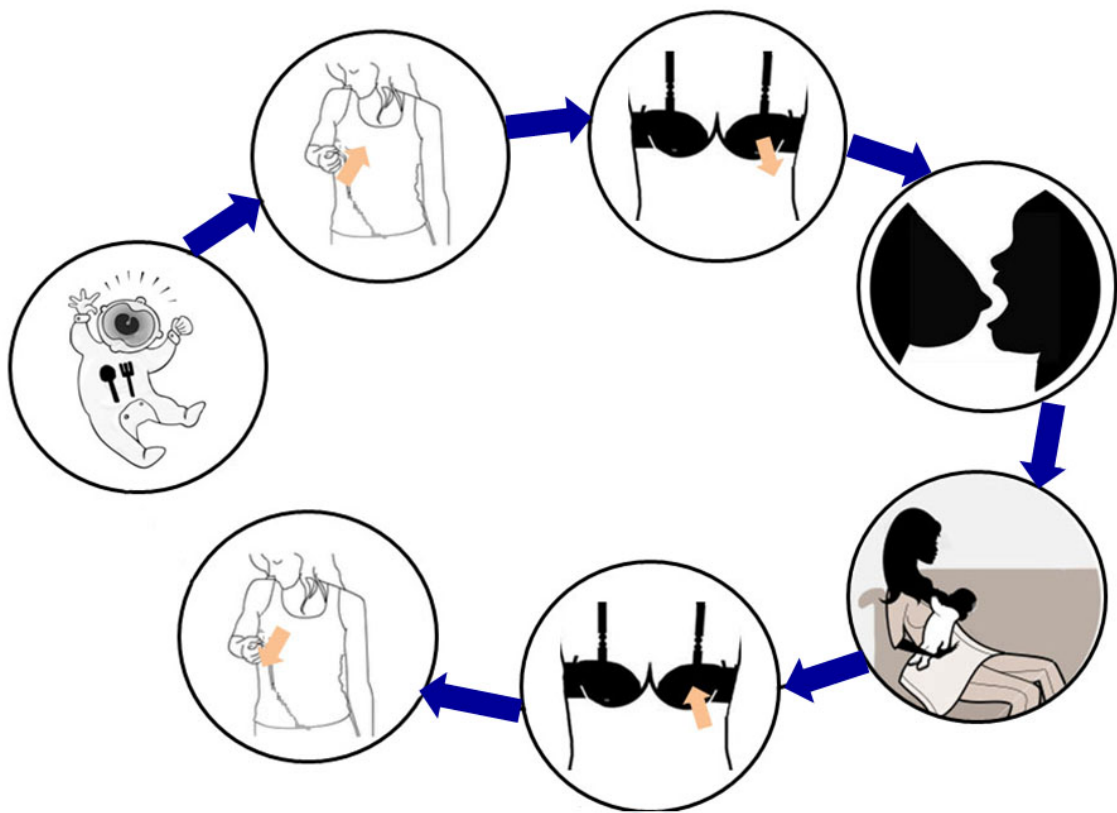


Figure 11. Illustration of Use-Scenario

Common themes of breastfeeding

- Holding a baby
- Donning and doffing all or part of nursing garments and bras
- Breastfeeding

	Stage	Task analysis
1	Pre-breastfeeding	Perceiving signals that baby is hungry. (Pollard, 2010)
2		Mom locates baby.
3		Mom picks up baby with both hands.
4		Mom decides position for breastfeeding. (Cradle, cross-cradle, football, or lying down position)
5		Sit in chair with baby.
6		Maneuvers baby to one hand (most cradle position).
7		Mom reaches and finds garment closure.
8		Undo top with one free hand and arm .
9		Mom reaches and find bra closure.
10		Undo bra with one free hand and arm.
11		Move baby to breast.
12		Mother listens for cues that baby is breathing well and nursing.
13	Breastfeeding	Baby latches .
14		The nipple drawn deeply into infant's mouth
15		Infant's tongue is ready to suck
16		The mother's nipple enlongates into a teat
17		The jaw of baby moves up and down
18		Back tongue elevates and presses against the posterior pharyngeal wall
19		New cycle of breastfeeding begins
20		Baby finished breastfeeding.
21	Post-breastfeeding	Mom frees one arm and hand.
22		Mom reaches and finds closure.
23		Mom closes bra.
24		Mom reaches and finds garment closure.
25		Mom closes garment.
26		Mom holds on to baby with two hands.
27		Mom gets up from chair or bed.
28		Mom gets towel and places on shoulder.
29		Mom burps baby and moves around house.
30		Baby burps.
31		Mom places baby back in crib, etc.

Table 12: Use-Scenario for Breastfeeding at Home

APPENDIX B: USE-SCENARIO FOR BREASTPUMPING AT WORK

	Stage	Task analysis
1	Pre-breastpumping	Breastpump tote is located
2		Mother walks to lactating room
3		Mother locks door or closes door
4		Mother examines the room for contents. For the purposes of this scenario, the room has a chair but not table or sink.
5		Mother sits in chair
6		Mother removes bra and top/dress. (typical from user interviews) Places on the back of the chair.
7		Mother places bag on lap
8		Mother unzips bag and examines contents
9		Mother finds the bag with tubing, breast shields and connectors
10		Mother attaches tubing to the breast pump
11		Mother finds empty bottles and connects breastshields and connector to bottle.
12		Mother attaches tubes to the breastconnector/bottle
		Mother plugs finds AC adaptor or battery pack and attaches it to the breast pump.
13	Breastpumping	Mother attaches breastshield to each breast
14		Mother turns breast pump on
15		Mother adjusts breast pump vaccuum for comfort
16		Mother expresses milk (approximately 6-10 minutes, according to amazon.com reviews)
17		Mother turns off breast pump
18		Mother removes breastshield
21	Post-breastpumping	Mother redisconnects breastsheild and connectors from bottle
22		Mother replaces bottle lids and places both bottles in cooling bag
23		Mother disconnects tubes from breast pump
24		Mom places tubes, breastsheild and connectors in appropriate bag
25		Mom wipes breast to remove any milk. She may or may not use a breast pad

26		Mom may or may not have wipes to clean equipment. If she does, she will clean equipment now (prior to replacing clothing to reduce chances of getting breastmilk on top)
27		Mom replaces components in bag. Zips bag.
28		Mom puts her bra and top back on
29		Mother either finds a sink to clean her pump parts or returns to work

Table 13: Use-Scenario for Breastfeeding at Work

APPENDIX C: HUMAN FACTOR REQUIREMENTS FOR
BREASTFEEDING GARMENTS

Human factors				
Anthropometrics	Lower limit	Upper limit	Purpose of human factors	Reference
Forward function reach	23.5"	28.5"	Important measurement for determining if closures and details placement is in a reachable area.	(Dreyfus, 2002)
Knee height	15.8"	19.7"	Garment should be at least to knee length (Modesty).	(Dreyfus, 2002)
Stature	58.1"	69.8"	Length of garment should be appropriate.	(Dreyfus, 2002)
Mid-shoulder height	46.7"	57.7"	Length of garment should be appropriate.	(Dreyfus, 2002)
Center back to bust length	7.5"	12.6"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Bust point height	50%: 45.6"		Location of breastfeeding detail	(Dreyfus, 2002)
Shoulder breath	13.5"	18"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Clavical link breath	10.9"	13.8"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Hip breath	11.2"	16.8"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Chest breath	8.8"	12.1"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Waist breath	7.4"	10.7"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Abdomen breast	7.5"	13"	Garment should fit to the wearer's body.	(Dreyfus, 2002)
Shoulder rotation to back	95%: 85°		Garment should not restrict the wearer's movement	(Dreyfus, 2002)
Optimal viewing zone	0~~30° 0~~35°		Closure and details should be within optimal viewing zone to be recognized when moving.	(Dreyfus, 2002)
Leg rotation to front	95%: 147°		Garment should not restrict the wearer's movement	(Dreyfus, 2002) (Rosenblad-Wallin, 1985)
Weight of baby	Average 2 months: 4.7 Kg 4 months: 6.7 Kg 6 months: 8 Kg		If appropriate, garment should stand weight of baby.	(Dreyfus, 2002)

Height of baby	Average 2 months: 21.9” 4 months: 24.9” 6 months: 27”	If appropriate, garment should cover the baby enough.	(Dreyfus, 2002)
Shoulder breast of baby	Average 2 months: 6.4” 4 months: 7.4” 6 months: 7.7”	If appropriate, garment should cover the baby enough.	(Dreyfus, 2002)
Cognition & Emotion	Purpose of human factors		Reference
Easy mental model	Are closures where user expects them to be? When wearing the garment, can user easily make a cognition map without complex processing. Function of detail should be understood easily. The garment should fit within the cultural norm.		(Wickens, 2005) (Rosenblad-Wallin, 1985)
Cognitive map of putting on and taking off	Wearer should be able to make a simple cognition map of donning and doffing.		(Wickens, 2005)
Body schema	Wearers need to be able to perceive the garment (and possibly baby) as the part of their body. The garment should help to extend body schema of the wearer.		(Wickens, 2005)
Modesty	The garment should cover body well while moving. The gown should cover body well while walking. The gown should cover body well while sitting. The gown should cover body well while nursing.		(Wickens, 2005) (Rosenblad-Wallin, 1985)
Wearer's identity	The garment should represent and expand wearers' value, role, and status. The garment should improve the wearer's self esteem.		(Wickens, 2005) (Rosenblad-Wallin, 1985)
Physiology	Purpose of human factors		Reference
Adequate temperature	Garment should help regulate thermal body temperature while breastfeeding.		(Wickens, 2005) (Rosenblad-Wallin, 1985)
Adequate temperature	The garment should cover body well to keep warm while breastfeeding		(Wickens, 2005)
Anatomy	Purpose of human factors		Reference
Blood circulation	The elastic band of the garment should not restrict the wearer's blood circulation.		(Wickens, 2005) (Rosenblad-Wallin, 1985)
Tactile sensory	Purpose of human factors		Reference
Non irritating textiles	The garment tactile elements and other details should do not irritate the patient's skin, especially sensitive areas, such as breast and nipples.		(Rosenblad-Wallin, 1985)
Tactile feedback	Tactile feedback of garment features should be distinct.		(Wickens, 2005)

	Tactile feedback of garment features should call attention to and provide information for the different elements of the garment.	
Visual sensory	Purpose of human factors	Reference
Visual search	Garment features should be placed to optimize visual search. Fasteners should be readily visible and conspicuous.	(Wickens, 2005)
Aesthetic	Design should represent the wearer and be fashionable	(Rosenblad-Wallin, 1985)
Visual comfort	Fasteners and garment features should be discriminable from background elements through the use of color, size or scale and brightness.	(Wickens, 2005) (Cho, 2006)

Table 14: Human Factors Requirements for Breastfeeding Garments

APPENDIX D: INTERVIEW QUESTIONS

How old are you?

- 18 – 26 26 – 30 31 – 35 36 – 40
 41 – 45 46 and up

How long have you been breastfeeding your current baby?

_____ months and _____ days

Is this your first child?

- Yes
 No

If no, did you breastfeed your previous children?

Are you married/single?

Did you give birth in a hospital?

Did the hospital have a Lactation Specialist or was the hospital certified as “Baby Friendly”?

Did the hospital staff offer any advice on nursing bras or apparel?

Did you breastfeed exclusively for the first month?

Do you still breastfeed exclusively or do you feed some formula?

At what point did you decide to feed formula? Why?

How often do you have to breastfeed or pump a day? How often did you breastfeed at month 1?

What is your current breastfeeding routine?

Did/Do you have any pain associated with breastfeeding? Sensitivity?

Did breastfeeding cause you to feel fatigued? What parts of your body?

Have you had any physical issues with Breastfeeding, such as clogged milk ducts, etc?

Does your bra or clothing cause any extra sensitivity or pain in your breasts?
 Rubbing/Chaffing/Lack of breathability?

What are the biggest issues are that you feel you face as a mother breastfeeding?

Do you feel comfortable breastfeeding in public? Does your apparel make this easier/more difficult?

Did you use any organizations to get information on breastfeeding apparel? Or did you have family members?

What type of breastfeeding apparel or products do you currently use?

- | | | |
|---|---|--|
| <input type="radio"/> Bra | <input type="radio"/> Night gown | <input type="radio"/> Top |
| <input type="radio"/> ④ Dress | <input type="radio"/> ⑤ Modesty Nursing Cover | <input type="radio"/> ⑥ Disposable Breast Pads |
| <input type="radio"/> ⑦ Re-usable Breast pads | <input type="radio"/> ⑧ Other _____ | |

Do you find the breastfeeding apparel helpful? Why/Why not?

What are your favorite apparel items for breastfeeding?

What are your least favorite apparel items for breastfeeding?

Do you find that your apparel needs change depending on whether you are at home, work or running errands?

What aspects of nursing apparel need improvement?

Where do you typically shop for breastfeeding apparel?

Do you have a brand or brands that you prefer?

What is your preferred amount of money that you would like to spend on breastfeeding apparel?

Are you currently working/Do you plan to go back to work?

What are your breastfeeding habits while working/when you return to work?