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The Impact of Breastfeeding Interventions on Breastfeeding Behavior

Ryan D. Steele
Augsburg University

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By

Ryan D. Steele, MA

Jenny Kluznik, MPH, PA-C

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ABSTRACT

Breast milk is the natural first food for all infants, and breastfeeding provides multiple benefits for both the mother and child. However, breastfeeding rates in the United States are far from optimal, despite these benefits. There are multiple complex and interrelated reasons for the suboptimal breastfeeding rates, and multiple interventions have been completed with the goal of obtaining optimal breastfeeding rates. This literature review examines the efficacy of these breastfeeding interventions, specifically examining whether antenatal breastfeeding education was associated with increased breastfeeding initiation and duration relative to individualized support. Results of the literature review suggest that a combination of antenatal breastfeeding education and individualized support was associated with the greatest increase in breastfeeding initiation and duration. Solutions to increase breastfeeding rates were proposed, including subsidizing antenatal breastfeeding education to make access universal. Overall, despite the complex hurdles that mothers face when deciding to pursue or forgo breastfeeding their infant, there exist multiple interventions to address these hurdles and ultimately promote breastfeeding initiation and duration.

INTRODUCTION

Breast milk is the natural first food for newborns, and is designed to provide all of the energy and nutrients that a newborn needs for the first six months of life. From 6-12 months of age breast milk continues to supply up to half of the energy and nutrients, and then up to a third needed during the second year of life.[1] In addition to providing adequate nutrients, breastfeeding is also a free source of nutrients for infants, in stark contrast to the costs associated with formula feeding, with 2017 monthly estimates for the cost of exclusive formula feeding ranging from $54 to $198.[2]

In addition to breast milk being a free and complete source of nutrients for the infant, there exists overwhelming evidence regarding many health benefits of breastfeeding that extend to both the mother and child. Data from multiple meta-analyses reveal that breastfeeding is associated with a number of short-term and long-term beneficial health outcomes. Specifically, short-term outcomes refer to those outcomes that are experienced for the duration of breastfeeding or shortly thereafter up until five years of age. In general, the short-term outcomes represent illnesses with more immediate consequences, such as diarrhea and respiratory illnesses. In contrast, long-term outcomes are those experienced after some time has passed following breastfeeding cessation. Depending on the long-term outcome of interest, age of assessment varied from one year old up until age 70 and beyond. In general, long-term outcomes represent illnesses with more chronic consequences, such as hypertension and hyperlipidemia.

Multiple studies have examined the short-term outcomes associated with breastfeeding for the mother. These short-term outcomes include postpartum uterine involution and lactational amenorrhea. For example, with respect to uterine involution, repeated suckling of the baby on the mother's breast has been shown to release oxytocin within the mother, which subsequently

stimulates uterine contractions and involution.[3] Uterine contraction is important immediately following birth as it helps to prevent postpartum hemorrhage, a serious condition in which the mother has excessive vaginal bleeding immediately following childbirth, which has been associated with maternal acute respiratory distress syndrome, shock, and death.[4]

Moreover, with respect to lactational amenorrhea, data from three studies has shown the probability of lactational amenorrhea at six months postpartum was 23% higher for exclusive or predominant breastfeeding in comparison to no breastfeeding (RR = 1.23, 95% CI 1.07-1.41).[5] Additionally, the same meta-analysis demonstrated that the probability of lactational amenorrhea at six months postpartum was 21% higher for exclusive or predominant breastfeeding even when compared to partial breastfeeding (RR = 1.21, 95% CI 1.01-1.25; five studies). Thus, these data suggest that the longer that a mother breastfeeds exclusively, the longer before she will start to menstruate again. In this way, lactational amenorrhea is important for the mother, as it is a method of increasing birth spacing. Specifically, studies show that decreased birth spacing of less than six months has been associated with severe maternal morbidity, including premature rupturing of membranes, anemia, endometritis, as well as maternal death.[6]

The long-term benefits of breastfeeding for the mother are also numerous, and outcomes that have been shown to be associated with breastfeeding include decreased incidence of breast carcinoma, ovarian carcinoma, and type II diabetes mellitus. For example, data examining the association between breastfeeding and the development of breast carcinoma found that ever breastfeeding (i.e., indicating “Yes, I have breastfed” without respect to duration of breastfeeding) was associated with a 22% reduction of breast carcinoma risk in comparison to never breastfeeding (OR 0.78, 95% CI 0.74-0.82; 98 studies).[5] Examining the impact of duration, the same authors found that breastfeeding for less than six months was associated with a 7% risk

reduction of breast carcinoma (OR 0.93, 95% CI 0.88-0.99; 39 studies), while breastfeeding for 6-12 months was associated with a 9% risk reduction of breast carcinoma (OR 0.91, 95% CI 0.87-0.96; 36 studies). Moreover, mothers who breastfed for greater than 12 months had a 26% lower risk of developing breast carcinoma than those who did not breastfeed (OR 0.77, 95% CI 0.72-0.83; 41 studies). Thus, breastfeeding for a longer duration decreased the odds that the mother would subsequently develop breast cancer.

With respect to the link between breastfeeding and ovarian carcinoma, data from a meta-analysis suggest that mothers who have ever breastfed their child had a 30% reduction in the risk of ovarian carcinoma when compared with those who had never breastfed (OR 0.70, 95% CI 0.64-0.77; 41 studies).[5] Regarding the impact of duration, the same researchers found that mothers who breastfed for less than 6 months and those who breastfed for 6-12 months had a risk reduction of 17% (OR 0.83, 95% CI 0.78-0.89; 41 studies) and 28% (OR 0.72, 95% CI 0.66-0.78; 19 studies) lower than those who never breastfed, respectively. In addition, those mothers who breastfed their children greater than 12 months had a risk reduction of 37% lower (OR 0.63, 95% CI 0.56-0.71; 29 studies) than those who did not breastfeed. Thus, similar to the pattern of results seen with breast carcinoma, breastfeeding for a longer duration decreased the odds that that the mother would subsequently develop ovarian cancer.

Finally, the long-term benefits of breastfeeding also extend to maternal development of type II diabetes mellitus. Data from a meta-analysis reveal that ever breastfeeding is associated with a 32% risk reduction in the development of type II diabetes in comparison with never breastfeeding (RR 0.68, 95% CI 0.57-0.82; 6 studies).[7] More data is needed to evaluate the impact of breastfeeding duration on the development of type II diabetes mellitus. However, this

preliminary finding is still important, as diagnosis of type II diabetes mellitus has been associated with significant mortality and morbidity in the United States.[8]

In addition to the numerous short- and long-term benefits of breastfeeding for the mother, there are also a multitude of short- and long-term benefits of breastfeeding that extend to the child as well. Short-term benefits for the child include decreased risks of diarrhea and respiratory tract infections. With respect to the association between breastfeeding and protection against diarrhea, data suggest that breastfeeding is associated with decreased risk of diarrhea and gastrointestinal illness in general in both developing (RR = 0.69, 95% CI 0.58-0.82; 15 studies)[9] and developed countries (OR 0.36, 95% CI 0.32-0.41; 14 studies).[10] Given that diarrhea remains one of the leading causes of death of infants and children worldwide, accounting for 1 in 9 deaths of children under 5 between 2000-2010, breastfeeding offers significant protection for young children.[11] Although the mortality-related effects of diarrhea may not be as relevant in developed countries such as the United States, significant morbidity is still a possibility secondary to dehydration if the child with diarrhea is not properly treated.

Breastfeeding has also been shown to be protective against respiratory tract infections in both developing and developed countries. For example, in developing countries, if a child was ever breastfed the risk of the child presenting with a respiratory infection was reduced by 57% (RR = 0.43, 95% CI 0.33-0.55; 50 studies). In developed countries, results from seven studies revealed a 72% reduction in the risk of hospitalization secondary to respiratory infections in infants who breastfed exclusively for greater than 2 months or greater than 9 months overall in comparison with formula-fed infants (RR = 0.28, 95% CI 0.14-0.54; 7 studies). This link is important to understand as respiratory infections have also been observed to be one of the

leading causes of death for children under five, in addition to diarrhea.[9] Indeed, in 2015, it was estimated that approximately 921,000 children died from pneumonia worldwide.[11]

The long-term benefits of breastfeeding for the child have been studied extensively as well. These include outcomes such as obesity, hypertension, and type II diabetes mellitus, as well as many more that are beyond the scope of this paper. With respect to the link between breastfeeding and obesity in the child, data from a meta-analysis suggests that breastfed children were less likely to be considered overweight/obese later in life (OR = .76, 95% CI 0.71-0.81; 71 studies) compared to those who were not breastfed.[12] Moreover, this effect did not differ as a function of length of breastfeeding. This association is important, as obesity is a risk factor for a number of non-communicable chronic diseases, such as cardiovascular disease, cancer, and diabetes.[12]

In addition to obesity, the long-term association between breastfeeding and decreased risk of hypertension has also been thoroughly researched. Data from a meta-analysis including 36 studies reveal that ever breastfed infants had lower measured systolic blood pressures (mean difference = -1.02 mmHg, 95% CI -1.45-[-0.59]) and diastolic blood pressures (mean difference = -0.37 mmHg, 95% CI -0.71-[-0.04]) later in life relative to those who had not been breastfed in infancy.[12] Similar to obesity, this is important as hypertension is associated with the incidence of stroke and ischemic heart disease.[12]

Finally, with respect to the link between breastfeeding and the development of type II diabetes mellitus in the child, data from a meta-analysis reveal that ever breastfed infants were less likely to be diagnosed with type II diabetes mellitus later in life (OR = 0.66, 95% CI 0.49-0.89) relative to infants who had not been breastfed.[12]

Overall, the available data examining links between breastfeeding and multiple short- and long-term outcomes reveal multiple benefits for both the mother and child. As a result of these numerous benefits, multiple obstetric, maternal health, and pediatric organizations have put forth guidelines to aid medical providers in educating their patients concerning the benefits of breastfeeding and the proposed duration of breastfeeding. The overall theme of the breastfeeding guidelines across all organizations is that infants should receive breast milk exclusively for the first six months of life, and should continue to receive breast milk in addition to solid food for up to one or two years, with the longer proposed time frame at the mother and child's mutual discretion (Table 1).[13-17]

Despite these recommendations, breastfeeding rates in the United States have remained suboptimal.[18] Indeed, data collected as a part of Healthy People 2020, a set of public health objectives put forth by the United States government's Office of Disease Prevention and Health Promotion, reveal a clear discrepancy between the guidelines set forth by the breastfeeding expert organizations and the current trends in breastfeeding in the United States (Table 2)[19]. Broadly, the data show that as the infant gets older, there is a sharp decline in the use of breast milk as a means of nutritional support for the infant. For example, although data collected in 2011 reveal that 79.2% of infants were ever breastfed, only 49.4% of infants were breastfed (not exclusively) by six months of age, and further only 18.8% were breastfed exclusively by six months of age. Moreover, only 26.2% of infants were still breastfed at a year of age. These data are in stark contrast to current clinical guidelines which call for exclusive breastfeeding for the first six months, and ongoing combined breastfeeding for at least one year, if not longer.

The reasons for the observed discrepancy between breastfeeding guidelines and rates are complex and multifaceted. In an attempt to better understand why breastfeeding rates are

suboptimal in the United states, Rollins et al.[20] proposed a conceptual model that summarized three levels of determinants for breastfeeding (Figure 1). The authors argue that the breastfeeding determinants "operate at multiple levels and affect breastfeeding decisions and behaviors over time".[20(p492)]

At the highest level are structural determinants, specifically social factors that influence the entire population, such as media, products available in stores, social trends, and advertising. For example, in one study focused on the role of media and advertisements on breastfeeding, the authors found that the number of bottle feeding ads in *Parents' Magazine* in the prior year was associated with decreased breastfeeding initiation rates the following year ($b = -0.20$, $p < 0.05$).[21] The study followed the relationship of these two variables over a 28-year time period, and therefore was able to get a detailed understanding of the temporal relationship between the two variables. Thus, the data suggest that advertisements for formula or bottle-feeding present in media have an impact on decreasing subsequent maternal breastfeeding behavior.

More proximal to the breastfeeding individual, although at the mid-level in the proposed model, are the determinants that are a function of the settings that the individual finds herself in. There are multiple different settings, such as those within healthcare settings, family and community settings, and workplace settings, each of which may impact the mother such that she changes her breastfeeding behaviors as a function of the setting. For instance, many healthcare-associated issues, such as maternal illness during the birth of the child, birth of a preterm newborn, and birthing a low weight for gestational age newborn may impact the mother's ability to start breastfeeding immediately in the hospital. This may have a negative impact on the mother's desire to continue to breastfeed upon leaving the hospital. For example, a study by performed by Verd et al.[22] found that the chance of exclusive breastfeeding continuing for the

first four weeks of life was significantly less for infants who were born at a low weight for gestational age relative to those who were at a normal weight for gestational age.

The third, most proximal level is composed of individual-level determinants, such as mother and infant attributes, as well as the mother-infant relationship, all of which will impact whether the mother continues to breastfeed. For example, in a study by Ahluwalia et al.[23], the authors examined the reasons women cited for breastfeeding cessation. The authors found that women were more likely to stop breastfeeding if they felt that the infant did not appear satiated, if they felt they had an inadequate milk supply, or if they reported experiencing sore nipples, among many other reasons.

As a whole, an examination of the current state of breastfeeding in the United States suggests that, despite nearly uniform breastfeeding guidelines recommending six months of exclusive breastfeeding and at least a year of breastfeeding in addition to complementary foods, breastfeeding mothers in the United States consistently fail to attain those goals. The following literature review will examine a number of the interventions that have been undertaken in the United States to increase breastfeeding rates to the length of time recommended by the expert guidelines. Specifically, the following research question will be addressed: For the mother, does receiving group-based general antepartum breastfeeding education lead to increased breastfeeding duration relative to only receiving individualized support (either in-person or via telephone) when problems arise throughout and following pregnancy?

LITERATURE REVIEW

Multiple studies have examined different interventions to increase rates of breastfeeding and breastfeeding duration. Such interventions have included antepartum breastfeeding

education, institutional changes in maternity care, individualized support when problems arise, peer counseling, written materials, early maternal contact, and commercial discharge packets.

One approach that has been studied to increase breastfeeding rates and duration is antepartum breastfeeding education. Antepartum breastfeeding education generally refers to information and resources regarding the benefits of breastfeeding being provided in small-group settings to pregnant mothers and family.[24] Content generally includes topics such as ideal nutrition for infants, benefits of breastfeeding for mother and infant, as well as brief explorations of anatomy and physiology.[25] This information is provided by individuals with an expertise in lactation management. This type of intervention is likely effective as many soon-to-be mothers without previous children do not have direct, personal knowledge of breastfeeding or the details of the benefits of breastfeeding.[24] Receiving information on the benefits of breastfeeding from an expert along with other pregnant mothers may facilitate understanding of the material presented.

A meta-analysis performed by Guise et al.[25] examined the impact of antepartum breastfeeding education on duration of breastfeeding, specifically whether breastfeeding was subsequently initiated, lasted from 1 to 3 months (i.e., short-term duration), and whether it continued for 4 to 6 months (i.e., long-term duration). The control group did not receive antepartum breastfeeding education. In order to increase sample size of analyses, mothers who endorsed breastfeeding at the time of the outcome assessment, regardless of whether it was exclusive or non-exclusive, were classified having breastfed. Results of the meta-analysis reveal that antepartum breastfeeding education increased breastfeeding initiation by 23% (mean difference = 0.23, 95% CI 0.12-0.34; 8 studies) relative to the control group. Additionally, the authors found that antepartum breastfeeding education increased short-term duration by 39% (mean difference = 0.39, 95% CI 0.27-0.50; 10 studies) in comparison to the control group,

although was not related to increased long-term duration (mean difference = 0.04, 95% CI -0.06-0.16; 7 studies) relative to controls.

The influence of individualized support as problems arise on breastfeeding initiation and duration has also been studied. Such support programs include telephone or in-person support by an expert in lactation, such as a nurse or a trained lactation consultant. This type of support is thought to be effective as the content of the support provided varies as a function of the patient's questions and concerns.[25] The support may be provided prenatally, ante-, or postpartum, depending on the patient's needs.

Guise et al.[25] examined the influence of individualized breastfeeding support on breastfeeding initiation and duration in a meta-analysis. The authors found that mothers who received individualized breastfeeding support were 11% more likely to endorse breastfeeding at least 1 to 3 months (i.e., short-term duration) relative to controls that did not receive individualized breastfeeding support (mean difference = 0.11, 95% CI 0.03-0.19; 10 studies). Those who received individualized breastfeeding support were also 8% more likely to endorse breastfeeding at least 4 to 6 months (i.e., long-term duration) than controls who did not receive individualized breastfeeding support (mean difference = 0.08, 95% CI 0.02-0.16; 2 studies). Of note, individualized support was not related to increased breastfeeding initiation (mean difference = 0.06, 95% CI -0.02-0.15; 8 studies) relative to the control group.

However, interventions to increase breastfeeding rates and duration include more than antepartum breastfeeding education and individualized support, which were the focus of the research question presented above. Another approach that has been studied to increase breastfeeding iniation and duration is institution-based changes in maternity care. Changes in maternity care include having a breastfeeding policy for all staff with sufficient education

provided, encouraging early breastfeeding initiation, and restricting promotion of pacifiers while remaining in the hospital.[24] Such changes are important as it has been posited that the maternity hospital stay immediately postpartum is a critical period for initiation of breastfeeding.[24]

A large-sample randomized control trial by Kramer et al.[26] examined the impact of institution-based maternity care changes in subsequent breastfeeding. This study was part of the Promotion of Breast-feeding Intervention Trial (PROBIT) in Belarus, and the outcome of interest was breastfeeding initiation and duration. The experimental group consisted of hospitals that had implemented the "Ten Steps to Successful Breastfeeding" guidelines published by the WHO in their Baby-Friendly Hospital Initiative (Table 3)[27,28], while the control group consisted of hospitals that did not change their current practices. Results from this study revealed that mothers in the experimental group were more likely to be exclusively breastfeeding at 3 months (43.3% vs 6.4%, $p < 0.001$ by unpaired *t*-test), exclusively breastfeeding at 6 months (7.9% vs 0.6%, $p < 0.01$ by unpaired *t*-test), and to have ever breastfed at 12 months (19.7% vs 11.4%; OR 0.47, 95% CI 0.32-0.69), in comparison to the control group.

Multiple studies have also examined the impact of peer support on breastfeeding initiation and duration. Peer support differs from individualized breastfeeding support in that peer support refers to peers of breastfeeding mothers who have themselves previously breastfed or are breastfeeding, or have the same socioeconomic background or locality as the women they are support.[29] In contrast, individualized breastfeeding support refers to support provided by an expert in lactation. This type of support is posited to be helpful to breastfeeding mothers as generally the peers are having or have had similar experiences while breastfeeding and can provide guidance and motivation.[25]

A meta-analysis performed by Jolly et al.[29] examined the impact of peer support on breastfeeding maintenance. All studies included in the meta-analysis were randomized control trials wherein peer support was provided in comparison with usual cares. The outcome variable of interest was whether the mother endorsed breastfeeding at the last follow up visit, without respect to duration. Results of the meta-analysis revealed that mothers who endorsed receiving peer support had 15% lower risk of not breastfeeding at the last follow up (RR = 0.85, 95% CI 0.77-0.94; 13 studies) relative to controls. Moreover, allocation of peer support was also associated with a lower risk of not breastfeeding exclusively at the last follow up (RR = 0.82, 95% CI 0.76-0.88; 12 studies).

Another intervention that has been assessed to improve breastfeeding rates and duration is education and information in the form of written materials. Written materials include media such as pamphlets and booklets that vary in their length and detail. This type of support may be helpful in various ways to increase breastfeeding rates, such as reinforcing material learned in classes or via videos, or providing information about breastfeeding when other options are not feasible.[25]

Studies examining the impact of written materials on breastfeeding rates and duration have not been subject to meta-analysis, as in most studies the effect of written materials on breastfeeding could not be independently assessed from other forms of interventions concurrently taking place, such as antenatal education or support. However, three studies have explicitly examined the association between written materials provided and breastfeeding behaviors. In Curro et al.[30], the authors found that providing a booklet regarding the advantages of exclusive breastfeeding for six months to new mothers did not result in statistically significant increased exclusive (48.5% vs 43.7%; $p = 0.52$ for log rank test; $n = 200$) or complementary

(59.2% vs 51.5%; $p = 0.35$; $n = 200$) breastfeeding rates. Note that the control group did not receive the booklet. Loh et al.[31] examined the impact of a written material containing eight positive aspects of breastfeeding on subsequent breastfeeding behavior. This paper was provided to mothers in clinic near the end of the pregnancy, and breastfeeding behavior was recorded on discharge from the hospital. The authors found no statistically significant differences between mothers who received the written material and those who were provided standard care (44% vs 32%; $p = 0.07$ for chi square test; $n = 193$). Kaplowitz et al.[32] explored the impact of a series of five written pamphlets mailed to participants homes weekly over a five week period on subsequent breastfeeding behavior. The pamphlets contained helpful information regarding physiology, proper nursing techniques, and also information regarding the benefits of breastfeeding. The control group did not receive the information in the mail. The authors found no effect of receiving the written pamphlets on subsequent breastfeeding at two months of age (28% vs 23%; $n = 40$).

Researchers have also examined the impact of early maternal contact on breastfeeding duration and initiation. Early maternal contact refers to skin-to-skin contact between the mother's bare chest and the naked newborn that is initiated within the first ten minutes following birth.[33] Early skin-to-skin contact immediately following birth has been demonstrated to have effects on increasing maternal oxytocin release and decreasing maternal stress, both of which may independently influence breastfeeding behavior and provide the mother with increased confidence regarding her breastfeeding abilities.[33]

Moore et al.[33] performed a meta-analysis on the available data examining the impact of early skin-to-skin contact on breastfeeding rates and duration. The authors found that mothers who received immediate skin-to-skin contact with their newborns were more likely to be

breastfeeding one to four months post birth (RR = 1.24, 95% CI 1.07-1.43; 14 studies) than mothers who did not receive skin-to-skin contact. Moreover, mothers who received skin-to-skin contact with their newborns immediately following birth were more likely to be exclusively breastfeeding between six weeks to six months (RR = 1.50, 95% CI 1.18-1.90; 7 studies) than mothers who did not receive skin-to-skin contact.

The impact of the distribution of commercial discharge packs containing formula on subsequent breastfeeding behavior has also been explored. The distribution of "helpful" items is commonplace in many hospitals.[34] The contents of the commercial discharge packs varies between hospitals, and the packs may or may not contain formula samples. Although not an intervention per se, the distribution of commercial discharge packs with or without formula may have the possibility to impact breastfeeding behavior, and thus the link between the two was explored via a meta-analysis.[34]

Donnelly et al.[34] explored the association between commercial discharge packs provided by hospitals from companies that produce and sell formula and subsequent breastfeeding duration. The authors found that providing discharge packs containing formula milk and leaflets negatively impacted exclusively breastfeeding at 0-2 weeks (OR = 1.99, 95% CI 1.04-3.79; 2 studies) and 3-6 weeks post-birth (OR = 1.25, 95% CI 1.06-1.47; 6 studies), as compared with providing non-commercial packs or no intervention. Providing discharge packs with formula did not negatively impact exclusive breastfeeding at 8-10 weeks (OR = 1.86, 95% CI 0.74-4.62; 1 study) or 16 weeks post-birth (OR = 1.10, 95% CI 0.91-1.33; 2 studies). In other words, the rates of exclusive breastfeeding at 8-10 weeks and at 16 weeks post-birth were identical whether a commercial discharge pack containing formula was provided or a non-commercial pack without formula was provided.

Finally, Guise et al.[25] also performed a meta-analysis on a limited number of studies that had examined the impact of combined antepartum breastfeeding education and individualized support on subsequent breastfeeding behaviors. Antepartum breastfeeding education and individualized support are defined as above. The authors found that combined antepartum breastfeeding education and individualized support led to increased initiation (mean difference = 0.21, 95% CI 0.07-0.35; 2 studies), short-term duration (mean difference = 0.36, 95% CI 0.22-0.49; 2 studies), and long-term duration (mean difference = 0.13, 95% CI 0.01-0.25; 2 studies).The comparison group consisted of controls that did not receive combined antepartum breastfeeding education and support.

METHOD

Data for this manuscript was acquired using two online search engines, specifically Google Scholar and Pubmed between June and July of 2017. The initial search terms used to acquire the relevant studies included “breastfeeding interventions”, breastfeeding interventions meta-analysis”, “promoting breastfeeding meta-analysis”, “antepartum breastfeeding education meta-analysis”, “peer counseling breastfeeding meta-analysis”, “early maternal contact breastfeeding meta-analysis”, and “commercial discharge packets breastfeeding meta-analysis”. Once the initial manuscripts were evaluated, the reference sections of those manuscripts were evaluated for additional relevant studies.

In general, an attempt was made to only include meta-analyses and systematic reviews in this manuscript. The rationale for this was that these forms of publications provide “population-based” estimates of associations of interest by using all available, non-duplicated data, so conclusions can be drawn about the state of the available data as a whole, and thus ideally not be subject to any particular bias of one dataset, and in the case of meta-analysis, any bias of

unpublished data as well. In some cases, such as data available examining the impact of written materials on breastfeeding rates and duration, a meta-analysis had not been performed as of yet on available data. The data were included and summarized nevertheless as the distribution of written materials with information regarding breastfeeding is common with new mothers and the impact of this intervention on breastfeeding behavior was deemed important to assess. The Kramer et al.[26] PROBIT study was also not a meta-analysis, however the study design was of high quality and the sample size was very large (N = 17,046), thus the data from the study was included in this literature review.

DISCUSSION

Results presented in the Guise et al.[25] meta-analysis address the research question proposed in the introduction, specifically whether receiving group-based general antepartum breastfeeding education leads to increased breastfeeding duration relative to only receiving individualized support when problems arise throughout and following pregnancy. The available data suggest that both antenatal breastfeeding education and individualized support are important components of initiating and maintaining breastfeeding, but that impact of each differs as a function of breastfeeding duration. For example, the data suggest that antenatal breastfeeding education may be more beneficial than individualized support with respect to breastfeeding initiation and short-term duration, while individualized support may be more beneficial for long-term breastfeeding duration. More specifically, antenatal breastfeeding education was associated with a 23% increase in breastfeeding initiation ($p < 0.05$), and 39% increase in short-term duration ($p < 0.05$), whereas individual support was only associated with a 6% increase in breastfeeding initiation ($p > 0.05$) and an 11% increase in short-term duration ($p < 0.05$). With respect to long-term breastfeeding duration, individualized support was associated with an 8%

increase in long-term duration ($p < 0.05$), where as antenatal breastfeeding was only associated with a 4% increase in long-term duration ($p > 0.05$).

Indeed, Guise et al.[25] found in their meta-analysis that interventions that included combined antepartum breastfeeding education and individualized support led to a 21% increase in breastfeeding initiation, 36% increase in short-term duration, and 13% increase in long-term duration, all of which were statistically significant increases. Overall, in light of the guidelines recommending six months of exclusive breastfeeding and at least one year of complementary breastfeeding, the available data suggest that the use of interventions that utilize both antepartum breastfeeding education and individualized support might provide mothers the best chance of achieving the duration of breastfeeding found in the guidelines.

Given that breastfeeding is associated with numerous positive outcomes for mother and child, as well as the observation that combined antepartum breastfeeding education and individualized support lead to increased breastfeeding initiation and duration, one possible solution to increase breastfeeding initiation and duration would be to subsidize antepartum breastfeeding education and individualized support without limitations for all mothers so that individuals of all financial backgrounds can benefit. Currently, services such as antepartum breastfeeding education and individualized support are listed within the Affordable Care Act as services that must be covered by all health insurance plans.[35] However, there are many caveats that limit the availability of coverage for all mothers. For instance, low-income mothers who seek insurance coverage through Medicaid have variable coverage of antepartum breastfeeding education and individualized support as a function of the state that they live in, especially if the state did not expand Medicaid with the rollout of the Affordable Care Act. Additional examples include grandfathered plans that had not made changes in multiple years to coverage, as these

plans were allowed to forgo coverage of antepartum breastfeeding education and support, as well as TRICARE, the health insurance for military families, which is not required to provide coverage for antepartum breastfeeding education and support. As such, it is clear that more can be done by the US government to expand coverage for antepartum breastfeeding education and individualized support and address caveats to current law so that all mothers can obtain the benefits of these services, regardless of their insurance coverage.

However, as evident in Rollins et al.[20] conceptual model (Figure 1), there are multiple complex layers that must be addressed in addition to antenatal breastfeeding education and individualized support to see meaningful increases in breastfeeding initiation and duration. These include structural, setting, and individual level determinants. Importantly, a number of the studies addressed in this literature review have discussed interventions aimed at these determinants. For example, the impact of advertising on breastfeeding behavior is described as a structural level determinant. One form of advertising provided to new mothers immediately following the birth of her child, right as she is making the difficult transition to caring for a new child, comes in the form of commercial discharge packs.[34] One proposed method of increasing breastfeeding initiation and duration is to have hospitals withhold distribution of free formula packs, as distribution of such materials has been show to be associated with decreased breastfeeding rates.[34] However, potentially withholding free formula packs from new mothers might be ethically challenging, as some new mothers might not plan to breastfeed regardless of the benefits or without the free formula packs. The alternative might be that the mother feeds the child something other than breast milk or formula that might be potentially dangerous for the child, such as milk from cows, which could have severe negative consequences for the child.

In terms of settings level determinants, examples of interventions aimed at this level are the institution-based changes taking place within maternity units, as described by Kramer et al.[26] Such changes taking place on maternity units to increase breastfeeding initiation and hopefully duration include helping mothers to initiate breastfeeding within one half-hour following birth, providing newborn infants no food or drink other than breast milk unless medically indicated, practicing rooming in, avoiding pacifiers, and encouraging breastfeeding on demand. These changes are outlines in the "Ten Steps to Successful Breastfeeding" guidelines published by the WHO in their Baby-Friendly Hospital Initiative (Table 3).[27,28] As such, one proposed solution to increase breastfeeding initiation and duration is for the US federal government, specifically the Department of Health and Human Services, to provide subsidies to hospitals that have birthplaces planning to or currently working to achieve the "Ten Steps" to become certified Baby-Friendly by the Baby-Friendly Hospital Initiative.[27]

Providing a subsidy to hospitals that are planning to or currently working to become certified Baby-Friendly may be necessary as the financial costs for hospitals to become certified are significant, with overall costs for obtaining the certification estimated to be approximately $12,000 USD over a four year period (as of 2017).[27] Moreover, there is also an annual fee of approximately $1,000 USD (as of 2017) to maintain the certification once it is attained. That said, although upfront costs might be high in order to help make more birthplaces certified Baby-Friendly, it is reasonable to assume that cost-savings associated with decreased future chronic illness (e.g., breast and ovarian carcinoma) would offset these initial costs, thus making such an investment worthwhile. Importantly, a recent study found that the implementation of Baby-Friendly policies in birthplaces across the US have not been associated with statistically significant increases in birth costs for the mother, a key consideration for hospitals who might be

concerned that mothers would seek an alternative birthplace if the cost was significantly cheaper.[36]

To acquire the funds for such a subsidy, it might be reasonable to impose a short-term federal tax on all wage earners, similar to the Medicare tax, that would subsequently be divided and paid out to all hospitals containing birthplaces attempting to become Baby-Friendly. In the same way that the Medicare tax is generally accepted as the benefit of such a tax will be realized later in life, so might a breastfeeding tax be accepted if the population was educated on the health benefits for both mother and child.

Given the significant financial investment required to become certified Baby-Friendly, as well as the significant changes required with respect to postpartum nursing practices, some critics of the Baby-Friendly Hospital Initiative have argued that attaining all of the "Ten Steps" may be excessive and may actually be associated with potentially problematic or worse outcomes for the mother and baby.[37] For instance, Bass et al.[37] argue that the implementation of immediate skin-to-skin contact has been shown to be associated with increased rates of sudden unexpected postnatal collapse, a condition in which the newborn suddenly stops breathing, based upon data reviewed from Europe and Massachusetts. The authors note that this may be a product of lack of supervision of the mother by nursing staff during the initial postpartum period.[37] Moreover, the authors argue that pacifier use should not be completely withheld as required within the "Ten Steps", as pacifier use is associated with reduced risk of sudden infant death syndrome.[37]

Overall, the examples of morbidity and mortality that Bass et al.[37] argue are associated with implementation of the Baby-Friendly "Ten Steps" are important to acknowledge and to address, but Meek et al.[38] argue in a rebuttal to Bass et al.[37] that hospitals that are considering not

pursuing Baby-Friendly certification must understand the low base rates of many of the disease processes described by Bass et al. Moreover, Meek et al.[38] state that it is also important to recognize that pacifier use is associated with decreased breastfeeding duration, which itself has health implications, as documented above.[38] As such, although more research is needed to definitively clarify whether the benefits of hospitals attaining the "Ten Steps to Successful Breastfeeding" outweigh the risks to mothers and their children, the data regarding the short-term and long-term benefits included in this literature review suggest that implementation of the Baby-Friendly "Ten Steps" should continue as standard of care.

Finally, in terms of individual level determinants, examples of interventions aimed at this level include studies examining the impact of peer support on breastfeeding behavior. For example, results from the Jolly et al.[29] meta-analysis revealed that mothers who endorsed receiving peer support had 15% lower risk of not breastfeeding at the last study follow up. Thus, one proposed solution might be to have free facilities accessible to breastfeeding mothers where they can go to meet with other breastfeeding mothers to discuss breastfeeding-related issues. Attaining this proposed solution might be the most reasonable in terms of expense, as it would only require that a space to meet be made available free of charge to the mothers, and multiple spaces exist that are free of charge to meet in, such as parks and public libraries. One notable limitation of this proposed solution is that in terms of the magnitude of the effect, the impact of peer support on breastfeeding initiation and duration is less than both antenatal breastfeeding education and individualized support, as detailed in Guise et al.[25] However, the association between peer support and subsequent breastfeeding behavior is still statistically significant and therefore likely meaningful, suggesting that even if peer support is the only form of

breastfeeding support that a mother has available to her, it is better than receiving no support at all, given the known benefits of breastfeeding.

Fortunately, in the Twin Cities, there are multiple organizations that exist to help support breastfeeding mothers, and one such organization is Amma Parenting Center, or Amma. Amma is an example of an organization that is working towards increasing breastfeeding rates and duration by addressing the complex layers of breastfeeding determinants. For example, in terms of structural level determinants, such as social trends and products available in stores, Amma attempts to promote breastfeeding by providing access to the latest breastfeeding equipment and accessories, all of which are aimed at facilitating the process for breastfeeding mothers.

In terms of settings level determinants, Amma works to normalize and promote breastfeeding by suggesting that breastfeeding mothers bring their spouses or a family member with them to the classes that they take. This works to provide the spouse or family member with the same information as the mother, in hopes that doing so will normalize breastfeeding for those around the breastfeeding mother. One such class is an antenatal breastfeeding class, similar to the intervention described in the literature review, wherein mothers and their partners learn about the benefits of breastfeeding as well as participate in a discussion regarding the difficulties associated with breastfeeding.

Finally, in terms of individual level determinants, Amma attempts to promote the mother-infant relationship and therefore promote breastfeeding by offering drop-in sessions with trained lactation consultants where the breastfeeding mother can ask questions or concerns that she has, and the lactation consultants can help to facilitate the breastfeeding experience for the mother and infant. In addition to receiving individualized support, peer support can also be

provided during these drop-in sessions, as other mothers may present to the clinic seeking help with similar issues.

Overall, the services provided by Amma attempt to address all the complex layers of breastfeeding determinants. As detailed in an interview with Sara Pearce (Table 4), a lactation consultant and founder of Amma, services such as the classes and individualized support provided help to facilitate the breastfeeding experience for mothers and their partners as they set the stage and begin to address one of the biggest obstacles for a breastfeeding mother: her own expectations. Pearce argues that one of the main reasons that a mother quits breastfeeding her infant so quickly after initiation is that her actual experiences do not match well with her expectations, as it is likely that she has not had up close and personal experience with the struggles and difficulty associated with breastfeeding prior to starting herself. She notes that this is a product of the society that we live in today, where mothers are used to "a fast pace of life" and "instant gratification". In contrast to "fast pace" and "instant gratification", Pearce states that breastfeeding is a skill that can take "weeks or even a couple months" to learn. As such, taking an antenatal breastfeeding class like the one provided by Amma helps mothers to form realistic expectations about breastfeeding prior to initiation, which likely ultimately improves breastfeeding duration.

CONCLUSION

In conclusion, this literature review has examined multiple interventions that have been performed to promote breastfeeding initiation and duration. The data examined reveal that a combination of antenatal breastfeeding education and individualized support are associated with the greatest odds of increasing breastfeeding initiation and duration, although many other forms of support have been shown to be beneficial as well. As outlined in the discussion,

recommendations to increase breastfeeding include subsidizing antepartum breastfeeding education programs and individualized support, as well as making all birthplaces "Baby-Friendly", providing free spaces for mothers to meet to discuss breastfeeding-related issues, and withholding commercial discharge packs on postpartum units.

Future research on interventions to promote breastfeeding should focus on providing a clearer understanding of the impacts of the interventions explored in this literature review. Currently in medical research, the general paradigm is to collect multiple datasets, with each containing a relatively small sample of participants, as large sample sizes are difficult to obtain due to restrictions with respect to obtaining funding and spreading the available funding around to multiple groups. These small datasets are then subjected to meta-analysis as the data accumulate over time, as is evident in this literature review. However, one limitation of meta-analysis is that some of the details of each study design are lost as the data are aggregated and coded for meta-analysis. An example of this is the impact of breastfeeding exclusivity in the Guise et al.[25] meta-analysis. The authors of this meta-analysis combined exclusive and non-exclusive breastfeeding to maximize sample size for their analyses, and as a result lost the ability to analyze the unique impact of interventions on exclusive breastfeeding behavior. The impact of the interventions on exclusive breastfeeding is important to clarify, as the recommendations call for six months of exclusive breastfeeding in addition to one year of complementary breastfeeding.

As such, future research should focus on evaluating the efficacy of breastfeeding interventions on very large sample sizes to attain a "population"-sized estimate of the effect. However, given that the results of pooled data from meta-analyses are certainly better than starting without any data, assessment of the efficacy of breastfeeding interventions using large

sample sizes should prioritized based upon replicating prior breastfeeding interventions. Following this logic, assessment of the "population"-sized effect of combined antenatal breastfeeding education and individualized support on breastfeeding initiation and duration would likely be sought first, as these variables have the most promising data available at this time with respect to promoting breastfeeding behavior for the longest duration.

Overall, the determinants of breastfeeding are complex and multi-layered, but fortunately there exist multiple local programs, such as Amma, that have services aimed at addressing these determinants to ultimately promote breastfeeding for all mothers and infants. More research is needed in this area to further clarify which interventions are associated with the best breastfeeding outcomes.

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Appendix

Table 1. Breastfeeding guidelines by organization

Organization	Guideline
American College of Obstetricians and Gynecologists (ACOG)[13]	Exclusive breastfeeding for the first 6 months of life, with continued breastfeeding as complementary foods are introduced through the infant's first year of life.
American Academy of Pediatrics (AAP)[14]	Exclusive breastfeeding for 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and the infant.
American Academy of Family Physicians (AAFP)[15]	Almost all babies should be breastfed or receive human milk exclusively for approximately six months. Breastfeeding with appropriate complementary foods, including iron-rich foods, should continue through at least the first year. Health outcomes for mothers and babies are best when breastfeeding continues for at least two years.
World Health Organization (WHO)[16]	WHO recommends mothers worldwide to exclusively breastfeed infants for the child's first six months to achieve optimal growth, development and health. Thereafter, they should be given nutritious complementary foods and continue breastfeeding up to the age of two years or beyond.
American College of Nurse Midwives[17]	Exclusive breastfeeding for the first 6 months provides complete nutritions for growth and development, and ideally breastfeeding should continue throughout the first year of life.

Appendix

Table 2. Summary percentages of Healthy People 2020 Objective MICH-21: "Increase the number of infants who are breastfed".[19]

Sub-objective	Baseline: 2006	Most recent: 2011	Target goal: 2020
MICH-21.1: "Increase the proportion of infants who are ever breastfed in the United States"	74%	79.2%	81.9%
MICH-21.2: "Increase the proportion of infants who are breastfed at 6 months (although not exclusively) in the United States"	43.5%	49.4%	60.6%
MICH-21.3: "Increase the proportion of infants breastfed at 1 year of age"	22.7%	26.7%	34.1%
MICH-21.4: "Increase the proportion of infants breastfed exclusively through 3 months of age"	33.6%	40.7%	46.2%
MICH-21.5: "Increase the proportion of infants who are breastfed exclusively through six months"	14.1%	18.8%	25.5%

Appendix

Table 3. The Ten Steps to Successful Breastfeeding[28]

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within one hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation, even if they are separated from their infants.
6. Give infants no food or drink other than breast-milk, unless medically indicated.
7. Practice rooming in - allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no pacifiers or artificial nipples to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or birth center.

Appendix

Table 4. Interview with Sara Pearce, APRN, CNM, IBCLC, Founder and Director of Education of Amma Parenting Center. Interview questions in italics.

1. *In your opinion, what are some of the biggest obstacles that breastfeeding mothers face?*

   One of the biggest obstacles is the expectations of the moms themselves. I find that most moms are pretty unprepared for the amount of work that goes into breastfeeding a baby. They underestimate the time, the effort, the physicality, and the cost - and frequently quit or introduce formula early on because their reality is so different from their expectations. This is a failure on our society's part to adequately prepare pregnant women, provide early support and resources, and connect women to each other (all of which were reasons I started Amma!). In today's culture, we don't live in collective societies any more, where multiple generations would be in one home and a girl might see breastfeeding going on around her as she grows up. Women often arrive at motherhood having never seen someone else navigate feeding a baby (or at least up close and personal). Our microwaves, cell phones and high speed internet get us used to a fast pace of life and instant gratification, so when a baby comes along who needs weeks or even a couple months to learn a skill like feeding, it feels "broken" or wrong. Another big obstacle is how quickly women have to return to work. Many women get no paid leave, or a very short leave. The pressure to get back to work, whether it's financial pressure or pressure from their employer, makes a big impact. Trying to jump back into their previous life with a very young infant at home makes pumping and breastfeeding extremely challenging. Our American work culture just isn't set up to support new mothers very well. Even women who work white collar jobs are given pumping rooms

at corporate headquarters, but are expected to travel, work late, and bring work home to advance their careers and maintain their position in the company. It takes an extremely dedicated mother to keep pumping in some sectors of the workforce.

2. *What are some of the ways that Amma is helping mothers address these obstacles? For example, some of the research that I have reviewed has suggested that a combination of antenatal breastfeeding education and individualized support provided ante- and postpartum leads to the greatest increase in breastfeeding rates and duration. In your personal experience, have you found any other approaches or services that ease the burden of the breastfeeding mother to allow her to pursue her breastfeeding goals?*

   I think the key is just what you said - prenatal education followed by swift and early postpartum support. Some of the hospitals in our area have their own drop-in breastfeeding groups, which is terrific because those hospitals often also provide clinical lactation care (where moms can make an appointment with a lactation consultant), but that appointment needs to be made separately at another time. The best idea I've heard this year is one I was introduced to at a lactation conference last May. I had breakfast with a lactation consultant from a huge inner city hospital that delivers about 10,000 babies a year. They run a drop-in breastfeeding group 4 days a week, staffed by 3 lactation consultants at a time, who not only answers group Q&A but comes around to any mom and does a quick hands-on lactation consultation, right on the spot. Of course, if a mom needs a more thorough evaluation she would need to make a separate appointment, but so many problems can be solved with about 10-20 minutes of skilled care. She called it a "breastfeeding emergency room" - I thought that was a brilliant idea! Most of their patients were low income mothers, and to get all the way back to a hospital for a separate appointment would be burdensome.

The fact that they can help right then and there is wonderful. Of course, she said it costs the hospital a lot of money because the lactation consultants do not submit insurance claims for each of those little micro-visits. But what a wonderful public health service.

3. *As a lactation consultant, have you heard of or experienced any notable workplace or government-based policies in Minnesota that are particularly effective in helping the breastfeeding mother reach her breastfeeding goals? For example, a workplace creating a separate room for mothers to pump with a fridge specifically for breast milk.*

   It definitely helps to have a pumping room at the work site. Giving new moms flexibility in their schedules is important, too. Some of the most supportive work environments arise organically from the members of the work group itself. Moms will say the support doesn't necessarily come from the employer, but her co-workers will cover her while she pumps, or cover her if she needs to leave early. You can install all the pumping rooms in the world, but if the mother's colleagues don't respect boundaries or pressure her to skip pumping appointments, it won't matter.

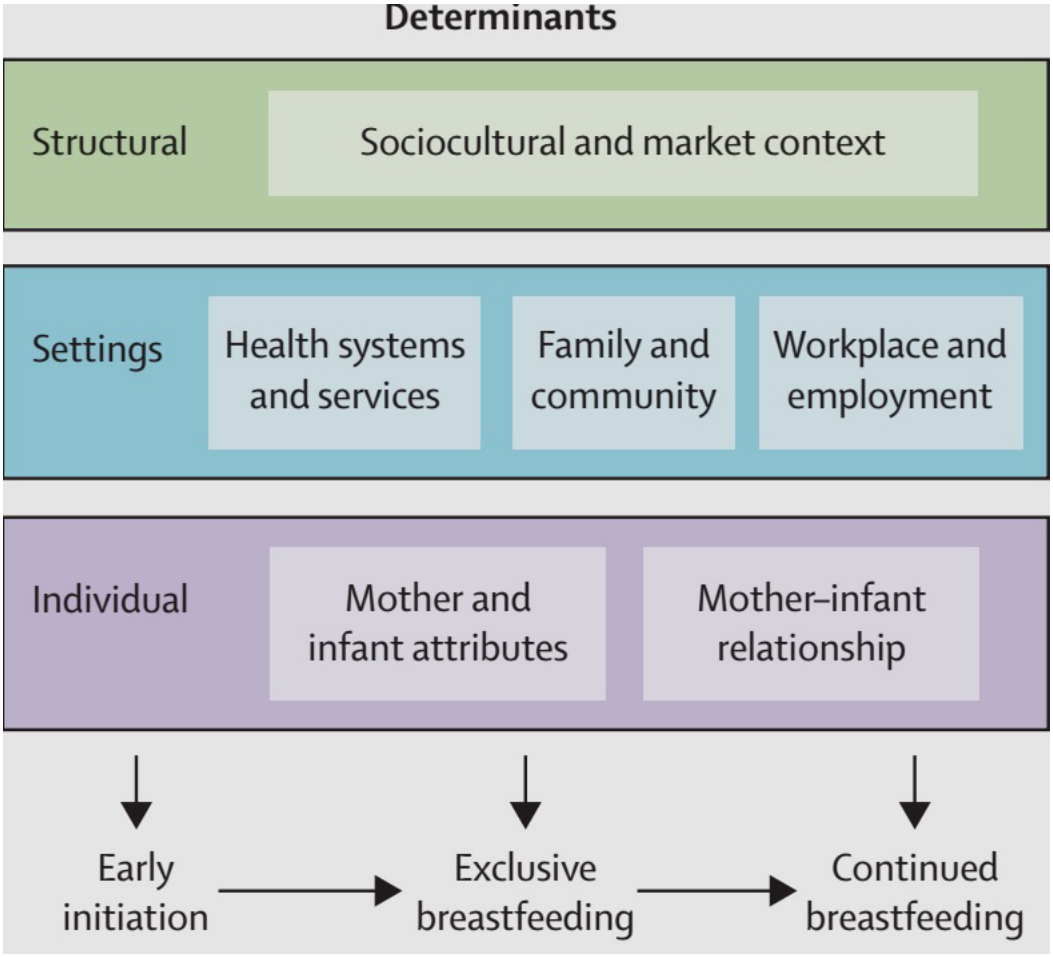
4. *Lastly, one unfortunate correlation that I have observed is that breastfeeding seems to be associated with income status. More specifically, using the Healthy People 2020 national data, it appears that infants born to higher income mothers seem to have a greater likelihood of ever being breastfed and are more likely to receive longer exclusive breastfeeding as well. Keeping that in mind, one other broad conclusion that I've drawn from my literature review and referenced above is that antenatal breastfeeding education and support seem to be the most effective way to increase breastfeeding initiation and duration. However, one issue that I have noticed in researching available education and support programs in Minnesota is that participation in these programs seems to depend on having financial resources. Given the*

benefits of breastfeeding in general, as well as the benefits receiving antenatal breastfeeding education and support in promoting breastfeeding initiation and duration, do you know of any programs for those with lower financial resources or steps that are being taken in Minnesota to make these programs accessible to people of lower resources?

Yes. Insurance companies who have plans for state funded insurance vary in regards to their support. We used to have a contract with an insurance company called UCare, and they would not only cover a breastfeeding class for all their members but their care coordinators would be so good about calling members, encouraging them to take a class, pay for transportation, and support Amma's efforts to make the education available. They also contracted with small companies who were doing community-based work, as well as the big clinics and systems. When UCare lost the contract to several other insurers, that all changed. The new holders of the contracts don't cover Amma classes, and I don't think there's the same level of community engagement. At Amma, we donate a childbirth class to every mother on a state-funded health insurance plan as long as they're delivering at one of our contracted hospitals. Some of the clinics run their own prenatal classes right on site, especially those who have a lot of teenagers or non-english speaking patients. And Everyday Miracles is an example of a community organization that takes state funded insurance for some things like breast pumps. On the postpartum side, there are lots and lots of free breastfeeding support groups, in a range of facilities, so I think that's even a stronger net than on the prenatal side. It's just a question of whether a low income mom knows about the support, can get there, speak the language, and has people around her who are encouraging her to go.

Appendix

Figure 1. Levels of breastfeeding determinants, from Rollins et al.[20]



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