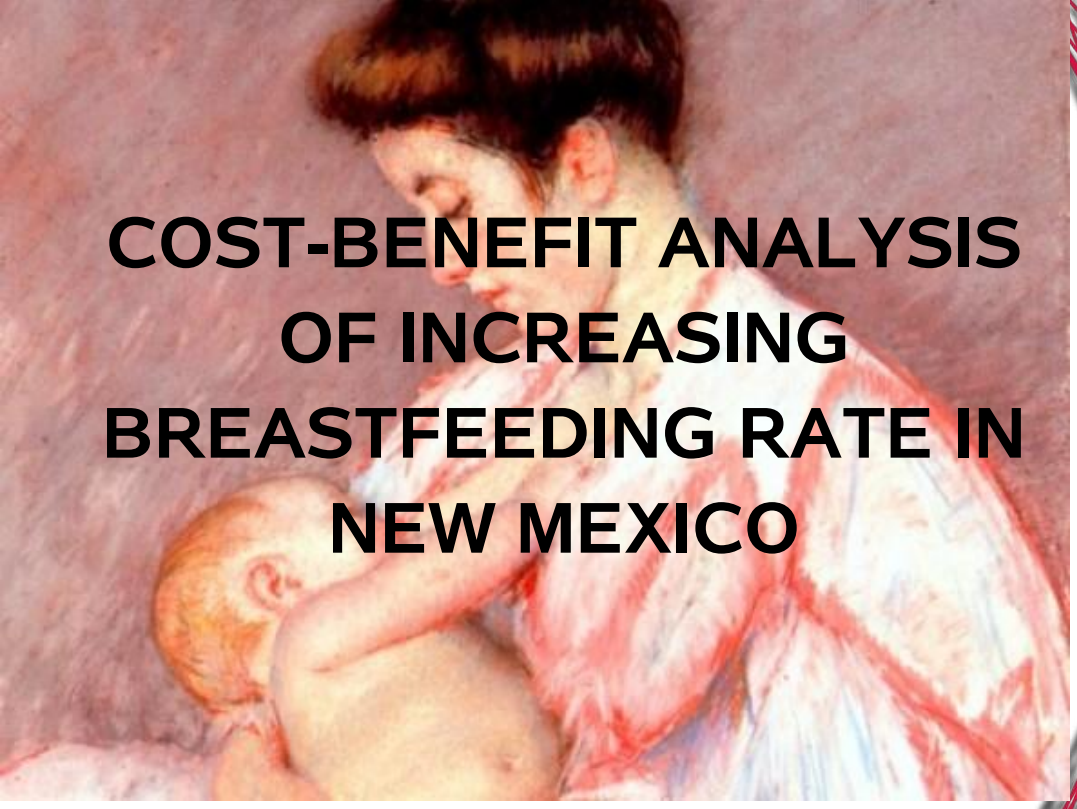

COST-BENEFIT ANALYSIS OF INCREASING BREASTFEEDING RATE IN NEW MEXICO

July 2014

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Cost-Benefit Analysis of Increasing Breastfeeding Rate in New Mexico

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-Doleswar Bhandari

EXECUTIVE SUMMARY

PEDIATRIC ILLNESSES RELATED TO SUBOPTIMAL BREASTFEEDING

BBER conducted an in-depth analysis of childhood asthma and obesity using the National Survey of Children Health (NSCH), as well as cohort data from the National Longitudinal Survey of Youth 1979 (LSLy79) conducted by the Bureau of Labor Statistics. To estimate the cost of these illnesses, BBER used 2011 Medical Expenditure Panel Surveys (MEPS) data.

- BBER conducted binary logit multiple regression to determine if breastfeeding was associated with asthma, diabetes, epilepsy, learning disabilities, speech problems, hearing problems, vision problems, ADD or ADHD, behavioral problems, autism, developmental delay, as well as bone, joint or muscle problems. Only asthma was found to be significantly and positively associated with suboptimal breastfeeding.
- Controlling gender, race/ethnicity, age, economic status and maternal smoking, the duration of breastfeeding had a significant protective effect against asthma.
- Each year, more than 8,500 obesity incidences could be prevented, accounting for $22 million total cost savings in New Mexico.
- More than 1,100 asthma incidences could be prevented. This decline in asthma results in the significant reduction of total medical expenses associated with health care. Total expenses are estimated to decrease by $3.6 million.
- It is estimated that nearly $27 million in total cost, including nearly $17 million direct cost, could be saved due to prevented pediatric illness incidences if New Mexico increases the breastfeeding rate by 10%.
- More than 108 Lower Respiratory Tract Infection (LRTI) incidences could be prevented and $567,000 could be saved each year if New Mexico increases the breastfeeding rate by 10%.
- BBER estimated that nearly one death could be prevented in New Mexico in 2013 had the breastfeeding rate increased by 10%.

MATERNAL ILLNESSES RELATED TO SUBOPTIMAL BREASTFEEDING

BBER also conducted an in-depth analysis of illness cost on breast cancer and ovarian cancer associated with suboptimal breastfeeding. The costs of other illnesses such as gastroenteritis, respiratory tract infection, childhood leukemia, necrotizing enterocolitis (NEC), sudden infant death syndrome (SIDS), otitis media and other maternal illnesses were estimated using secondary sources and/or literature review.

- According to annual data by the New Mexico Department of Health, 1,310 women are diagnosed with and 240 women die of breast cancer, statewide.
- Based on 2011 Medical Expenditure Panel Survey data, BBER estimated, on average, the total annual medical expenses to be greater by $4,236 for adult females with breast cancer as compared to those without an incidence of cancer.

- On average, total annual medical expenses were estimated to be $4,851 more for adult females with ovary cancer as compared to those without an incidence of cancer.
- BBER estimates a significant reduction in hypertension (401 incidences), breast cancer (37 incidences), and MI (104 incidences) if New Mexico increased its breastfeeding rate by 11% in one year. In addition, nearly 33 deaths could be prevented in New Mexico.
- Among the maternal illnesses associated with suboptimal breastfeeding, hyper tension accounts for the highest expenditures, with $2.8 million (43% of cost savings).
- The second highest cost savings were estimated for MI ($1.7 million or 25%).
- Type 2 diabetes accounts for nearly a million dollar savings. In the Bartick et al. estimation, using a 3% discount rate, the average cost of premature death was $4.15 million. If the same value of statistical life is applied to New Mexico premature deaths (i.e. 33), it would be $137 million every year in 2011 dollars.

BUSINESS SURVEY

As part of the cost-benefit analysis of breastfeeding in New Mexico, BBER conducted survey of New Mexico businesses regarding the cost and availability of nursing room, maternity leave, flex-time, awareness of the laws pertaining to the use of breast-pumps in the workplace, and business performance. BBER conducted this survey by using Survey Monkey, an internet based platform, from mid of January to the end of April, 2014. BBER sent survey requests to more than 17,000 New Mexico businesses and received only 274 usable responses. The length and difficulty of the survey might explain the low response rate. This also might indicate that businesses were reluctant to share their information on this issue. The purpose of this business survey was not only to collect data but also to inform business about the best practices for employee management and breastfeeding support needed for their employees. Due to low the response rate, the margin of error on our estimates could be huge. Therefore, our results should be used cautiously.

The BBER survey attempted to address following questions:

What is the cost for businesses to provide breastfeeding support to their employees? Are businesses aware of the laws related to the use of breast pumps in the workplace? Do businesses provide nursing space(s) for their breastfeeding employees? What kind of breastfeeding-related support do businesses provide for their employees? Do businesses provide paid/unpaid maternity leave? Is paid maternity leave contingent upon having sufficient balances of annual/sick leave or are there separate benefits to cover the cost of maternity leave? Are businesses aware of what makes a workplace "breastfeeding friendly"? What is the value of productivity loss that accommodates the needs of the breastfeeding employee? Are businesses aware of the value in increased productivity from employee job satisfaction due to working in a supportive environment?

The main highlights of the survey findings are presented as follows:

- Overall, small businesses employ a higher proportion of women compared to larger businesses. Businesses with 50 or less employees have a larger share of female employees (50% or more) compared to businesses with 201 or more employees (38%).
- Nearly all responding businesses (95%) reported that they are aware of the legal right to breastfeed in public.
- A full 65% of businesses reported that they are aware of the New Mexico workplace breast milk pumping law. The reported level of awareness, however, increases with size of businesses.
- Overall, 65% of businesses reported they "know what makes a workplace breastfeeding friendly."
- Across all businesses, 72% responded that they have space(s) for employees to nurse or express breastmilk.
- Survey results show that on average there is one nursing space available for 65 female employees in New Mexico. This ratio decreases for smaller businesses.
- Most businesses (73%) provide unpaid maternity leave for their employees; however, 3% reported they do not provide any maternity leave and 19% reported they do not have fixed policy on maternity leave.
- Only 30% of businesses have a provision of maternity leave which is not contingent upon sufficient balances of annual/sick leave. Of 180 responses, 16% of businesses indicated a separate benefit to cover the cost of maternity leave.
- The overall duration of average allowable unpaid maternity leave was 60 days.
- Among OECD countries, Australia and United Kingdom ranked the highest in providing paid maternity leave (52 weeks), followed by Norway (35 weeks), Slovakia (34 weeks), and Czech Republic (28 weeks). Nearly all countries provide support through their social security programs or social insurance programs. The United States is one of the few industrialized nations that does not provide paid family leave for new parents.
- Of the total 184 business responses, nearly 80% reported that they provide for a flexible work environment with “part-time” options and almost 70% provide “flex-time” options.
- The survey asked “Research has shown that there are lower medical cost and health insurance claims for breastfeeding employees and their infants (relative to formula fed). Is this true for your entity?” Of the 254 respondents, the vast majority (90%) reported that they did not know about it.
- BBER estimated that the average monthly value of productivity loss to accommodate the needs of a breastfeeding employee was $67.
- 86 businesses estimated the average monthly value of increased productivity due to working in a supportive environment. A majority (60%) reported that they “do not know but save a lot”. The average monthly value of increased productivity was $1,320.
- On average, 71% of New Mexico businesses are spending $87 per month per nursing space; the annual cost of 4,097 nursing spaces is estimated to be $4.2 million. This number is very small if compared to the long-term average monthly value of increased productivity from employee job satisfaction.

MOTHER SURVEY

As part of the cost-benefit analysis of breastfeeding in New Mexico, BBER conducted survey of mothers to estimate cost and benefit of breastfeeding and formula feeding. The main objective of the survey was to understand mothers, their work-life balance, work hours, breastfeeding challenges and duration, childcare costs, level of satisfaction as a mother, satisfaction with their health, their youngest child's health, and satisfaction with their family's financial health.

Women over 18 years of age with at least one child less than 5 years of age were asked to participate. The survey was conducted from May to June, 2014. The survey was designed and uploaded to the Survey Monkey website. Survey questions were pretested and refined after two separate focus group discussions with breastfeeding and formula feeding mothers. A total of 372 survey responses were collected.

Due to the lack of mothers' contact addresses, BBER could not make a random sample of New Mexico mothers. BBER relied on convenience sampling, a non-probability sampling technique where mothers were selected through their convenient accessibility to social media such as *Facebook*, email, WIC clinic, and referrals. BBER used two separate censored regression models to explain work hours and monthly income.

The survey findings are as follows:

- Only 54% of surveyed mothers with a child less than 5 years old work for remuneration. More than 30% of mothers worked 31 hours or more, 15% worked less than 20 hours per week and 7% work between 21 to 30 hours.
- The average number of work hours per week was 16 (SD=17.7) and average monthly wage or salary of mother was $1,506 (SD=2003) including those who do not work at all. The average household income was $4,454.
- The level of education was significant in determining weekly work hours. Controlling other factors (such as ethnicity, length of breastfeeding, mother's age, number of children, and household income), a one year increase in educational attainment results in a corresponding increase of 3.6 hours of work.
- The length of breastfeeding was found to be negatively associated with weekly work hours. Controlling other factors, roughly every 3 months increase of breastfeeding is associated with a one hour decrease in weekly work hours.
- Controlling other factors, married mothers work nearly 12 hours less compared to other categories of marital status, just as single, divorced, or separated. Married mothers may possess more resources (financial or otherwise) and thus be able to work shorter hours which can be used to care for children.
- Each additional child below 5 years of age results in a reduction of 8.2 work hours for mothers.

- Controlling other factors, higher income families tends to work longer hours compared to lower income family. Every additional one thousand dollar of monthly household income increases hours of work per week by 1.2.
- Controlling other factors, the length of breastfeeding is found to be significantly negative in relation to mothers' monthly income. Each additional day of breastfeeding results in a reduction of $1.65 of monthly income; each additional month of breastfeeding results in a reduction of $50 to mother's monthly income.
- As the total number of children under 5 years of age increases, the mothers' monthly income decreases. Each additional child under 5 years of age results in a reduction of $779 in monthly income.

NEW MEXICO MEDICAID PROGRAM

- In New Mexico, a total of 71,200 children (13%) below 19 years of age did not have health insurance in FY12. In the case of low income children, only 10% were covered by employer-sponsored insurance, but 68% of low-income children were covered by Medicaid. A relatively large proportion (18%) of low income children did not have health insurance in FY12.
- According to the Kaiser Foundation, New Mexico spent more than $3.3 billion in Medicaid expenditure in FY10. Of the total, 48% was spent on children.
- According to the American Academy of Pediatrics[1], the total Medicaid expenditure for children's services (ages 0-20) was $1.1 billion in FY09 and $2,990 per child.
- About 84% of Medicaid expenditures for hospitalizations occurred for breastfeeding-related illnesses.
- In New Mexico, 70% of the Medicaid expenditure is born by the federal government with the remaining 30% sustained by the state.
- Most of the Medicaid spending in New Mexico for FY12 was accounted for by acute care services (88% or $3 billion) while 10% was accounted for by long-term care. The remaining 2% was accounted for by Disproportional Share Hospital (DSH) payments.
- A total 5,052 hospitalization occurred in New Mexico during 2011 with a total expenditure of $208.6 million. Medicare accounted for 37% (or 1859 cases) of hospitalization, and born 44% ($92.6 million) of the cost. Medicaid ranked third in terms of number of hospitalizations and total expenditures. Medicaid paid for 20% of the hospitalizations in New Mexico with $22.4 million in expenditures.
- Of the illnesses related to breastfeeding, nearly 40% of total hospitalizations were diabetes. Bronchiolitis composed 30% of hospitalizations, with breast cancer composing 11%.

[1] Medicaid state report: http://www.aap.org/en-us/professional-resources/Research/research-resources/Pages/Medicaid-State-Reports.aspx

1. Introduction

New Mexico Breastfeeding Task Force (NMBTF) commissioned the University of New Mexico's Bureau of Business and Economic Research (BBER) to conduct a cost-benefit analysis of increasing the breastfeeding rate in New Mexico. Breastfeeding is associated with reduced risk of many diseases in infants, children, adolescents, and mothers. Notwithstanding, breastfeeding is also associated with earning losses for the mother, associated with fewer hours of work, or no work, as well as decreased competitiveness in the job market. Some studies' findings provide evidence in support of breastfeeding while others contradict them. The general findings of these studies imply that breastfeeding not only impacts infants, children, mother, and the entire family, but also health service providing organizations and job providing entities or professions. Indeed, breastfeeding impacts society in various ways. Therefore, it is imperative to conduct a holistic and objective analysis which takes into consideration the various parties that may be impacted by breastfeeding. To this end, BBER conducted a cost-benefit analysis of breastfeeding for families, New Mexico Employers, as well as Medicaid program.

The rest of the report is organized as follows. Chapter 2 presents the cost analysis of pediatric and maternal illnesses associated with suboptimal breastfeeding. BBER conducted an in-depth analysis for childhood asthma and obesity using the National Survey of Children Health (NSCH) as well as cohort data from the National Longitudinal Survey of Youth 1979 (LSLy79) conducted by the Bureau of Labor Statistics, respectively. To estimate the cost of these illnesses, BBER used 2011 Medical Expenditure Panel Surveys (MEPS) data. BBER also conducted in-depth analysis of illness cost on breast cancer and ovarian cancer associated with suboptimal breastfeeding. The costs of other illnesses, such as gastroenteritis, respiratory tract infection, childhood leukemia, necrotizing enterocolitis (NEC), sudden infant death syndrome (SIDS), otitis media and other maternal illnesses, were estimated using secondary sources and/or literature review.

Chapter 3 discusses the survey of New Mexico businesses conducted from February to April, 2014. The survey collected data on the awareness of breastfeeding-related laws, breastfeeding support, maternity leave, cost of support to breastfeeding employees, and also to inform employee management best practices. Chapter 4 is devoted the survey of mothers. The main objective was to understand mothers and their work-life balance, work hours, breastfeeding challenges or duration, childcare cost, satisfaction as a mother, satisfaction of health and youngest child's health, as well as satisfaction of their family's financial health. And the final chapter presents the cost-benefit analysis of breastfeeding on New Mexico Medicaid program.

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2. Cost Analysis of Pediatric and Maternal Illnesses

2.1 Cost Analysis of Pediatric Illnesses Associated with Suboptimal Breastfeeding

2.1.1. Relationship between Childhood Asthma and Breastfeeding

2.1.1.1 Background

Asthma is a chronic lung disease that affects an estimated 16.4 million adults (aged ≥ 18 years) and 7.0 million children (aged < 18 years) in the United States[2]. In 2008, an estimated 38,410 children in New Mexico had asthma with the current asthma prevalence being 7.6% among children[3].

General consensus is that breastfeeding protects against many infections, including childhood asthma. Information from various studies and data sources was used to estimate the changes in medical expenses attributable to childhood asthma in relation to improving breastfeeding rate for New Mexico population. We first estimated the annual medical expenses attributable to childhood asthma. Then, through the simulation, we estimated the effect of improving the breastfeeding rate on childhood asthma prevalence rate and total medical expenses.

2.1.1.2 Studies on Childhood Asthma and Breastfeeding

During the last few decades the incidence of asthma among children under the age of 4 has risen 160% (Eichenfield et al., 2003). Although many studies have assessed the relationship between breastfeeding and asthma, results tend to be equivocal due to the fact that many studies are nonrandomized, retrospective, or observational (Greer et al., 2008). The Eidelman et al. (2012) cites results published by Ip et al. (2007), which updated a 2001 meta-analysis (Gdalevich et al., 2001) founding an odds ratio favoring exclusive breastfeeding for at least 3 months of 0.70 (95% CI 0.60-0.81). Ip et al. (2007) stratified the updated meta-analysis by family history of asthma. The meta-analysis of children *without* a family history of asthma yielded an odds ratio (OR) in favor of exclusive breastfeeding (for at least 3 months) of 0.73 (95% CI 0.59-0.92). The meta-analysis pertaining to children *with* a family history of asthma suggested no statistically significant relationship between breastfeeding and asthma (OR_{adj} 0.81 with 95% CI of 0.41-1.60)[4]. However, the finding of non-significance was driven by the inclusion of one study – Wright et al. (2001), which (as noted by Ip et al.) differed from the other studies in that the age of follow up was 13 years, while the age of follow up in other studies ranged from 2 to 9 years. When Wright et al. (2001) was excluded from the meta-analysis update, results indicated that

[2] National Health Interview Survey (NHIS), 2008
[3] Behavioral Risk Factor Surveillance System (BRFSS), 2008
[4] Studies new to the 2007 meta-analysis were: Kull et al. (2004); Wright et al. (2001); Burgess et al. (2006)

exclusive breastfeeding for at least 3 months (for children with a family history of asthma) is associated with a reduced risk of asthma (OR_{adj} 0.60 with 95% CI of 0.43-0.82).

Greer et al. (2008) discussed the research conducted by Wright et al. (2001), and noted that the definition of asthma used by Wright et al. is more accurate – in their study Wright et al. distinguish between the "wheezy bronchitis associated with viral infections in younger children and that of the allergic disease seen in older children" (Greer et al., 2008). This suggests that the result found by Wright et al. – that exclusive breastfeeding (EBF) for any length of time is associated with an *increased* risk of asthma in children with mothers who suffer from asthma – may in fact result from the authors' more accurate definition of asthma. A similar result (an association between BF and an increased risk of asthma; however, the increased risk was not associated with maternal asthma) was found in a New Zealand study (Sears et al., 2002), although the study has been criticized for a number of design flaws.

Ultimately there appears to be a difference of opinion regarding how to interpret the divergent results regarding the relationship between BF and asthma. The 2012 Eidelman et al. article appears to interpret the results to mean that BF reduces the risk of asthma, while Greer et al. (2008) appear to interpret the results to mean that an accurate definition of asthma may yield results that suggest that BF increases the risk of asthma. As explained by Guilbert and Wright (2012) in their brief review and discussion of the disparate results found by researchers, there are numerous potential explanations for the disparity, including how exclusive breastfeeding is defined, potential reverse causation, asthma definitions, etc.

Research conducted by Brew et al. (2012) aims to disentangle divergent results found in two studies – one in Australia and a second in Sweden. The Australian study found that BF provided no protection against asthma at 5 years of age, and furthermore that BF for at least 6 months was associated increased sensitization to allergens at 5 years of age. In contrast, the Swedish study found that BF did offer protection against asthma and allergen sensitization at both 4 and 8 years of age. Brew et al. were able to obtain access to individual data from both studies and thus were able to harmonize most (but not all) aspects of the studies and conduct a meta-regression (rather than the typical meta-analysis). The authors found that once harmonized the results indicate that longer BF duration in general had no impact on asthma risk. The one exception occurred within the Swedish population, in which longer BF duration was associated with a somewhat increased prevalence of asthma among 8 year olds.

A recent study by Silvers et al. (2012) attempted to address the discrepancies in results from prior research pertaining to (a) the relationship between breastfeeding and asthma in children of different ages and (b) the relationship between breastfeeding and asthma in children either with atopy or a family history of allergic disease. The study was stronger than many others in that it was prospective and clear definitions were used for asthma and exclusive breastfeeding. Results indicate that breastfeeding, and in particular exclusive breastfeeding, offers protection against asthma in children ages 2 through 6. The intensity of protection offered by breastfeeding was

found to diminish with age. The protection offered by exclusive breastfeeding was more pronounced among children with atopy who were more than 3 years of age. Silvers et al. discuss differences between their results and those of other studies, in particular results derived by Burgess et al. (2006), Mandhane et al. (2007), Sears et al. (2002), and Wright et al. (2001). Studies that show no relationship between breastfeeding and asthma among older children may simply reflect the diminished benefit found by Silvers et al. (2012). Studies that indicate that breastfeeding *increases* the risk of asthma may suffer from poor data quality, in particular poor quality breastfeeding data. Finally, Silvers et al. note that due to differences in food supply, environmental contaminants, etc., it may not be appropriate to compare findings derived in different geographic locations.

2.1.1.3 Data and Methods

This study uses the data from the National Survey of Children's Health (NSCH) 2011/12, which was collected by telephones during the period from February 28, 2011 to June 25, 2012 by the Centers for Disease Control and Prevention (CDC) and the National Center for Health Statistics. The survey was sponsored by the U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. Randomly selected telephone numbers were dialed to identify households with children ages 0-17. When a household had two or more children, one child was randomly selected for the questionnaire. The interview questions were asked to the adult in the household who knew more about the child's health. The data included 95,677 completed interviews in 50 States and DC with children ages 0-17 years. The questions on breastfeeding were asked only for children ages 0-5 years, which included 29,997 completed surveys.

There were 4 questions specific to a child's breastfeeding:

[1] Was the child ever breastfed or fed breast milk? (Yes/No)
[2] How old was he/she when he/she completely stopped breastfeeding or being fed breast milk? (Standardized to age in Days and top coded)
[3] How old was the child when he/she was first fed formula? (Standardized to age in Days)
[4] How old was the child when he/she was first fed anything other than breast milk or formula? (Standardized to age in Days)

For each question, the respondent had the options of either responding with "Don't know" or "Refused to answer". In order to examine the effect of breastfeeding on child asthma, we generated the following five variables from the questions outlined above: 1) *EVERBREASTFED*, 2) *DURATION*, 3) *DURATION_6M*, 4) *EX_DURATION*, and 5) *EX_DURATION_6M*.

Table 2.1 Descriptive Statistics

Variables	Description	Without Survey Weights		With Survey Weights	
		Mean	SD	Mean	SD
Breastfeeding Variables					
EVERBREASTFED	Child ever breastfed? = 1, if yes 0 otherwise	0.788	0.409	0.792	0.406
DURATION	Duration of breastfeeding (in Months/30 days)	7.427	6.642	7.086	6.395
DURATIONSQ	*DURATION* Squared	--	--	--	--
DURATION_6M	Indicator variable for Duration, = 1 if *DURATION* > 6, 0 otherwise	0.53	0.499	0.507	0.5
EX_DURATION	Duration of exclusive breastfeeding (in months)	3.062	3.876	3.028	3.973
EX_DURATION_6M	Indicator variable for Exclusive Duration, = 1 if *EX_DURATION* > 6, 0 otherwise	0.203	0.402	0.199	0.399
Other Variables					
BIRTHWEIGHT	Child weight at birth (in oz.)	115.682	20.998	115.027	21.381
AGE	Age of the child (in years)	2.551	1.733	2.529	1.742
PREMATURE	Indicator variable for whether child was born premature	0.118	0.323	0.127	0.333
MALE	Indicator variable gender, = 1 if Male, 0 otherwise	0.508	0.5	0.51	0.5
BLACK	Indicator variable race, = 1 if Black, 0 otherwise	0.101	0.301	0.135	0.341
HISPANIC	Indicator variable race, = 1 if Hispanic, 0 otherwise	0.157	0.364	0.263	0.44
M_AGE	Age of mother at child's birth	29.548	6.372	28.769	6.117
M_AGESQ	*M_AGE* Squared	--	--	--	--
POVERTY	Indicator variable for poverty, = 1 if the household is below poverty line, 0 otherwise	0.187	0.39	0.255	0.436
M_HEALTH	Indicator variable for mother's health, = 1 if Fair or Poor, 0 otherwise	0.073	0.26	0.09	0.286
SMOKE	Indicator variable, = 1 if any household member smokes, 0 otherwise	0.235	0.424	0.23	0.421

Source: National Survey of Children Helath, 2011

The NSCH data uses complex sampling design, requiring a 1-stage sampling plan using STATE (States codes) and SAMPLE (cell phone vs. land line telephone) as strata, IDNUMR (Individual ID code) as the cluster and NSCHWT (Sampling Weight) as the weight. We followed standard procedure to incorporate complex sampling design in the estimation of various statistics and statistical models in this study. Table 2.1 reports the descriptive statistics of variables used in the regression models. For each variable, mean and standard deviation (SD) are reported with and without using survey weights. Although the mean values are only different by a small margin,

they are nationally representative when survey weights are used in the calculation of these statistics. As mentioned above, the dataset includes children of ages 0-5 years with an average age of 2.53 years. The mean weight of children at birth was 115 oz. and approximately 13 percent of the children were born premature. The dataset was evenly distributed gender wise with 51 percent of the children being male. About 13.5 and 26.3 percent of the children were Black and Hispanic respectively. The mother's age at the birth of child was on average 28.8 years. Similarly, 25.5 percent of the children belonged to families with reported income falling below the poverty line. Approximately 9 percent of the respondents reported mother's health as fair or poor with about 23 percent of children having at least one household member with a smoking habit.

Among the breastfeeding variables, the indicator variable *EVERBREASTFED* was generated from the question number [1], which takes on value 1 if the respondent answered "Yes" and 0 otherwise. On average 79.2 percent of the children were breastfed at least once. Similarly, on average a child was breastfed for approximately 7 months as is represented by the continuous variable *DURATION*, which was derived from question [2] and represents the number of months (or 30 days interval) the child was breastfed. The indicator variable *DURATION_6M* is also derived from question [2], where it takes on value 1 if the *DURATION* is 180 days or more and 0 otherwise. Approximately 53 percent of the sample children were breastfed for 6 months.

The continuous variable *EX_DURATION* is derived from questions [2], [3] and [4], and refers to the number of days until the child was exclusively breastfed. The child is said to be exclusively breastfed when he/she was not being fed anything (formula or any other food) other than breast milk. Finally, the indicator variable *EX_DURATION_6M* is derived, which takes on value 1 if *EX_DURATION* is 180 or more and 0 otherwise. Only 20 percent of the sample children were exclusively breastfed for six months.

One of the primary purposes of the NSCH survey was to facilitate the estimation of national and state-level prevalence for a variety of child health indicators. The survey included information on various child illnesses such as asthma, diabetes, learning disability, etc. The next section describes the logistic regression method used to estimate the effect of breastfeeding on child asthma. Based on the availability of information, this study includes a number of confounding factors in the logistic regression to analyze the protective effect of breastfeeding on child asthma.

2.1.1.4 Empirical Estimation

This study uses logistic regression analysis to assess the effects of breastfeeding on the probability of having asthma for children ages 0-5 years. The logistic (or logit) regression model can be expressed as:

$$\Pr(y = 1|\mathbf{x}) = \Lambda(\mathbf{x\beta}) = \frac{\exp(\mathbf{x\beta})}{1 + \exp(\mathbf{x\beta})} \quad (1)$$

where y is the dependent binary variable, $\Pr(y = 1|\mathbf{x})$ is the probability that y takes on value 1 for given values of the vector of independent variables $\mathbf{x}$, Λ represents link function and is the cumulative standard logistic distribution function. The logistic regression of y on independent variables $\mathbf{x} = x_1, x_2, \dots, x_k$ estimates the parameter values for $\beta = \beta_0, \beta_1, \dots, \beta_k$ using maximum likelihood method such that

$$\begin{aligned} \text{logit}[\Pr(y = 1|x)] &= \log\left[\frac{Pr(y = 1|x)}{1 - Pr(y = 1|x)}\right] \\ &= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k \end{aligned} \tag{2}$$

which can be translated to the probabilities as

$$\Pr(\text{y} = 1|\text{x}) = \frac{\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)} \tag{3}$$

Once the parameters are estimated, the probability of occurrence can be predicted for a given set of data. The predicted probabilities are important in estimating the marginal effects or the effects of discrete changes and are useful in sensitivity analysis.

2.1.1.5 Results

Table 2.2 shows the logistic regression results. Most of the sets of independent variables had significant effects except birth weight, and mother's smoking on the probability of having asthma. All breastfeeding related variables such as duration of breastfeeding, duration of exclusive breastfeeding, and related indicator variables (except ever breastfed) are found to be significant and negative in all models. Controlling gender, race and ethnicity, age, economic status and maternal smoking, the duration of breastfeeding had a significant protective effect against asthma. The ever breastfed variable was found to be not significant, indicating that breastfeeding should be practiced up to a certain duration to have a protective effect against asthma. This suggests that public health efforts towards increasing breastfeeding duration could benefit from targeted interventions that have the potential to improve asthma care and the overall health of children.

Table 2.2 Coefficient estimates from logistic regression

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
CONSTANT	-1.0245	-1.1322	-1.192	-0.9195	-0.9384
	-0.7782	-1.0183	-1.0162	-1.032	-1.0203
BIRTHWEIGHT	-0.0039	-0.0025	-0.0027	-0.0029	-0.0032
	-0.0027	-0.0033	-0.0033	-0.0033	-0.0033
AGE	0.2874***	0.3283***	0.3268***	0.3145***	0.3142***
	-0.0297	-0.0338	-0.034	-0.0332	-0.0331
PREMATURE	0.4901***	0.4872**	0.4797**	0.4660**	0.4565**
	-0.1582	-0.2	-0.199	-0.1987	-0.2006
MALE	0.5280***	0.5392***	0.5501***	0.5478***	0.5557***
	-0.1	-0.119	-0.12	-0.12	-0.1204
BLACK	0.5965***	0.6962***	0.7063***	0.7069***	0.6970***
	-0.1251	-0.145	-0.1456	-0.1459	-0.1469
HISPANIC	-0.2322	-0.2676*	-0.2690*	-0.2680*	-0.2758*
	-0.1427	-0.1554	-0.1558	-0.1553	-0.1554
M_AGE	-0.1309***	-0.1388**	-0.1417**	-0.1567**	-0.1560**
	-0.0472	-0.0618	-0.0614	-0.0626	-0.0618
M_AGESQ	0.0017**	0.0019*	0.0020*	0.0022**	0.0022**
	-0.0008	-0.001	-0.001	-0.001	-0.001
POVERTY	0.2945**	0.2353	0.2415	0.2344	0.2431
	-0.1223	-0.1483	-0.148	-0.1487	-0.1482
M_HEALTH	0.6443***	0.7932***	0.7776***	0.7957***	0.7958***
	-0.1586	-0.189	-0.1897	-0.1891	-0.1887
SMOKE	0.1152	0.1874	0.2005	0.208	0.1969
	-0.1157	-0.1427	-0.1426	-0.1422	-0.1421
EVERBREASTFED	-0.153				
	-0.1215				
DURATION		-0.0648***			
		-0.0213			
DURATIONSQ		0.0017**			
		-0.0007			
DURATION_6M			-0.3610***		
			-0.12		
EX_DURATION				-0.0457***	
				-0.0152	
EX_DURATION_6M					-0.5137***
					-0.1446
McFadden R-sq.	0.0832	0.0915	0.0911	0.0898	0.0912
N	24992	20140	20140	20212	20212

***, **, and * denotes significance at 0.01, 0.05, and 0.1 level; Standard errors are in parentheses

Source: Estimated by Bureau of Business and Economic Research, UNM

2.1.1.6 Estimation of Annual Medical Expenses attributable to Asthma

We estimated the annual medical expenditures of children and young-adults aged 5-19 years associated with childhood asthma. The average medical expenditures attributable to childhood asthma are estimated using the data from 2011 Medical Expenditure Panel Surveys (MEPS). MEPS is a national representative survey of the civilian population that quantifies a person's total annual medical spending by type of service and source of payment. The data also included information about each person's health conditions as well as socio-demographic characteristics, including age, sex, and race/ethnicity.

2.1.1.7 Method

BBER used a four-equation regression approach to predict annual medical spending attributable to asthma among children ages 5-19 years. This approach was first proposed by authors of the RAND Health Insurance Experiment[5] and is now commonly applied in medical spending analyses. The inclusion of variables describing prevalence of asthma into the regression model allowed us to estimate the expenditures associated with these health conditions. The four equations model is briefly outlined as follows5:

1) Estimate a logit equation for a dichotomous event of positive versus zero medical expenditure.
2) Estimate a logit equation for a dichotomous event of positive versus zero inpatient expense, given that the person has positive medical expenditure.
3) Estimate a linear model on the log scale of positive medical expenses, given that the person has positive medical expenses but no inpatient expenses.
4) Estimate a linear model on the log scale of positive medical expenses, given that the person has positive inpatient expenses.

Finally a consistent estimate of the expected medical expense for medical services based on the four-equation model is given by

$$\mathrm{E(Medical\ Expenditure_i)} = \hat{p}_i\left[(1-\hat{\pi}_i)\exp\left(x_i\hat{\beta}_3\right)\hat{\phi}_3 + \hat{\pi}_i\exp\left(x_i\hat{\beta}_4\right)\hat{\phi}_4\right] \quad (4)$$

where,

$\hat{p}$ = estimated probability of any medical expense,

$\hat{\pi}$ = estimated conditional probability for a medical user to have any inpatient expense

$\exp\left(x_i\hat{\beta}_3\right)\hat{\phi}_3$ = estimate of the conditional expense for medical services, given that the person has positive medical expenses but no inpatient expenses

[5] For detail see (Manning et al., 1987)

$\exp(x_i\hat{\beta}_4)\,\hat{\phi}_4$ = estimate of the conditional expense for medical services, given that the person has positive inpatient expenses

$\hat{\phi}_3, \hat{\phi}_4$ = estimated retransformation factor, each calculated as

$$\hat{\phi}_j = \frac{1}{n_j}\sum_i \exp(\hat{\varepsilon}_{ij})$$

where,

n_j = sample size for equation j,

ε_{ij} = $\ln(y_{ij}) - x_i\hat{\beta}_j$, and

$\hat{\beta}_j$ = OLS estimate of β_j

2.1.1.8 Results

Table 2.3 reports the average annual medical expenses of children and young adults ages 5-19 estimated from four-equation models classified by payers and incidence of having asthma. An individual with incidence of asthma is expected to have a total of $1,878.5 more annual expenses than those without asthma.

Table 2.3 Per Person Average Annual Medical Expenses among children aged 5-19 with and without asthma

Insurance categories	Average Annual Medical Spending ($)		
	With Asthma	Without Asthma	Difference
Private Insurance	590	285	305
Medicaid	1153	248	905
Others	477	200	277
All payers	2887	1008	1879

Source: BBER estimates based on 2011 Medical Expenditure Panel Surveys

2.1.1.9 Effects of Improving Breastfeeding Rate on Annual Medical Expenses

Simulations are performed to estimate the asthma prevalence rate and total annual medical expenses attributable to asthma in relation to breastfeeding rate among children and adolescents aged 5-19 years in New Mexico. Although the estimation procedure is intended to provide the cost difference of asthma treatment for different rates of breastfeeding that is representative to New Mexico population, some of the key parameters used in the simulation are obtained from literatures and data sets that are rather representative to national population. However, whenever

the data are available, the parameters are derived for New Mexico population and are used in the simulation procedure.

2.1.1.10 Simulation Procedure

The main objective of this simulation is to estimate the asthma prevalence and total medical expenses in relation to estimated asthma prevalence rate for a given rate of breastfeeding in New Mexico. Simulations are performed for different rates of breastfeeding, and the prevalence rate and total expenses are computed. In each iteration of the simulations 100,000 individuals are randomly generated and indicator variables for each individual are assigned on the basis of whether or not they are breastfed. Each individual has a possibility of being breastfed and the value of indicator variable depends on the pre-assigned probability. Given the breastfeeding information, each individual has a possibility of having asthma. Finally, each individual is assigned a set of health care expenses depending on whether the individual has asthma. Finally, the average cost per person for each health care expense category is calculated for the entire 100,000 individuals. Since the simulation gives the average health care expenses for all of those who may or may not have asthma, the total expenses for the entire New Mexico population is obtained by multiplying each of the expenses by total population ages 5-19 years.

For breastfeeding rates, two scenarios are considered:

1) Ever-breastfed vs. Never breastfed
2) Breastfed 6 months or more vs. breastfed less than 6 months

The result of the simulations from this study is based on the assumption that there is a causal effect of breastfeeding on childhood asthma so that the likelihood of a child having 'ever asthma' depends on whether the child is breastfed. Therefore, there are three key figures utilized while determining an individual's likelihood of having asthma: a) percentage of children who are breastfed for each category, b) percentage of children having asthma for each breastfeeding category, and c) odds-ratio representing the protective effect of breastfeeding on childhood asthma. The first two components, namely the current rate of breastfeeding and the likelihood of having asthma if never breastfed/ breastfed for less than six months, were obtained from National Survey of Child Health (NSCH) 2011/12 data. From cross-frequency table, determined 11.38 percent of children were never breastfed also had asthma. Similarly, 7 percent of children breastfed for less than six months reported having asthma. The information for the third component, viz. odds ratios, was obtained from a recently published meta-analysis (Dogaru et al., 2014). Table 2.4 summarizes source and values of the key information used in the simulation.

Table 2.4 Key parameters used in the simulation

Source	Key Parameter	Values
NSCH	Ever-breastfed (New Mexico)	80.80%
	Breastfed 6 months (New Mexico)	42.50%
Meta-analysis Study (Dogaru et al., 2014)	Odds-ratio (ever breastfed vs. never breastfed)	0.76667
	Odds-ratio (breastfed ≥6 months vs. < 6 months)	0.70667
BBER Database	Total population ages 5-19 (New Mexico)	428,469

Based on NSCH data, 80.8 percent of the children (ages 0-5 years) in New Mexico are breastfed at least once and 42.5 percent are breastfed for 6 months (Table 2.3). There exists a wide range of studies analyzing the effects of breastfeeding rate on asthma, with many supporting the hypothesis that breastfeeding has protective effects on asthma. However, the actual odds-ratio varies among studies. This study uses the odds-ratio from the recently published meta-analysis (Dogaru et al., 2014). The reported odds ratios are the average values calculated for each breastfeeding category. The average medical expenses were estimated from MEPS data set as described above.

2.1.1.11 Results

The results from simulations reported in Table 2.6 show the asthma prevalence rate and total medical expenses for the current rate of breastfeeding (defined as if the child is ever breastfed), improved rate of breastfeeding (if 10 percent more children were ever breastfed) and the differences. The results suggest that if the current rate of breastfeeding is increased by 10 percent, asthma prevalence rate decreases by 0.26 percent. This decline in asthma prevalence rate results in significant reduction in total medical expenses associated with health care; total expenses (all payers) are estimated to decrease by $2.1 million. The standard deviations and the reported confidence intervals suggest that these differences are statistically significant highlighting the importance of breastfeeding in reducing total medical expenses. The results in Table 2.6 differ from Table 2.5 in terms of the breastfeeding variable used in the analysis. Because the asthma prevalence rate of children breastfed for 6 months or less is lower than those who were never breastfed, the asthma prevalence rate and medical expenses are lower in Table 2.6 than in Table 2.5. This shows that breastfeeding in early stage is more important than the later stage.

Table 2.5 Asthma prevalence rate and medical expenses for current and improved rate of breastfeeding for New Mexico

Prevalence rate and expense categories	Current rate of breastfeeding (when 80.8 percent were ever breastfed)	Improved rate of breastfeeding (if 90.8 percent were ever breastfed)	Difference in asthma prevalence and total expenses for New Mexico
Prevalence Rate	9.23 [9.05, 9.41]	8.96 [8.79, 9.14]	0.26 [0.01, 0.51]
Private Insurance	134,202.8 [133,966.3, 134,440]	133,859 [133,631.4, 134,084.1]	344 [14.4, 671.2]
Medicaid	142,111 [141,409.4, 142,813.5]	141,091 [140,416.5, 141,758.6]	1,020 [42.6, 1,989.8]
Others	96,528 [96,313.2, 96,743.3]	96,216 [96,009, 96,420.1]	312 [13, 609.5]
All Payers	506,204 [504,748.8, 507,662.6]	504,087 [502,688.3, 505,473.3]	2,117 [88.3, 4,129.2]

Notes: Prevalence rates are in percentages and expenses are in $1,000 for entire NM population ages 5-19 years. 95% Confidence Intervals in brackets.

Source: Estimated by Bureau of Business and Economic Research, UNM

Table 2.6 Asthma prevalence rate and medical expenses for current and improved rate of breastfeeding in New Mexico

Prevalence rate and expense categories	Current rate of breastfeeding (when 42.5 percent were breastfed for 6 months)	Improved rate of breastfeeding (if 52.5 percent were breastfed for 6 months)	Difference in asthma prevalence and total expenses for New Mexico
Prevalence Rate	6.13 [5.98, 6.28]	5.92 [5.78, 6.08]	0.2 [-0.01, 0.41]
Private Insurance	130,147.80 [129,952.2, 130,342.2]	129,882 [129,694.5, 130,087]	265.8 [-14.4, 535.2]
Medicaid	130,090 [129,510.2, 130,666.2]	129,302.10 [128,746.1, 129,909.7]	787.9 [-42.7, 1,586.4]
Others	92,845.60 [92,668, 93,022.1]	92,604.20 [92,433.9, 92,790.4]	241.4 [-13.1, 486]
All Payers	481,258.40 [480,055.1, 482,454]	479,623.40 [478,469.5, 480,884.3]	1,635.10 [-88.5, 3,292.2]

Notes: Prevalence rates are in percentages and expenses are in $1,000 for entire NM population ages 5-19 years. 95% Confidence Intervals in brackets
Source: Estimated by Bureau of Business and Economic Research

2.1.2 Relationship between Childhood Obesity and Breastfeeding

2.1.2.1 Background

Obesity among children has both immediate and long-term effects on health and well-being. Obesity has more than doubled in children and tripled in adolescents in the past 30 years with an increase in obese children ages 6-11 years from 7% in 1980 to nearly 18% in 2010 and an increase in obese adolescents ages 12-19 years from 5% to 18% over the same period (National Center for Health Statistics (US), 2011; Ogden CL et al., 2012).

2.1.2.2 Studies on Childhood Obesity and Breastfeeding

Metzger and McDade (2010) use linear, logistic and sibling fixed-effects regression models to evaluate the association between infant feeding history and body mass index in late childhood or

adolescence. Using the data from the 2002 Child Development supplement of the Panel Study of Income Dynamics, the authors conclude that breastfeeding in infancy may be an important protective factor against the development of obesity in the United States. A recent study of 7798 children at nine years of age from Ireland used multivariable analysis to show that children who were breastfed for 13 to 25 weeks were associated with a 38 percent ($p < 0.05$) reduction in the risk of obesity and those who were breastfed for 26 weeks or more were associated with a 51 percent ($p < 0.01$) reduction in the risk of obesity (McCrory and Layte, 2012).

Using an odd-ratio for obesity as outcome variables, two meta-analyses (Arenz et al., 2004; Owen et al., 2005b) show that the breastfeeding has a consistent protective effect against obesity in children with an adjusted odds-ratio of becoming obese after having been breastfed ranging from 0.78 to 0.93 after controlling for other risk factors. Harder et al (2005) use weighted regression on the odds ratio of overweight from 17 published studies to show a significant inverse linear relation between the duration of breastfeeding and the risk of overweight. In another meta-analysis, Owen et al. (2005a) compared the mean differences in BMI between breastfed and formula-fed children. The authors found that the mean BMI associated with breastfeeding was slightly lower the mean BNI associated with formula feeding. Nevertheless, the effect no longer remained significant after taking into account socioeconomics as well as other confounding factors. Beyerlein and Kries (2011) use quantile regression for data on pre-school children in southern Germany to show that the protective effect of breastfeeding was confined to higher BMI percentiles (90^{th} and 97^{th}) with no significant point estimates for middle ranges of percentiles (40^{th} to 80^{th}). Crume et al (2012) found similar results for the data on retrospective cohort children from Denver, Colorado. The authors detected no significant differences in mean levels of childhood adiposity levels between adequate and low breastfeeding status using the linear regression. However, the quantile regression showed lower levels of adiposity levels were associated with adequate breastfeeding for those in the upper percentiles, particularly the 85^{th} and 95^{th} percentiles for BMI. These studies suggest that breastfeeding may shift individual BMI to the mean and prevent being overweight as well as being underweight.

Oddy (2012) explained the mechanisms behind the associations of breastfeeding, formula-feeding and later obesity risk observed in epidemiological studies. Infant feeding practices, growth patterns among infants and presence of bioactive compounds in breast milk have been found to be important mechanisms associated with the protective effects of breastfeeding against obesity. Bottle-fed infants in early infancy are more likely to empty bottle or cup during feeding in late infancy than infants fed directly at the breast (Li et al., 2010). The risk for excess weight during late infancy is negatively associated with breastfeeding intensity but positively associated with infant-initiated bottle emptying during early infancy (Li et al., 2008). Hence formula fed infants may be more likely to have larger meals consuming up to a 20-30% higher volume than breastfed infants (Sievers et al., 2002). However, a recent trial found the role of free glutamate in the infant's regulation of intake, calling into question the claim that formula-feeding impairs infants' abilities to self-regulate energy intake (Ventura et al., 2012).

Infant growth patterns have also been associated with breastfeeding. By the end of first year, formula fed-infants weight on average 400-600 grams more than breastfed infants (Gale et al., 2012). Both observational studies and randomized trials support the hypothesis that a rapid infant growth is related to the higher risk of obesity (Fewtrell, 2011). Few studies have reported the associations between protein intake and growth velocity and weight gain (Axelsson et al., 1989; Fomon et al., 1995). Higher protein content of formula is responsible for an increased growth rate and adiposity during the influential period of infancy (Koletzko et al., 2009). The studies that support this early protein hypothesis have compared the BMI infants fed high-protein formula versus infants fed low-protein formula, showing a higher BMI at 2 years in the high-protein group and that the BMI values are closer to that of breastfed infants in the low-protein group (Grote et al., 2010). High-protein intake during 12 months to 24 months of age was associated with an unfavorable body composition, as measured by BMI and percentage of body fat, at the age of 7 years (Günther et al., 2007). The presence of bioactive compounds such as hormones and growth factors in breastmilk appear to be the most important factor contributing to the protective effects of breastfeeding against obesity in childhood and later in life (Garofalo and Goldman, 1998; Hamosh, 2001; Lustig, 2001; Savino et al., 2009).

2.1.2.3 Association between breastfeeding and childhood obesity (BBER analysis)

BBER used a growth curve model to estimate the association between breastfeeding and obesity among children and young adults. The children and young adult (Child/YA) cohort data from National Longitudinal Survey of Youth 1979 (NLSY79) was used to assess the association between breastfeeding and obesity. NLSY79 is a nationally representative dataset containing information on height and weight of respondents as well as information on breastfeeding and various socioeconomic characteristics. BMI for each respondent was calculated from the reported height and weight of each respondent using standard formula. Obesity is determined by using the CDC's growth chart: a child or adolescent is considered obese if the calculated BMI exceeds 95th percentile of the given age cohort.

2.1.2.4 Method

BBER used two-level mixed effect models to estimate the effect of breastfeeding on obesity. The two-level growth curve model can be written in the simple form as

$$\text{logit}(p_{ij}) = \beta_0 + \beta_1 x_{ij} + u_j + \varepsilon_{ij}, \quad (5)$$

where p_{ij} is the probability that y_{ij} equals one, y_{ij} is the binary response variable representing obesity, x_{ij} are the confounders and u_j is the random effect at level two, ε_{ij} is the level one random effect.

2.1.2.5 Results

Results from the random intercept model are presented in Table 2.7. All of the variables are highly significant. The estimated coefficients of all of the variables representing breastfeeding information have negative signs, which imply that breastfeeding has protective effect against obesity. The coefficient on *EVERBREASTFED* in Model 1 is -0.364, which yields an odds-ratio of 0.695 and indicates that the risk of obesity is 1.44 times higher among children who were never breastfed than among those who were ever breastfed. In Model 2 the variable *DURATION* appears as a quadratic function. Although the estimated coefficient for the $DURATION^2$ term is insignificant, the estimated coefficient for *DURATION* is negative and statistically significant, implying that the risks of obesity decreases with an additional week of breastfeeding (odds-ratio, OR 0.98). The two breastfeeding variables included in Model 3 (*SHORTDURATION* and *LONGDURATION)* both have negative and statistically significant coefficients, implying that breastfed infants have a lower risk of obesity in childhood and adolescence, regardless of whether they were breastfed for a short or long duration. More precisely, children who were never breastfed are 1.318 (OR 0.759) and 1.487 (OR 0.672) times more likely to be obese than are those who were breastfed for a short or long period, respectively.

Regression results are used to calculate the predicted probabilities of obesity among children and adolescents. Model 1 results are used to calculate the predicted probabilities in Figure 1 – the predicted probabilities of obesity at ages 2 through 20 years among male and female children and adolescents with respect to whether they were ever-breastfed. Figure 1 clearly illustrates that predicted obesity probabilities are higher for those who were never breastfed, irrespective of race, ethnicity, or gender. Figure 2.1 is developed using results from Model 2 and shows the predicted probabilities of obesity among 10 year old male children with respect to the duration of breastfeeding. The shape of the probability plots indicate that the protective effects of breastfeeding against obesity is larger during the initial period. Similar relationships between breastfeeding duration and predicted probabilities were obtained at different ages and among females.

The greater importance of the initial weeks of breastfeeding is reiterated by resulted depicted in Figure 2.2, derived using Model 3 regression results. Figure 2.3 shows the predicted probability of obesity as a function of short versus long breastfeeding duration. Predicted probabilities are clearly much lower for breastfed children and adolescents regardless of age, race, ethnicity, or gender. The largest decrease in the predicted probability of obesity stems from the first 24 weeks of breastfeeding; those breastfed for more than 24 weeks have only slightly more protection against obesity than those breastfed for less than 24 weeks.

Table 2.7 Mixed-effect model coefficients for the effect of breastfeeding on obesity

Variables	**Model 1**	**Model 2**	**Model 3**
Fixed Coefficients			
CONSTANT	-4.626***	-4.846***	-4.888***
	(0.234)	(0.238)	(0.239)
AGE	-0.031***	-0.028***	-0.029***
	(0.004)	(0.004)	(0.004)
MALE	0.221***	0.261***	0.265***
	(0.074)	(0.075)	(0.075)
BIRTHWEIGHT	0.012***	0.012***	0.013***
	(0.002)	(0.002)	(0.002)
SMOKE	0.263***	0.323***	0.354***
	(0.080)	(0.082)	(0.082)
HISPANIC	0.487***	0.474***	0.627***
	(0.098)	(0.100)	(0.100)
BLACK	0.549***	0.592***	0.681***
	(0.089)	(0.090)	(0.091)
M_OBESE	1.822***	1.916***	1.816***
	(0.114)	(0.116)	(0.116)
EVERBREASTFED	-0.364***		
	(0.078)		
DURATION		-0.020***	
		(0.004)	
DURATIONSQ		0.000***	
		(0.000)	
SHORTDURATION			-0.276***
			(0.090)
LONGDURATION			-0.397***
			(0.119)
Random Coefficients			
σ_u	2.206	2.232	2.231
Log-likelihood	-11927	-11641	-11643
AIC	23875	23305	23309
BIC	23959	23399	23402
N	36090	35258	35258
Groups	8088	7893	7893

***, **, and * denotes significance at 0.01, 0.05, and 0.1 level

Standard errors in the parentheses

Figure 2.1 Predicted probabilities of obesity among children and adolescent for ever-breastfed and never breastfed during infancy

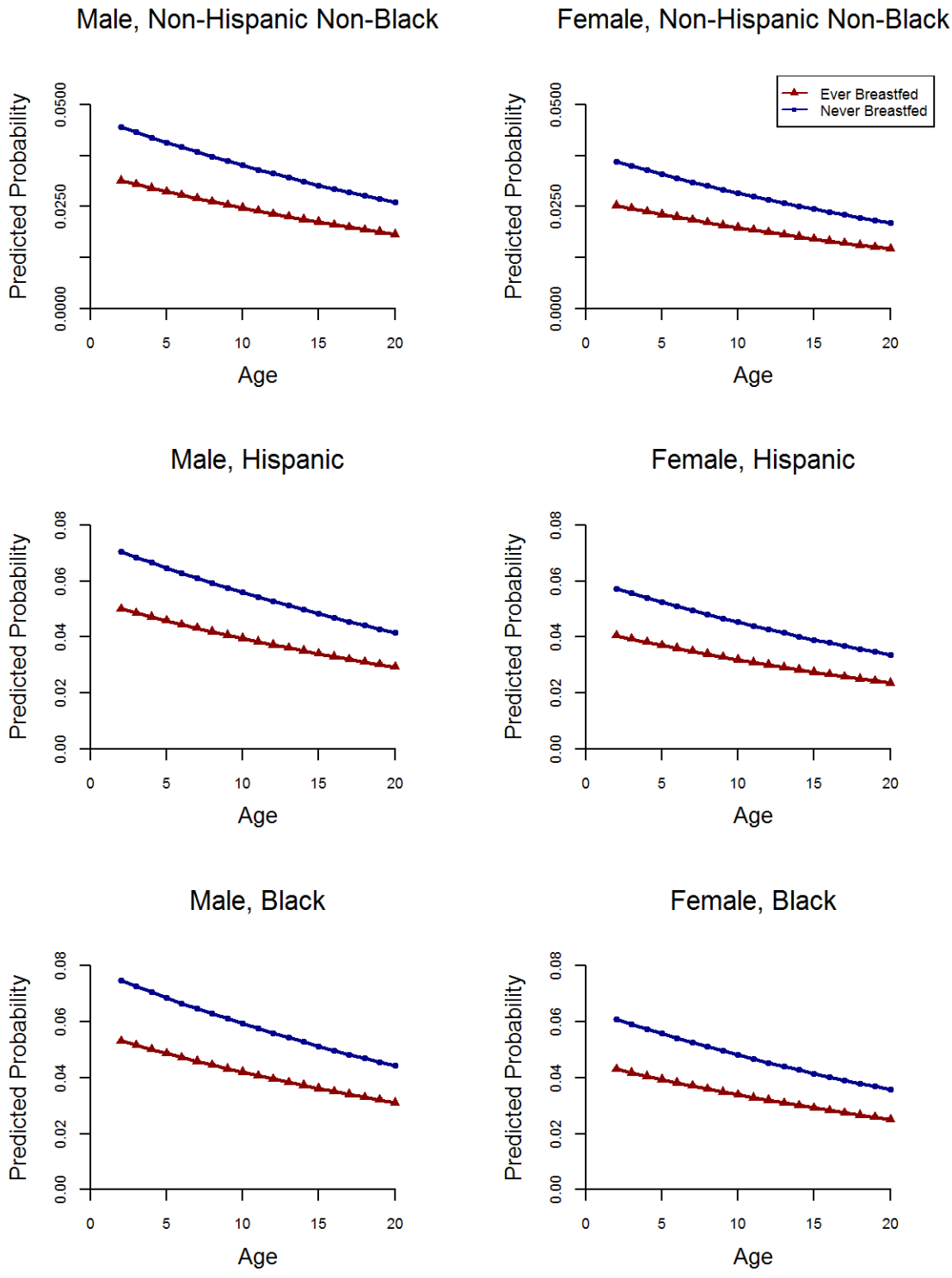


Figure 2.2 Predicted probability of obesity among male children of age 10 years in relation to the duration of breastfeeding during infancy

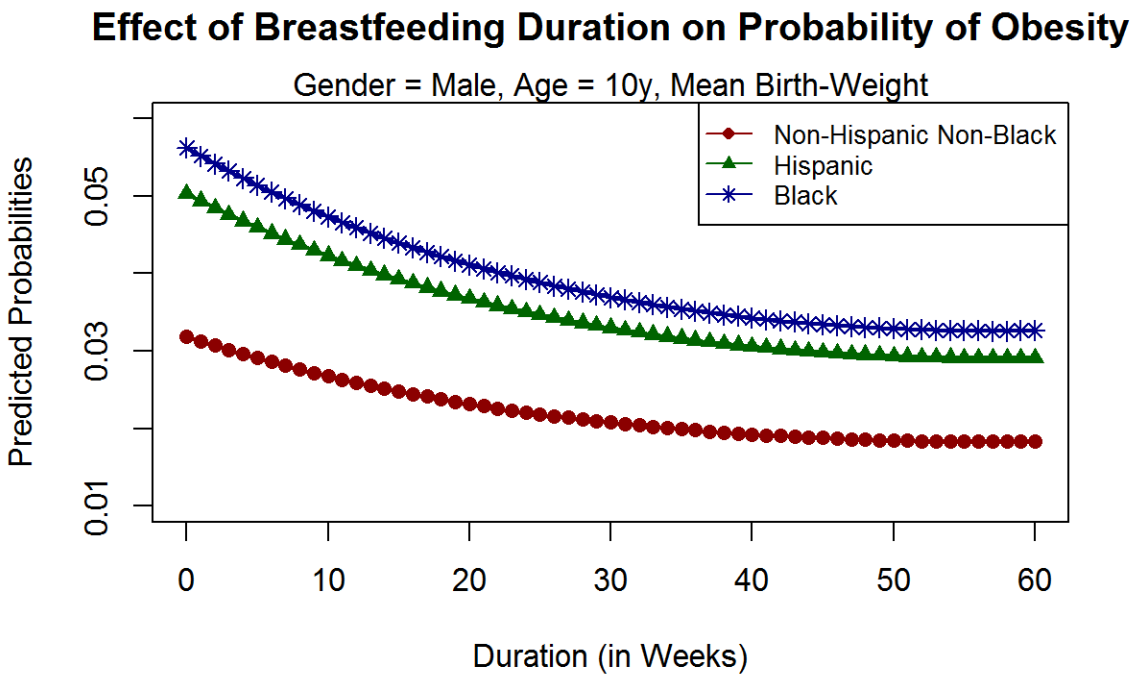
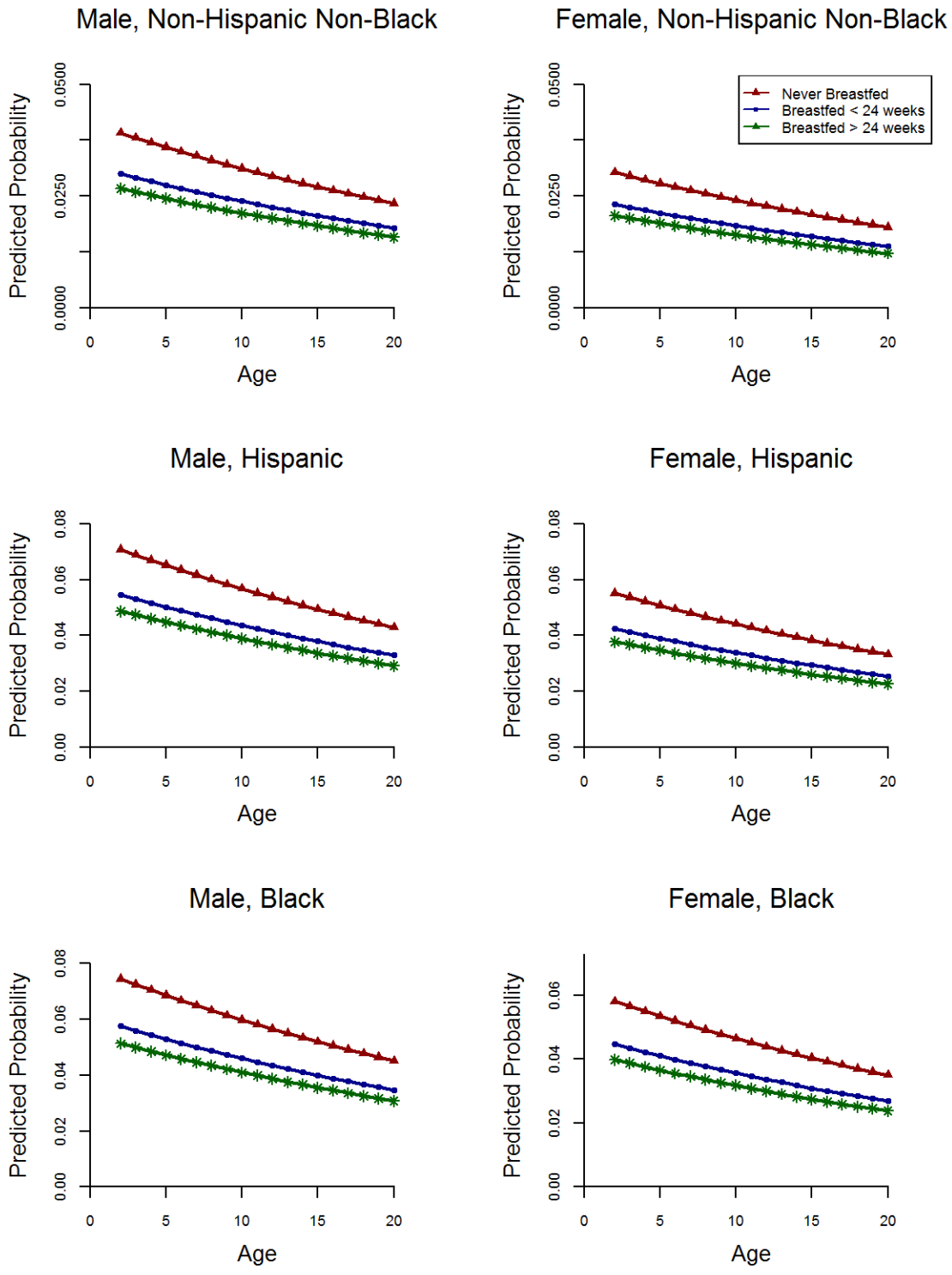


Figure 2.3 Predicted probabilities of obesity for children and adolescents with respect to breastfeeding period during infancy



2.1.2.6 Estimation of Annual Medical Expenses attributable to Childhood and Adult Obesity

We estimated the average annual medical expenditures of children and young-adults aged 6-17 years and adults aged 18 years or more with and without obesity. We utilized the data from 2011 Medical Expenditure Panel Surveys (MEPS) for the estimation of expenses. MEPS data included information about each person's health conditions, medical expenses as well as socio-demographic characteristics, including age, sex, and race/ethnicity. The data also included information on body mass index (BMI) for children and adults, which were used in the estimation of medical expenses associated with obesity.

2.1.2.7 Method

We used a four-equation regression approach to predict annual medical spending attributable to obesity separately for children aged 6-17 years and adults aged 18 years or more. The details of four-equation regression approach are described in the section: 'Estimation of Annual Medical Expenses attributable to Childhood Asthma'.

2.1.2.8 Results

Table 2.8 reports the average annual medical expenses of children and young adults ages 6-17 estimated from four-equation models classified by payers and incidence of obesity. Although the average annual medical expenses for adults have been found to be significantly larger for obese individuals as compared to individuals with normal weight, we did not find similar results among children and young adults.

Table 2.8 Average annual medical expenses among children aged 6-17 with and without obesity

Insurance categories	Average Annual Medical Spending ($)		
	With Obesity	Without Obesity	Difference
Private	203.76	440.01	-236.25
Medicaid	382.08	279.8	102.28
Others	167.02	290.38	-123.36
All payers	1045	1415.1	-370.1

Source: BBER estimates based on 2011 Medical Expenditure Panel Surveys

Table 2.9 reports the average annual medical expenses of adults ages 18 years or more estimated from four-equation models classified by payers and incidence of obesity. The total expenses are $1,074.8 higher for an average obese adult than for non-obese adult.

Table 2.9 Average annual medical expenses among adults aged 18 years or more with and without obesity

Insurance Categories	Average Annual Medical Spending		
	With Obesity	Without Obesity	Difference
Private Insurance	974.2	725.5	248.7
Medicaid	236.1	110.8	125.3
Medicare	960.4	848.5	111.9
OtherExp	1006.4	767.8	238.6
All Payers	3822.2	2747.4	1074.8

Source: BBER estimates based on 2011 Medical Expenditure Panel Surveys

2.1.3 Effects of Improving Breastfeeding Rate on Annual Medical Expenses through obesity

Simulations are performed to estimate the obesity prevalence rate and total annual medical expenses attributable to obesity in relation to breastfeeding rate. The estimation procedure is intended to provide the cost differences resulting from the protective effect of breastfeeding against obesity. Since we did not detect higher costs among obese children than non-obese children, the simulation procedure is performed for estimating the medical expenses for adults aged 20 years or more.

2.1.3.1 Simulation Procedure

The simulation procedure is similar to the one described in Asthma. However, the expenses are estimated for an obese adult rather than for children. In each iteration of the simulations 100,000 individuals are randomly generated and indicator variables for each individual are assigned on the basis of whether or not they are breastfed. Each individual has a possibility of being breastfed and the value of indicator variable depends on the pre-assigned probability. Given the breastfeeding information, each individual has a possibility of being obese. Given that the child is obese, there is a possibility of the individual remaining obese in the later life. Finally, each individual is assigned a set of health care expenses depending on whether the individual has obesity. Finally, the average cost per person for each health care expense category is calculated for the entire 100,000 individuals. Since the simulation gives the average health care expenses for all of those who may or may not have obesity, the total expenses for the entire New Mexico population is obtained by multiplying each of the expenses by total population ages 20 years or more.

The key figures utilized in the simulation are reported in Table 2.10. The rate of ever breastfed for New Mexico is 80.8% and is obtained from NSCH dataset. The prevalence rates of obesity among children with breastfeeding information are obtained from NLSY79 dataset. Serdula et al (1993) reported that about half of the obese school age children remained obese in their adult

life. Therefore, the simulation generates indicator variable denoting obesity at adult life in such a way that only half of the obese children remain obese.

Table 2.10 Key parameters used in the simulation

Source	Key Parameter	Values
NSCH	Ever-breastfed (New Mexico)	80.80%
NLSY	Prevalence rate of obesity among children without breastfeeding	16.14%
	Prevalence rate of obesity among children with everbreastfed	13.08%
BBER Database	Total population ages > 19 (New Mexico)	1,513,533

2.1.3.2 Results

The results from simulations reported in Table 2.11 show the obesity prevalence rate and total medical expenses for the current rate of breastfeeding (defined as whether the child is ever breastfed), improved rate of breastfeeding (if 10 percent more children were ever breastfed) and the differences. The results suggest that if current rate of breastfeeding is increased by 10 percent, obesity prevalence rate among adult decreases by 0.15 percent. This decline in obesity prevalence rate results in significant reduction in total medical expenses associated with health care; total expenses (all payers) are estimated to decrease by $709,000.

It should be noted that the actual obesity prevalence rate among adults may be different than those reported in Table 2.11. For instance, Ogden et al (2014) reported that 16.9% of children and adolescents were obese in 2011/12 whereas 34.9% adults were obese during the same period. Since the goal of this study is to estimate the difference in the obesity prevalence rate resulting from the change in the breastfeeding rate, the obesity prevalence rate reflects only the projection from obese children. The simulation in this study is based on the assumption that half of the obese children remain obese as adults and ignores the other determinants of obesity among adults.

Table 2.11 Obesity prevalence rate and medical expenses for current and improved rate of breastfeeding for New Mexico

Prevalence rate and expense categories	Current rate of breastfeeding (when 80.8 percent were ever breastfed)	Improved rate of breastfeeding (if 90.8 percent were ever breastfed)	Difference in adult obesity prevalence and total expenses for New Mexico
Prevalence Rate	6.84 [6.67, 6.99]	6.68 [6.53, 6.84]	0.15 [-0.07, 0.37]
Private Insurance	318,127.1 [317,954.4, 318,294.4]	317,963 [317,799.8, 318,127.1]	164 [-71.4, 392.2]
Medicaid	51,140 [51,052.8, 51,224.2]	51,057 [50,974.9, 51,139.8]	83 [-36, 197.6]
Medicare	366,822 [366,744.4, 366,897.4]	366,748 [366,674.9, 366,822.1]	74 [-32.1, 176.5]
Other sources	335965 [335,799.3, 336,125.5]	335,807.60 [335,651, 335,965]	157.4 [-68.5, 376.3]
All Payers	1,208,650 [1,207,903.5, 1,209,372.9]	1,207,941 [1,207,235.6, 1,208,649.7]	709 [-308.6, 1694.8]

Notes: Prevalence rates are in percentages and expenses are in $1,000 for entire NM population ages 20 years or more. 95% Confidence Intervals in brackets.

Source: Estimated by Bureau of Business and Economic Research, UNM

2.1.4 Relationship between lower respiratory tract infection and breastfeeding

Among U.S. children and infants respiratory infections are more common than any other medical problem, and three percent of U.S. infants are hospitalized each year with a moderate or severe respiratory infection. Citing a meta-analysis published by Bachrach et al. in 2003, the AAP states that infants who are exclusively breastfed for at least 4 months are 72% less likely to be hospitalized for LRTI (Eidelman et al., 2012).

As noted in the section above pertaining to gastroenteritis, research published by Quigley et al. (2007) uses breastfeeding and outcome data from the same month to assess the effect of current breastfeeding. Outcome data from the months after breastfeeding cessation was used to assess the effects of past breastfeeding. The large sample size (15,890 infants) allowed for more complex analysis and an ability to account for a wide range of potential confounders. Quigley et al. find that infants who were exclusively breastfed were less likely to be hospitalized for LRTI than were infants who were never breastfed (OR_{adj} =0.66, 95% CI 0.47-0.92). As with GI, partial breastfeeding did not have a statistically significant protective effect, and results indicate that breastfeeding's protective effect diminishes after cessation of breastfeeding.

Duijts et al. (2010) report on a portion of the results from an ongoing Generation R Study in the Netherlands (see the section above pertaining to gastroenteritis). The authors find that relative to infants who were never breastfed, infants who were partially breastfed for less at least 4 months had a decreased risk of developing LRTI (OR_{adj} =0.56, 95% CI) between the ages of 7 and 12 months. Additionally, and again relative to never breastfed infants, infants who were exclusively breastfed for at least 4 months and partially breastfed thereafter had a decreased likelihood of LRTI during both the first 6 months of life (OR_{adj} =0.50, CI 0.32-0.79), as well as between 7 and 12 months of age (OR_{adj} =0.46, 95% CI 0.31-0.69).

Fisk et al. (2011) note a gap in the existing literature – much of the existing research has focused on hospital admissions (rather than a broader morbidity outcome) and lacks adjustment for confounders. Fisk et al. use the Southampton Women's Survey (a longitudinal birth cohort study) to focus on the relationship between breastfeeding and LRTI symptoms and adjust for confounders. The analysis presented by Fisk et al. involved 1,764 infants born to the 12,583 women enrolled in the Southampton Women's Survey (SWS). Outcomes of interest were captured both for ages 0-6 months and 6-12 months. Exposure was breastfeeding duration, where breastfeeding was any and all breastfeeding, and thus included mixed feeding. The statistical analysis approach taken by the authors differs from that of others. Univariate regressions were used to assess the relationships between breastfeeding duration (the dependent variable) and various maternal and infant characteristics (such as maternal age, gestational age, etc.). Those variables that were statistically significant were subsequently included in a multivariate breastfeeding duration model. Those variables that were statistically significant in the multivariate model were considered to be potential confounders and were thus included as covariates in the morbidity models. Results indicate that breastfeeding duration decreases the relative risk for all outcomes (including LRTI) during the first 6 months of life. However, breastfeeding duration did not have a statistically significant impact on the relative risk of LRTI during the second 6 months of life. To assess whether the protective effects of breastfeeding endured after cessation of breastfeeding the authors assessed relative risks during the second 6 months of life for those infants who had been breastfed for less than 6 months, and found no evidence for protective effects beyond breastfeeding cessation.

A recent article (Morales et al., 2012) (referred to in the previous section) reports on a prospective population-based study conducted in Spain, for which one of the outcomes of interest was physician-confirmed LRTI diagnosis. The adjusted odds ratios suggests that predominant breastfeeding for 2-4 months has a protective effect against LRTI (OR_{adj} =0.33, 95% CI 0.13-0.86), while predominant breastfeeding for 4-6 months also decreases the risk of LRTI diagnosis between 7 and 14 months of age (OR_{adj} =0.51, 95% CI 0.31-0.83) as well as recurrent LRTIs (OR_{adj} =0.48, 95% CI 0.24-0.96). Estimation of annual medical expenses attributable to LRTI is presented in Section 2.1.11.

2.1.5 Relationship between Gastroenteritis and Breastfeeding

In their 2012 policy statement regarding breastfeeding, the American Academy of Pediatrics (AAP) states that breastfeeding (regardless of exclusivity) is associated with a 64 percent lower incidence of gastoenteritis (gastrointestinal infections) (Eidelman et al., 2012). A meta-analysis conducted by Chien and Howie (2001) is reviewed in the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services 2007 report (Ip et al., 2007), which notes that of the 19 studies reviewed by Chien and Howie, only 4 meet various quality criteria[6].2 Of these 4 studies, 3 provided evidence that breastfeeding reduces the risk of gastroenteritis; the other study found no association.

One of the more recent articles pertaining to the relationship between breastfeeding and gastrointestinal tract infections is that by Morales et al. (2012). The authors report on a prospective population-based study conducted in Spain, for which one of the outcomes of interest was gastroenteritis. Complete information was obtained from 580 (88%) participants. The exposure variable used was "predominant breastfeeding," defined as breastmilk supplemented with non-milk liquids only (e.g. water, tea, fruit juice), for periods of < 2 months, 2-4 months, 4-6 months, and > 6 months. The adjusted odds ratios suggest that predominant breastfeeding for 4-6 months has a protective effect against GI during the first 6 months of life (OR_{adj} =0.34, 95% confidence interval (CI) 0.31-0.83), as well as recurrent GI (OR_{adj} =0.37, 95% CI 0.17-0.77).

Duijts et al. (2010) report on a portion of the results from an ongoing Generation R Study in the Netherlands. The study is a prospective cohort study – nearly 8,000 mothers of children born between 2002 and 2006 were enrolled while pregnant. Infectious disease and breastfeeding duration and exclusivity information was obtained through surveys completed at 6 and 12 months of age. Although the survey did yield information regarding whether the child had experienced a serious gastrointestinal tract infection, the survey did not yield information regarding the number of such infections. In addition to breastfeeding variables, covariates included ethnicity, mother's education, family medical history, gestational age, birth weight, day care attendance, and others. Regression analysis was used to assess the importance of the duration of any breastfeeding and the importance of the duration of exclusive breastfeeding. Relative to infants who were never breastfed, the risk of gastroenteritis during the first 6 months of life was lower in infants who were exclusively breastfed for 4 months and subsequently partially breastfed (OR=0.41, 95% CI 0.26-0.64). However, results pertaining to an association between gastroenteritis during the first 6 months of life and other breastfeeding measures (including partial BF for <4 mo with no BF thereafter, partial BF for 4-6 mo, exclusive BF for 4 mo with no BF thereafter, and exclusive BF for 6 months) were all statistically insignificant. Similarly, no statistically significant associations were found between any of the breastfeeding

[6] The criteria are: controlling for detection bias, analyses of confounders, and using clear definitions of infant feeding practices and outcomes.

measures used in the Duijts et al. study and the occurrence of gastroenteritis between 7 and 12 months of age.

Results from research conducted in the UK were published by Quigley et al. (2007). The breastfeeding exposure variable differs from those used in other studies; the authors used breastfeeding and outcome data from the same month to assess the effect of current breastfeeding, and used outcome data from the months after breastfeeding was ceased to assess the effects of past breastfeeding. The study was also quite large – 15,890 infants were included in the study, allowing for the more complex analysis and an ability to account for a wide range of potential confounders. The authors find that infants who were exclusively breastfed were much less likely to be hospitalized for diarrheal infection than were infants who were never breastfed (ORadj =0.37, 95% CI 0.18-0.78). Partial breastfeeding did not have a statistically significant protective effect. Results also provide statistical evidence that shows that breastfeeding's protective effect diminishes after cessation of breastfeeding. Estimation of annual medical expenses attributable to gastroenteritis with suboptimal breastfeeding is presented in Section 2.1.11.

2.1.6 Otitis media

Otitis media is one of the most common infections affecting children; 44 percent of children have at least one otitis media episode during their first year of life. Formula feeding has been implicated in increasing infants' risk of developing otitis media (OM). In their 2007 meta-analysis of five cohort studies, Ip et al. find that relative to infants who were exclusively breastfed for either 3 or 6 months, those who received any formula during the first 6 months of life were twice as likely to develop acute otitis media (95% CI 1.40-2.78). In addition, relative to those who were ever breastfed, those who were exclusively breastfed had a risk of acute OM that was reduced by 23 percent.

In 2010 McNiel et al. noted that much of the literature uses formula feeding as the normative practice and presents the benefits of breastfeeding rather than the risks of formula feeding. The authors review studies indexed in PubMed that include measures of exclusive breastfeeding, and re-calculate the odds ratios to reflect the risks of formula use. Pooling the results from three otitis media studies[7], McNiel et al. show that the introduction of formula within the first 3 to 6 months of life is associated with an odds ratio of 2.00 (95% CI 1.40-2.78).

Abrahams and Labbok (2011) provide a review of more recently published studies (from 2010 and early-2011). Research conducted in Crete (Ladomenou et al., 2010) found a statistically significant relationship between duration of exclusive breastfeeding and risk of OM in the first year of life, but an insignificant relationship when exclusive breastfeeding was used as a dichotomous variable. Due to its use of a large prospective cohort and precise measures of

[7] Studies included in their review are 1997 and earlier –Duffy et al. (1997), Scariati et al. (1997); Duncan et al (1993).

breastfeeding, Abrahams and Labbok consider the Ladomenou et al. (2010) study to be of particular importance. A Finland study (Hatakka et al., 2010) compared infants partially breastfed for at least 6 months with those partially breastfed less than 6 months and found breastfeeding to be protective (OR=0.20, 95% CI 0.07-0.56). However, the study does not include information regarding exclusivity, which thereby limits the ability to interpret results. As noted by Abrahams and Labbok, a lack of information regarding exclusivity also limits interpretation of results from a study conducted in the Netherlands, which found no associated between acute otitis media in the second year of life and infant feeding practices (Labout et al., 2011). Finally, a small prospective longitudinal study involving 128 children conducted in the US (McCormick et al., 2011) found no relationship between ever breastfeeding and symptom severity. However, this study also lacked information regarding exclusivity, as well as duration. Abrahams and Labbok note that future research should use more precise and consistent definitions of infant feeding alternatives, and should also distinguish between direct breastfeeding and the feeding of breast milk via bottle.

Further support for breastfeeding providing protection against OM is provided by Nokso-Koivisto et al. (2014), who find that infants who are not breastfed (measured as a dichotomous variable) are at increased risk for developing OM (OR=1.46, P value 0.013). Although their study was focused on the issue of whether administering a poliovirus vaccine could decrease the occurrence of otitis media during the first two years of life, Seppala et al. (2011) also control for breastfeeding (specifically, whether the child was breastfed for more than 6 months), gender, age at which daycare attendance began, whether pets are present in the home, and number of siblings. The authors find that breastfeeding had no significant effect on the rate of otitis media infection, although the study suffers from lack of precise breastfeeding measures. Similarly, results from a study published by ?, which measures breastfeeding as not breastfed or breastfed <1 week, 1 week to 3 months, 3-6 months, and >6 months, found no evidence of an association between breastfeeding and otitis media. Estimation of annual medical expenses attributable to otitis media with suboptimal breastfeeding is presented in Section 2.1.11.

2.1.7 Childhood Leukemia

In the United States leukemia is the most common cause of cancer morbidity in children under the age of 15. Acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML) accounted for 78 and 16 percent, respectively, of all childhood leukemia cases diagnosed in the US between 1975 and 1995 (Kwan et al., 2004). Thus ALL and AML are the focus of research pertaining to the association between breastfeeding and childhood leukemia.

Eidelman et al. (2012) (the current AAP policy statement regarding breastfeeding) states that relative to infants who are never breastfed, the risk of developing ALL (AML) is 12 (10) percent lower in infants BF for less than 6 months and 20 (15) percent lower in infants breastfed for 6 months or longer. A meta-analysis by Martin et al. (2005) found that relative to those who were never breastfed, those who were ever breastfed had a 9% decrease in their relative risk for ALL.

Ip et al. (2007) note that a systematic review by Guise et al. (2005) found that high-quality studies yield conflicting results regarding the relationship between breastfeeding and ALL, while a meta-analysis by Kwan et al. (2004) found that short-term BF was associated with a reduced risk of ALL and long-term BF was associated with reduced risk for both ALL and AML. Ip et al. conducted a meta-analysis using 3 of the 4 studies reviewed by Guise et al.[8], and found evidence to suggest that long-term BF is associated with reduced risk of ALL.

Some of the more recent research pertaining to the issue of breastfeeding and childhood leukemia includes Rudant et al. (2010), MacArthur et al. (2008), and Kwan et al. (2005). Rudant et al. report findings derived from the ESCALE case-control study conducted in France during 2003 and 2004[9]. In addition to breastfeeding, the ESCALE study also considered birth order, day care attendance, early infections, contact with farms and farm animals, asthma, eczema, parental profession and education, parental smoking, pesticide exposure, urban/rural living, and maternal age[10]. The regression model yielded an OR of 0.7 (95% CI 0.5-1.0) for breastfeeding for at least 6 months, indicating that breastfeeding is associated with a decreased risk of ALL[11]. MacArthur et al. report on a study of children ages 0-15 living within major Canadian cities and diagnosed with leukemia between 1990 and 1994. In addition to detailed information regarding infant feeding patterns, the study also accounted for various socioeconomic characteristics (e.g. parents' ages, parents' education levels, child's ethnicity, etc.), vaccinations received, illnesses and infections, and vitamin and medication use. Model results indicate that compared with children who were exclusively breastfed; children who were fed breastmilk that was supplemented with more than 50 percent milk had an increased risk of developing leukemia. Kwan et al. (2005) report on findings of the Northern California Childhood Leukemia study, which included children between the ages of 0 and 14 diagnosed with leukemia between 1995 and 2002. The authors controlled for such characteristics as race/ethnicity, birth weight, maternal age at birth, maternal education, and household income. In contrast to results derived by Rudant et al. and MacArthur et al., Kwan et al. find no evidence to support an association between breastfeeding and childhood ALL.

Estimation of annual medical expenses attributable to childhood leukemia with suboptimal breastfeeding is presented in Section 2.1.11.

[8] One of the 4 studies (Rosenbaum et al., 2000) was not included in the Ip et al. meta-analysis because breastfeeding duration information was not reported in the study

[9] The ESCALE study included all children under the age of 15 diagnosed with either acute leukemia, lymphoma, brain tumor, or neuroblastoma in France during 2003 and 2004.

[10] Because a number of the independent variables captured exposures that occurred in the first year of life, only data pertaining to children at least one year of age were included in the regression analyses.

[11] This is the authors' interpretation of their result. Because the 95% CI includes 1.00, we would interpret this finding as statistically insignificant.

2.1.8 Necrotizing enterocolitis

NEC is the third most common cause of death in newborns (Weimer, 2001). Approximately 90 percent of NEC cases occur among infants born prematurely, while 10 percent of cases occur in term babies. NEC often results in death; the mortality rate among well-established cases is between 20 and 40 percent (Lucas and Cole, 1990). Holman et al. (2006) provides NEC rates by region, race, gender, birth-weight, hospital type & size, median HH income by patients' zip code, and primary payer. During 2000, 4,463 infants were hospitalized in the U.S. for NEC (approximately 110 hospitalizations per 100,000 live births) and had a median hospital stay of 49 days. The mortality rate among infants hospitalized for NEC was approximately 15% (approximately 1 in 7). Among very low birth weight infants, the NEC incidence rate is between 7 and 13 percent, while the incidence rate is even higher among extremely low birth weight infants (Meinzen-Derr et al., 2009). Severity is also inversely related to gestational age and birth weight.

In their most recent statement regarding the impacts of breastfeeding on infant and maternal health (Eidelman et al., 2012), the AAP references the 2007 Agency for Healthcare Research and Quality (AHRQ) report and its finding that human milk reduces the incidence of NEC by 58 percent[12]. The AAP also references a more recent study (Sullivan et al., 2010) that finds that preterm infants fed solely human milk were 77 percent less likely to develop NEC than were preterm infants fed a combination of human milk and formula.

In the mid-1980s results from three randomized controlled trials were published (Gross (1983), Behrman et al. (1983), and Lucas et al. (1984)). Each study assessed the risk of NEC as a function of diet, comparing NEC-related health outcomes among preterm infants fed some form of formula (e.g. formula or preterm formula) with outcomes among preterm infants fed some form of human milk (e.g. unfortifed term donor breast milk). A meta-analysis (McGuire and Anthony, 2001) of these three studies found no statistically significant difference in NEC risk among infants. Ip et al. (2007) updates McGuire and Anthony's meta-analysis, including another randomized controlled trial (RCT) – Schanler et al. (2005) – and finds breast milk lowers the risk of developing NEC. Specifically, Ip et al. report a risk ratio of 0.42 (with a 95% CI of 0.18, 0.96) – a small but statistically significant reduction in the occurrence of NEC due to feeding breast milk.

Studies published subsequent to the AHRQ report include one by Meinzen-Derr et al. (2009), who use data pertaining to infants enrolled between October 1999 and August 2001 in a multicenter, randomized, double-masked study conducted by the National Institute of Child Health and Human Development Neonatal Network. Data from a subset of 1,272 of the enrolled infants was used by Meinzen-Derr et al.. The 1,272 infants met various inclusion criteria – the

[12]Because NEC is most common in preterm infants who thus experience difficulties with breastfeeding, the focus of NEC research has been on the differences in health outcomes when human milk (from the mother or a milk bank) is provided compared with formula or cow's milk.

infants had a gestational age of at least 23 weeks, weighed between 401 and 1,000 g at birth, were not moved to a different facility, and survived NEC-free for at least 14 days. The outcome assessed is development of NEC[13] or death between (a) the age of 14 days and (b) either hospital discharge or the age of 120 days, whichever occurred first. The independent variables that are of particular interest are different measures of the amount of maternal milk given, and were measured over the first 14 days of life (an arbitrary cutoff imposed by the authors). Two models were used to assess the effects of maternal milk as (a) the proportion of total (enteral and parenteral intake) and (b) the proportion of enteral intake.

A third model (which included only infants who received at least some maternal milk) was used to assess whether a dose-response relationship exists between the total volume of maternal milk given per unit body weight (ml kg−1) and NEC or death after the age of 14 days. Potential confounders included in the regression analyses were birth weight, race, and various medical care covariates known to be associated with NEC or death. The model that included maternal milk as a portion of total (enteral and parenteral) intake yielded a hazard ratio (HR) of 0.83, with a 95% CI of 0.72 to 0.96. The model that included maternal milk as a portion of enteral intake found no statistically significant relationship. Results from the third and final model indicate that increasing the total volume of maternal milk received during the first 2 weeks of life by 100 ml kg−1 decreased the hazard of NEC or death by 13 percent (HR=0.87, with 95% CI 0.77, 0.97). The study therefore provides credence to the concept of a dose-response relationship between breast milk and NEC.

In a paper aimed at assessing the effects on NEC incidence rates of an exclusively human-milk diet versus a diet comprised of both human milk and bovine milk-based products, Sullivan et al. (2010) report that infants receiving solely a human milk diet experienced lower rates of NEC and NEC requiring surgery. Note – this paper has a somewhat different focus. Earlier research compared the incidence of NEC in preterm infants fed formula and that among those fed preterm infant formula fortified with bovine milk-based human milk fortifier, but found no significant difference. Sullivan et al. compare NEC incidence rates in preterm infants fed mother's milk and donor milk supplemented with human milk-based human milk fortifier (HMF) versus rates in preterm infants fed mother's milk and preterm formula supplemented with bovine milk-based HMF.

Lucas and Cole (1990) randomly assigned 926 preterm babies to one of several feeding programs: (a) donated breastmilk, (b) preterm formula, (c) term formula, (d) mother's milk + donated breastmilk, (e) mother's milk + preterm formula, and (f) mother's milk + term formula. Rate of NEC was the same among infants fed the two different types of formula, and the same between infants fed donated or maternal breastmilk. Lucas and Cole were thus able to divide the 926 infants into 3 groups: formula only, formula + breastmilk, and breastmilk only. Results indicate that infants receiving formula only were 6 times more likely to develop NEC than

[13] Specifically, Belle's stage II or III (Bell et al., 1978)

infants receiving breastmilk only. Infants receiving formula only were also 3.5 times more likely to develop NEC than were infants receiving both formula and breastmilk, which suggests that even when formula is used as a supplement to breastmilk, the breastmilk serves to protect against NEC.

Estimation of annual medical expenses attributable to NEC with suboptimal breastfeeding is presented in Section 2.1.11.

2.1.9 Sudden Infant Death Syndrome

Much of the literature regarding breastfeeding and SIDS is somewhat dated. However, in 2009 published results from a case-control study of SIDS conducted in Germany. Included in the study were 333 infants who died of SIDS and 998 age-matched controls. Conditional logistic regression analysis was used to assess the association between SIDS and breastfeeding while controlling for maternal smoking during pregnancy, maternal age at delivery, socioeconomic status, birth weight, various SIDS risk factors, etc. Three models used three different breastfeeding variables – any breastfeeding at 2 weeks of age; exclusive, partial, or no breastfeeding at 1 month of age; and exclusive, partial, or no breastfeeding during the last month before death (cases) or interview (controls). Results indicate that any breastfeeding at 2 weeks of age provides protection (OR=0.43, 95% CI 0.27-0.69). Although partial breastfeeding at one month of age was not shown to have a protective effect, exclusive breastfeeding was (OR=0.48, 95% CI 0.28-0.82). In the last month before death/interview, both exclusive and partial breastfeeding were shown to be protective; exclusive breastfeeding had an OR of 0.27, 95% CI 0.13-0.56, while partial breastfeeding had an OR of 0.29, 95% CI 0.16-0.53.

In 2011 Hauck et al. published a meta-analysis of studies published between 1966 and 2009. Of twenty-four original case-control studies addressing breastfeeding and SIDS, eighteen passed quality control criteria and were included in the meta-analysis. The association between SIDS and breastfeeding was assessed using three different breastfeeding definitions – (1) any breastfeeding, (2) breastfeeding of any amount at 2 months, and (3) exclusive breastfeeding for any duration. Seven studies provided the information necessary for a multivariate pooled analysis regarding the association of SIDS with any breastfeeding; the analysis yielded an OR of 0.55, with a 95% CI of 0.44-0.69. Only three studies provided information regarding breastfeeding (of any amount) at 2 months of age, and only two of the three provided a multivariate analysis (the remaining study provided only a univariate analysis). Analysis pertaining to the association of breastfeeding at 2 months of age and SIDS was therefore restricted to a univariate analysis, which yielded an OR of 0.38 (95% CI 0.27-0.54). Finally, eight studies provided information regarding exclusive breastfeeding, although the meta-analysis was once again restricted to a univariate analysis due to the lack of multivariate analysis in all 8 studies. The univariate pooled analysis of the association of SIDS and exclusive breastfeeding yielded a summary OR of 0.27 (95% CI 0.24-0.31). The meta-analysis thus provides evidence that breastfeeding offers protection against SIDS, and furthermore, that breastfeeding exclusively

and for longer duration increases breastfeeding's protective effect. Estimation of annual preventable deaths attributable to SIDS with suboptimal breastfeeding is presented in Section 2.1.11.

2.1.10 Illnesses Not Associated with Suboptimal Breastfeeding

BBER conducted binary logit multiple regression to determine if breastfeeding was associated with asthma, diabetes, epilepsy, learning disabilities, speech problems, hearing problems, vision problems, ADD or ADHD, behavioral problems, autism, developmental delay as well as bone, joint or muscle problems (Table 2.12). Only asthma was found to be significantly and positively associated with suboptimal breastfeeding. No other illness was found to be significantly associated with breastfeeding.

Table 2.12 Frequency and percentage of disease prevalence among US children below 5

Illnesses	Frequency of disease prevalence			Percentage of disease prevalence		
	Exclusively		Total	Exclusively		Total
	No	Yes		No	Yes	
Childhood Diabetes	14	9	23	0.07	0.19	0.1
Childhood Asthma	1302	265	1567	6.95	5.64	6.69
Epilepsy	115	26	141	0.61	0.55	0.6
Bone, Joint or Muscle Problem	310	64	374	1.66	1.36	1.6
Learning Disability	304	102	406	3.36	3.63	3.42
Speech Problem	1011	284	1295	8.74	8.07	8.58
Hearing Problem	512	105	617	2.73	2.24	2.63
Vision Problem	132	31	163	0.7	0.66	0.7
ADD or ADHD (Attention Disorder)	148	40	188	1.28	1.14	1.25
Behavioral Problem	107	37	144	0.92	1.05	0.95
Autism	154	57	211	1.33	1.62	1.4
Developmental Delay	629	159	788	5.44	4.52	5.22
Intellectual Disability	69	19	88	0.6	0.54	0.58
Cerebral Palsy	26	12	38	0.22	0.34	0.25
Tourette Syndrome	3	1	4	0.03	0.03	0.03
Therapy	1181	326	1507	6.31	6.94	6.43

Source: Analysis conducted by BBER based on 2011 National Survey of Children Health data

2.1.11 Pediatric Illnesses' Cost estimation

Due to the lack of cost data on various pediatric illnesses, BBER used secondary sources for cost estimation. BBER followed the methodology used by Weimer[14] and Bartick and Reinhold[15]. BBER used breastfeeding data from the 2013 birth cohort of the National Immunization Survey by the Center for Disease Control and Prevention (CDC). The CDC reported some key indicators of breastfeeding such as ever breastfed, breastfeeding at 6 months, breastfeeding at 12 months, exclusive breastfeeding at 3 months, and exclusive breastfeeding at 6 months. Using New Mexico breastfeeding indicators such as those, BBER further expanded to 12 months (Table 2.13).

Table 2.13 Estimated current breastfeeding rate in New Mexico by month

Month	Breastfeeding	Exclusive Breastfeeding	Exclusive Formula
0	85%	85%	15%
1	79%	67%	21%
2	72%	48%	28%
3	66%	30%	34%
4	60%	26%	40%
5	53%	23%	47%
6	47%	19%	53%
7	44%	15%	56%
8	40%	12%	60%
9	37%	8%	63%
10	34%	4%	66%
11	30%	1%	70%

Source: Estimated based CDC's 2013 rates for New Mexico

Bureau of Business & Economic Research, University of New Mexico, 2014

Table 2.14 below shows the odds ratios and incidence rates cost for different illnesses borrowed from the Matrick and Reinhold paper. Following their procedure, we obtained differential incidence of illness in breastfed and non-breastfed children by using the following formula. $x = s/(br + 1 - b)$ where x is the incidence in non-breastfed children, s is the overall incidence of the illness, b is the current breastfeeding rate, r is the odds ratio in favor of breastfeeding, and xr is the incidence of illnesses in breastfeeding children.

The cost data presented in Table 2.14 are in 2007 dollars. The direct cost of otitis media was $156 and total cost was $291 per episode. These cost estimates were obtained from the Agency

[14] Weimer J. *The Economic Benefits of Breastfeeding: A Review and Analysis, Washington, DC.* Food and Rural Economics Division Economic Research Services, US Department of Agriculture, 2001.

[15] Matrick, M. and A. Reinhold. *The Burden of Suboptimal Breastfeeding in the United States: A Pediatric Cost Analysis.* Pediatrics Vol 125 (5), 2010.

for Healthcare Research and Quality, part of the U.S. Department of Health and Human Services. The cost estimates for gastroenteritis were obtained from a secondary source[16]. The average direct cost of visits and hospitalizations were $66.15 and $2,395, respectively. Outpatient indirect costs were $273, including work missed and personal expenses. Bartick and Reinhold obtained NEC cost data from a secondary source[17]. The direct cost of surgical NEC and medical NEC in "very low birth weight" (VLBW) infants was $260,506 and $140,858, respectively. Bartick and Reinhold used Weimer[18]'s figure ($150,406) for surgical NEC. The median cost of hospitalization for a LRTI patient was $4,338[19]. The annual cost of childhood asthma was $773[20]. To obtain the cost of obesity, BBER used the Medical Expenditure Panel Survey 2011 data (please see section: 2.1.2.6). BBER could not find a significant difference in medical expenditure between obese children and non-obese children. However, Bartick and Reinhold used different sources[21] [22] [23] for estimating the cost of childhood obesity. They estimated $1,460 and $2,285, both direct and total cost for childhood obesity per year, respectively. Therefore, BBER used their obesity cost numbers in this analysis. BBER converted all costs in 2013 dollars. Table 2.15 presents age group (of which the cost estimation was based), number of children falling under that group in 2013, number of prevented incidences, type and duration of breastfeeding, 10% increased breastfeeding rate and direct and total cost by illness. The cost for gastroenteritis was separately estimated for hospitalization and outpatient rates. Using separate odds ratios for hospitalization and outpatient visits, BBER estimated six gastroenteritis hospitalization that could have been prevented and 482 preventable outpatient visits. The cost of other illnesses was estimated per year per case basis possibly including both outpatient visit and hospitalization cost. The saving cost for asthma was estimated based on the Medical Expenditure Panel Survey 2011. BBER estimated the total cost savings for asthma by multiplying direct cost by 1.7, the ratio of total to direct cost estimated by Bartick and Reinhold.

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[16] Zimmerman, C.M., J.S. Bresee, U.D. Parshar, T.L. Riggs, R.C. Holman, R.I. Glass. 2001. Cost of diarrhea-associated hospitalizations and outpatient visits in an insured population of young children in the U.S. *Pediatr Infect Dis. Vol 20(1): 14-9.*

[17] Bisquera, J.A., T.R. Cooper, C.L. Berseth. 2002. Impact of necrotizing enterocolitis on length of stay and hospital charges in very low birth weight infants. *Pediatrics Vol 109(3):423-428.*

[18] Weimer, J. 2001. The economic benefits of breastfeeding: a review and analysis. U.S. Department of Agriculture. Food Assistance and Nutrition Research Report No. (FANRR-13) 20.

[19] Obtained from Yorita, K.L., R.C. Holman, C.A. Steiner, et al. 2007. Severe bronchiolitis and respiratory syncytial virum among young children in Hawai. *Pediatr Infect Dis* Vol 26(12):1081-1088.

[20] Obtained from Wang, L.Y. Y. Zhong, L. Wheeler 2005. Direct and indirect cost of asthma in school-aged children. *Prev Chronic Dis* Vol 2(1): A11.

[21] Simpson LA, Cooper J. Paying for obesity: a changing landscape. Pediatrics. 2009;123(suppl 5):S301–S307

[22] Thomson Medstat. 2006. Childhood obesity: costs, treatment patterns, disparities in care, and prevalent medical condition.

[23] Centers for Disease Control and Prevention. Childhood overweight and obesity. Available at: www.cdc.gov/obesity/childhood/index.html and US Department of Health and Human Services and National Institutes of Health. Statistics related to overweight and obesity. www.win.niddk.nih.gov/statistics/#preval.

Table 2.14 Figures and Assumptions used in calculating cost impact for each disease

Illness	Type and Duration of Breastfeeding	OR in favor of Breastfeeding	Overall incidence	Cost
Otitis Media	EBF and any breastfeeding for 3 mo	0.77 for any breastfeeding, 0.5 for EBF	1.9 episodes in first year (reported data are fro children 6-11 mo old)	$156 direct cost per episode, $291 total cost per episode
Gestroenteritis	EBF for 6 mo	0.36	0.222 ambulatory visits, 0.00298 hospitalizations in infants <1 yr old	$66 direct cost per outpatient visit, 2395 direct cost per hospitalization, $339 total costs per outpatient visit: $2668 total cost per hospitalization
Necrotising enterocolitis	Exclusively breast milk fed for 3 mo	Risk Ratio of 0.42	LBW infants: 0.00308; VLBW infants 0.0414	LBW: $150 406 direct cost surgical NEC:$81 219 direct cost medical NEC VLBW:$260 506 direct cost surgical NEC;$140 858 direct cost medical NEC LBW:$155 845 total cost surgical NEC;$84 858 total cost medical NEC; VLBW:$265 945 total cost surgical NEC;$144 497 total cost medical NEC
NEC deaths	Exclusively breast milk fed for 3 mo	Risk Ratio 0.42	LBW: 0.058 of NEC; VLBW: 0.20 of NEC	$10 560 000 per case
Lowr Respiratory Tract Infection	EBF for 4 mo	0.28	0.0409	$4338 direct cost per case; $4680 total cost per case
Death from LRTI	EBF for 4 mo	0.28	0.0000732	$10 560 000 per case
Sudden Infant Death Syndrome	Any breastfeeding	0.64	0.00054	$10 560 000 per case
Childwood Asthma	Any breastfeeding	0.73	0.127	$453 direct cost per y; $3633 direct cost for 10 y; $774 total cost per y; $6602 total cost per case
Childwood deaths from asthma	Any breastfeeding for 3 months	0.73	0.00000273	$10 560 000 per case
Childwood Leukemia	Any breastfeeding for 6 mo	0.81 for All; 0.85 for AML	0.0000321 for ALL (74% of cases) 0.0000113 for AML	$136 444 direct cost per case; $153 617 total cost per case
T1D	Any breastfeeding for 3 mo	0.77 (average of 2 OR listed in AHRQ: 0.81 and 0.73)	0.000186	$4390 direct cost per y; $77 463 direct per case; $7378 total cost per y; $130,187 total cost per case
Deaths from T1D	Any breastfeeding for 3 mo	0.75	0.00000121	$10 560 000 per case
Childhood obesity*	Ever vs Never	0.695	0.176 by age 19 y	$1460 direct cost per y; $28 758 direct cost per case; $2285 total per y; $36,040 total cost per case

ABBREVIATIONS NEC—necrotizing enterocolitis OM— otitis mediaAHRQ—Agency for Healthcare Research and Quality LRTI—lower respiratory tract infection AD—atopic dermatitis SIDS—sudden infant death syndrome T1D—type 1 diabetes CDC—Centers for Disease Control and Prevention OR— odds ratioEBF—exclusively breastfed EFF— exclusively formula fed LBW—low birth weight VLBW—very low birth weight ALL—acute lymphocytic leukemia AML—acute myelogenous leukemia

*Childhood obesity odds ratio is based on BBER analysis

Source: Bartick, M, A. Reinhodl, "The Burden of Suboptimal Breastfeeding in the United States: A Pediatric Cost Analysis, Pediatrics 2010; 125

It is estimated that nearly $27 million in total cost, including nearly $17 million direct cost, could have been saved due to prevented pediatric illness incidences if New Mexico increases the breastfeeding rate by 10%. The first most important childhood health condition was obesity. More than 8,500 childhood obesity incidences could have been prevented accounting for 82% ($22 million) of the cost savings. More than 1,100 prevented asthma incidences accounted for nearly $3.6 million or 13% of the total cost savings. The third most important illness is lower respiratory tract infection (LRTI) of which 108 incidences could have been prevented. LRTI

accounted for about 2% of the total cost savings. BBER estimated that nearly 1 death could have been prevented in New Mexico in 2013 had the breastfeeding rate increased by 10%. Bartick and Reinhold put a $10 million price tag on human life in their study. If we put the similar price tag on prevented deaths from increased breastfeeding rate, additional $10 million could have been saved. Please note that this analysis may underestimate the true pediatric costs of suboptimal breastfeeding, we estimated the effect of breastfeeding on only selected nine pediatric health conditions.

Table 2.15 Estimation of prevented incidences and associated cost saving as a result of 10% increase in current rate of breastfeeding

Name of Illness	Age group	No. of Children in New Mexico in 2013	Type and Duration of Breastfeeding	10% increase in current BF rate	Prevented incidences	Total direct cost savings	Total cost savings
Otitis Media	<1 year old	29,788	Any BF for 6 mo	57%	1,460	$255,811	$477,186
Gestroenteritis	<1 year old	29,788	EBF for 6 mo	29%	482	$16,145	$17,986
Necrotising enterocolitis	low birth weight infants	2,621	EBF for 3 mo	40%	0.6	$51,733	$92,039
NEC deaths	NEC patient	8	EBF for 3 mo	40%	0.033	-	-
LRTI	<1 year old	29,788	EBF for 4 mo	36%	108	$526,007	$567,476
Death from LRTI	<1 year old	29,788	EBF for 4 mo	76%	1.0	-	-
Sudden Infant Death Syndrome	<1 year old	29,788	Any BF for 3 mo	76%	0.8	-	-
Childwood Asthma	5-19 year old	428,469	Everbreastfed	90%	1,114	$2,117,000	$3,598,900
Childwood deaths from asthma	0-10 year old	324,860	Any BF for 3 mo	76%	0.029	-	-
Childwood Leukemia	0-5 year old	177,261	Any BF for 6 mo	57%	0.119	$18,199	$20,489
T1D	0-17 year old	527,597	Any BF for 3 mo	76%	3	$13,125	$22,058
Deaths from T1D	0-17 year old	527,597	Any BF for 3 mo	76%	0.019	-	-
Childhood obesity	0-19 year old	439,904	Any BF for 3 mo	95%	8,574	$13,929,692	$22,011,996
Total						$16,927,712	$26,808,130

Source: All the cost estimates except asthma are estimated by BBER based on Bartick and Reinhold cost data. Asthma direct cost was estimated based on Medical Expenditure Panel Survey 2011. Bartick and Reinhold's estimate for total cost of asthma was 1.7 times the direct cost.

2.2 Cost Analysis of Maternal Illnesses Associated with Suboptimal Breastfeeding

2.2.1 Relationship between Breast Cancer and Breastfeeding

2.2.1.1 Background

According to Breastcancer.org[24], about 1 in 8 U.S. women (just under 12%) will develop invasive breast cancer over the course of her lifetime. In 2013, an estimated 232,340 new cases of invasive breast cancer were expected to be diagnosed in women in the U.S., along with 64,640 new cases of non-invasive (in situ) breast cancer. About 2,240 new cases of invasive breast cancer were expected to be diagnosed in men in 2013. A man's lifetime risk of breast cancer is about 1 in 1,000. Breast cancer incidence rates in the U.S. began decreasing in the year 2000, after increasing for the previous two decades. They dropped by 7% from 2002 to 2003 alone. One theory is that this decrease was partially due to the reduced use of hormone replacement therapy (HRT) by women after the results of a large study called the Women's Health Initiative were published in 2002. These results suggested a connection between HRT and increased breast cancer risk.

About 39,620 women in the U.S. were expected to die in 2013 from breast cancer, though death rates have been decreasing since 1989 — with larger decreases in women under 50. These decreases are thought to be the result of treatment advances, earlier detection through screening, and increased awareness. For women in the U.S., breast cancer death rates are higher than those for any other cancer, besides lung cancer. Besides skin cancer, breast cancer is the most commonly diagnosed cancer among American women. Just under 30% of cancers in women are breast cancers.

White women are slightly more likely to develop breast cancer than African-American women. However, in women under 45, breast cancer is more common in African-American women than white women. Overall, African-American women are more likely to die of breast cancer. Asian, Hispanic, and Native-American women have a lower risk of developing and dying from breast cancer. In 2013, there were more than 2.8 million women with a history of breast cancer in the U.S. This includes women currently being treated and women who have finished treatment.

According to New Mexico Department of Health, in New Mexico 1,310 women are diagnosed with breast cancer and 240 women die of breast cancer each year.

[24] Breastcancer.org is a nonprofit organization dedicated to providing information about breast cancer.

2.2.1.2 Studies on association between breast cancer and breastfeeding

Using data from the Nurses' Health Study[25], Warner et al. (2013) assess the relationships between invasive premenopausal breast cancer and various reproductive factors (e.g. age at menarche, age at first birth, parity, and breastfeeding). The authors were interested in assessing whether the relationships between reproductive factors and premenopausal breast cancer differed for women less than age 40 and older premenopausal women.[26] A mother was considered to have never breastfed if she breastfed for less than 1 month. Breastfeeding duration was measured in yearly increments (i.e., <1 month, 1-12 months, 12-24 months, and ≤24 months). Multivariate relative risks and associated 95% CIs were estimated using Cox proportional hazard models. Results suggest that associations between reproductive factors and the risk of premenopausal breast cancer do not vary with age at diagnosis. Due to the small number of breast cancer cases in women before age 40 (374 cases), numerous Warner et al. analyses suffered from limited statistical power. However the authors did find evidence that ever breastfeeding reduces the risk of breast cancer older premenopausal women (for those less than 40 years of age, relative risk (RR) = 0.84 with a 95% CI of 0.57-1.22; for those age 40 or older, RR = 0.85 with a 95% CI of 0.72-0.99).

Stuebe et al. (2009b) also used data from the Nurses' Health Study (specifically, NHS II) to assess the association between breastfeeding and premenopausal invasive breast cancer[27]. A Cox proportional hazards model was used to model the relative risk of breast cancer as a function of health status (measured by such variables as BMI, physical activity, and alcohol consumption), family breast cancer history, and various reproductive factors (such as age at menarche, parity, age at first birth, and breastfeeding). As in Warner et al. (2013), women who breastfed for less than one month were considered to have never breastfed. Model results suggest that breastfeeding does offer protection against premenopausal breast cancer, but that the protection (a 59 percent reduction in risk; HR=0.41, 95% CI 0.22-0.75) is restricted to women with a first-degree family history of breast cancer. Although the authors also assessed both duration and exclusivity of breastfeeding, neither was found to be a significant determinant of breast cancer risk. To differentiate between the effects of parity and lactation the authors assessed additional models that included only women with 1 child. Findings suggest that the association between breastfeeding and cancer is stronger among women with only 1 child, although duration again was insignificant.

[25] The Nurses' Health Study (NHS I and NHS II) are ongoing prospective cohort studies of U.S. female nurses. NHS I began in 1976 with the enrollment of 121,700 primarily Caucasian nurses ages 30-55. NHS II began in 1989 with the enrollment of 116,608 primarily Caucasian nurses ages 25-42. Questionnaires are mailed to all enrollees biennially, and cover such topics as medical history, risk factors for cancer, and current health status.

[26] NHS I included an assessment of breastfeeding in the 1986 questionnaire, yet no breast cancers were diagnosed among NHS I women less than 40 years of age after the 1986-1988 cycle, Warner et al. (2013) therefore limit their breastfeeding analysis to NHS II.

[27] Women with in situ breast cancer were excluded from the analysis.

Stendell-Hollis et al. (2013) use data from the Women's Health Initiative (WHI) Hormone Trial (HT) and Observational Study (OS), a retrospective cohort analysis, to examine the effect of lactation for a period of at least 24 months on breast cancer risk in postmenopausal women (ages 50-79) exposed and not exposed to hormone therapy[28]. The WHI study gathered information on the following breastfeeding characteristics: number of children breastfed (1-2, 3-5, and >5), age of first and last breastfeeding (<20, 20-24, 25-29, 30-34, and ≥35 years), and cumulative breastfeeding duration (1-3,4-12, 13-23, and ≥24 months)[29]. Hazard ratios and 95% CIs were estimated using Cox proportional hazards regressions stratified by age at diagnosis (<40 and ≥40). The study yielded few statistically significant results pertaining to breastfeeding, but did indicate a significantly increased breast cancer risk (HR=1.66; 95% CI 1.14-2.41) among women in the OS who first breastfed when at least 30 years of age and who reported CEE/MPA[30] hormone use. Breast cancer risk was also higher among women who last breastfed when they were at least 35 years of age (HR=1.50; 95% CI 1.05-2.14). The authors note that analyses pertaining to extended breastfeeding duration of at least 24 months were impeded by a relatively small sample size for such women. Although results have not been consistent, some prior research has indicated that any benefits construed by breastfeeding may diminish with time, and that breastfeeding might be more protective again premenopausal cancer than postmenopausal cancer. The lack of results derived by Stendell-Hollis et al. pertaining to breastfeeding might also be due to the large number of women in the WHI study (65.4%) with BMIs of at least 25 kg/m2. One further drawback to the analysis is the lack of a breastfeeding intensity or exclusivity measure.

The approach taken by Gaudet et al. (2011) differs notably from that of other papers discussed herein – the authors consider breast cancer molecular subtypes. Prior research has shown that among postmenopausal women breast cancer risk factors differ by cancer subtype. Gaudet et al. (2011) apply a multivariate polytomous regression model to case-control data to address this issue among women ≤ 56 years of age. The presence of various breast cancer molecular subtypes was modeled as a function of breastfeeding (specifically, duration in 6 month increments), as well as numerous additional independent variables, including age, numerous reproductive variables (such as age at menarche, ate at first birth, oral contraceptive use, and menopausal status), family breast cancer history, and others. The authors find that women who have done little or no breastfeeding have an increased risk of triple negative breast cancer (OR=0.76, 95% CI 0.64-0.90)[31], 18 but no significant association between breastfeeding and other molecular subtypes of breast cancer. As noted by the authors, understanding the risk factors for triple negative breast cancer is of particular importance due to the lack of targeted therapies, poor 5-

[28] As noted by Stendell-Hollis et al., much of prior research has focused on premenopausal women.
[29] Women who breastfed less than one month were considered to have never breastfed.
[30] CEE/MPA denotes conjugated equine estrogen (CEE) plus medroxyprogesterone acetate (MPA).
[31] Triple negative breast cancer does not express genes for estrogen receptor, progesterone receptor, or Her2/neu. This makes treatment difficult, as most chemotherapies target one of these three receptors.

year survival rate for such cancer, and the fact such cancer accounts for 15-20 percent of all breast cancers.

Ma et al. (2010) assess associations between reproductive factors and postmenopausal diagnosis of (a) invasive breast cancer (in general or by hormone receptor subtype) and (b) breast carcinoma *in situ* (CIS). Data from the California Teachers Study were used in multivariable Cox proportional hazards regression models to assess the relative risks for postmenopausal breast cancer associated with breastfeeding duration, parity, age at first full-term pregnancy, nausea or vomiting during pregnancy, and preeclampsia. Breastfeeding duration is designated as never, <6, 6-11, 12-23, and ≥24 months. The study yielded no evidence of an association between breastfeeding and breast cancer (either CIS or invasive). The lack of statistical evidence for an association between breastfeeding duration and breast cancer may result from the fact that the study focuses on postmenopausal breast cancer – other studies have found stronger associations in younger or premenopausal women, while others have found that the protective effect of breastfeeding diminishes as time after most recent pregnancy increases.

The Long Island Breast Cancer Study Project (1996-1997) was a population-based case-control study involving 3,064 women ages 20 to 98. Shantakumar et al. (2007) used data from the study to assess relationships between various reproductive factors and breast cancer among three sub-groups of women created based upon age and menopausal status: premenopausal, postmenopausal and less than 65 years old, and postmenopausal and 65 years old or older. The study included women recently diagnosed with either in situ or invasive breast cancer. Unconditional logistic regressions were used to model breast cancer as a function of breastfeeding as well as age, education, age at menarche, time to onset of regular menstrual cycles, parity, age at first birth, age at last birth, and time since last birth. Ever having breastfed was found to have no effect on the risk of breast cancer among premenopausal women or postmenopausal women under the age of 65, but decreased the risk of breast cancer among postmenopausal women age 65 or older. Specifically, relative to women who had never breastfed, those who had breastfed had a hazard ratio of 0.67 with a 95% CI of 0.48-0.92. In addition, evidence of a dose-response relationship was found among older postmenopausal women – a longer lifetime duration of breastfeeding was found to decrease the risk of breast cancer (HR=0.40, 95% CI 0.21-0.76).

2.2.1.3 Estimation of Annual Medical Expenses attributable to Breast Cancer

We estimated the average annual medical expenditures of adult females (≥ 25 years) with an incidence of breast cancer diagnosed and compare the results with those without cancer. We utilized the data from 2011 Medical Expenditure Panel Surveys (MEPS) for the estimation of expenses. MEPS data included information about each person's health conditions, medical expenses as well as socio-demographic characteristics, including age, sex, and race/ethnicity.

2.2.1.4 Method

We used a four-equation regression approach to predict annual medical spending attributable to breast cancer among adult females. The details of four-equation regression approach are described in the section: 'Estimation of Annual Medical Expenses attributable to Childhood Asthma'.

2.2.1.5 Results

Table 2.16 reports the average annual medical expenses of adult females aged years or more estimated from four-equation models classified by payers and incidence of breast cancer. On average, the total annual medical expenses were estimated to be larger by $4,236 for adult females with breast cancer as compared to those without an incidence of cancer.

Table 2.16 Per person average annual medical expenses with and without breast cancer

Insurance categories	Average Annual Medical Spending		
	With Breast Cancer	Without Cancer	Difference
Private	1,612	839	773
Medicaid	790	288	502
Medicare	2,013	712	1,301
Others	1,867	767	1,100
All payers	7,054	2,818	4,236

Source: BBER estimates based on 2011 Medical Expenditure Panel Surveys

2.2.1.6 Effects of Improving Breastfeeding Rate on Annual Medical Expenses

We estimated the differences in the breast cancer prevalence rate and direct total annual medical expenses for the entire NM female population of ages 25 year or more. We utilized various sources for the key parameters in estimating the breast cancer prevalence rate and direct medical expenses. We used the relative risk ratio from Warner et al. (2013). The current prevalence rate of breast cancer was obtained from CDC's website (US Cancer Statistics Working Group, 2013). Average annual medical expenses were used from the estimated values utilizing MEPS data (previous section). We obtained the differential incidence of disease in breastfed and non-breastfed women at the current rate of breastfeeding by using the following formula: x= x/(br+1-b), where x is the incidence in non-breastfed women, s is the overall incidence of the disease, b is the current breastfeeding rate, and r is the odds ratio (OR) in favor of breastfeeding. The incidence of disease in breastfed subjects is xr (Weimer, 2001). Table 2.17 reports the estimated differences in breastfeeding prevalence rate and total medical expenses in New Mexico. Nearly $54,000 could be saved in New Mexico if 10% more women ever breastfeed their children. BBER also estimated cost savings by using Bartick et al. method and data in section 2.2.3 and

found that nearly $1 million could be saved if New Mexico increase 11% breastfeeding rate at 1-year.

Table 2.17 Differences in breast cancer prevalence rate and total medical expenses

	Difference in breast cancer prevalence rate and medical expenses (if 10% more women breastfeed)
Prevalence rate	1.81
	[-26.45, 23.56]
Private Insurance	9,819.31
	[-143,361.87, 127,650.98]
Medicaid	6,371.25
	[-93020.21, 82826.22]
Medicare	16,516.31
	[-241,138.12, 214,712.02]
Others	13,968.27
	[-203,936.7, 181,587.48]
All payers	53,783.14
	[-785,233.8, 699,180.78]

Notes: Prevalence rates are in 100,000 and expenses are in $ for entire NM population of female adults. Confidence intervals are estimated using the confidence intervals of RR.

Source: Estimated by Bureau of Business and Economic Research

2.2.2 Relationship between Ovary Cancer and Breastfeeding

2.2.2.1 Background

According to National Cancer Institute, the number of new cases of ovary cancer was 12.3 per 100,000 women per year. The number of deaths was 8.1 per 100,000 women per year. These rates are age-adjusted and based on 2007-2011 cases and 2006-2010 deaths. Approximately 1.4 percent of women will be diagnosed with ovary cancer at some point during their lifetime, based on 2008-2010 data. In 2011, there were an estimated 188,867 women living with ovary cancer in the United States. According to CDC, there were 10.3 to 11 ovarian cancer incidences among per 100,000 women in New Mexico in 2010.

2.2.2.2 Studies on association between ovary cancer and breastfeeding

Most ovarian cancers are epithelial. The potential existence of modifiable risk factors for epithelial ovarian cancer (EOC) is of particular interest due to the fact that EOC is often diagnosed at an advanced stage and has only a 45 percent 5-year survival rate. In 2013 Luan et al. conducted a meta-analysis of 35 case-control and cohort studies published between 1983 and

2012, and assessed the association between EOC and both ever breastfeeding & the duration of breastfeeding. The meta-analysis included 14,465 cases and 706,152 non-cases. Results indicate that ever breastfeeding reduced the risk of EOC by 24 percent (RR 0.76, 95% CI 0.69-0.83), and also provide evidence of a dose-response relationship – every 5-month increase in total breastfeeding duration was associated with an 8 percent decrease in EOC risk (RR 0.92, 95% CI 0.90-0.95). Studies were conducted in a number of different countries, thereby enabling subgroup analysis based upon study population. Results of the subgroup analysis imply that breastfeeding duration has a significant protective effect only in American populations (RR 0.55, 95% CI 0.43-0.71). The authors surmise that this result may be attributed to the greater variation in breastfeeding duration that exists in the American population.

In a September 2007 - November 2011 study of 1,346 women living in Poland (1,144 healthy women and 202 women with ovarian cancer), Pieta et al. (2012) calculate odds ratios associated with various obstetric history variables and the incidence of ovarian cancer. The authors find significant relationships between ovarian cancer and age at menarche, age at menopause, age at first pregnancy, number of pregnancies, miscarriage, age at first live delivery, breastfeeding, and duration of breastfeeding. Relative to those who had breastfed; those who had never breastfed were 1.7 times more likely to develop ovarian cancer (OR 1.73, 95% CI 1.22-2.45).

Between 2001 and 2005 Jordan et al. (2010) conducted a case-control study of epithelial ovarian cancer among parous women between the ages of 17 and 89 living in Australia. Ultimately their results suggest that breastfeeding reduces the risk of ovarian cancer, and that this reduction in risk is independent of the reduction in risk that arises as a result of parity. However, the effect of breastfeeding on the risk of ovarian cancer varied by histological subtype. Various breastfeeding measures were used in regression analyses – ever breastfed, total months of breastfeeding, a categorical total breastfeeding duration variable (0.1-6, 6.1-18, 18.1-30, 30.1-42, and >42 months), and average months of breastfeeding (total duration divided by number of live births). Conditional logistic regressions also included covariates such as age at first birth, duration of oral contraceptive use, menopausal status, family history, and others. Relative to parous women who had never breastfed, those who had ever breastfed had a relative risk of 0.77 (with a 95% CI of 0.61-0.96). Each additional month of breastfeeding was estimated to reduce the risk of ovarian cancer by 1.4%. Results also suggest that the protective effect of breastfeeding varies by histological subtype; no association was found between breastfeeding and serous borderline cancers, and while ever breastfed provided protection against mucinous cancers, the duration of breastfeeding did not appear to matter for this histological subtype.

Using data from the Nurses' Health Study (NHS) and Nurses' Health Study II (NHS II), Danforth et al. (2007) provide a *prospective* analysis pertaining to the relationship between breastfeeding and ovarian cancer. Multivariate Cox proportional hazards regression models were used to assess the association between various breastfeeding measures and the risk of ovarian cancer. Three different breastfeeding measures were used – (1) ever breastfed versus never breastfed, (2) categorical breastfeeding duration (0, 1-6, 7-11, 12-18, 18+ months), and (3)

continuous breastfeeding duration19. Models adjust for age, parity, duration of oral contractive use, tubal ligation, and age at menarche. Results indicate that ever breastfeeding is not significantly associated with ovarian cancer (RR = 0.86, 95% CI 0.70-1.06). However, the median breastfeeding duration was 9 months and thus may not be of sufficient length to yield a significant effect. Analysis using the categorical breastfeeding duration variable suggests that a duration of 18 months or longer yields a protective effect (RR = 0.66, CI 0.46-0.96). Regression results from the model using the "continuous" breastfeeding duration variable indicate a weak protective effect (RR = 0.98, CI 0.97-1.00). As noted by the authors, because the data did not enable assessment of the exclusivity of breastfeeding, the results may underestimate breastfeeding's protective effect.

2.2.2.3 Estimation of Annual Medical Expenses attributable to Breast Cancer

We estimated the average annual medical expenditures of adult females (≥ 25 years) with an incidence of diagnosed ovary cancer and compare the results with those without cancer. We utilized the data from 2011 Medical Expenditure Panel Surveys (MEPS) for the estimation of expenses. MEPS data included information about each person's health conditions, medical expenses as well as socio-demographic characteristics, including age, sex, and race/ethnicity.

2.2.2.4 Method

We used a four-equation regression approach to predict annual medical spending attributable to ovary cancer among adult females. The details of four-equation regression approach are described in the section: 'Estimation of Annual Medical Expenses attributable to Childhood Asthma'.

2.2.2.5 Results

Table 2.18 reports the average annual medical expenses of adult females aged years or more estimated from four-equation models classified by payers and incidence of ovary cancer. On average, the total annual medical expenses were estimated to be larger by $4,851 for adult females with ovary cancer as compared to those without an incidence of cancer.

Table 2.18 Per person average annual medical expenses with and without ovary cancer

Insurance categories	Average Annual Medical Spending		
	With Ovary Cancer	Without Ovary Cancer	Difference
Private	2461	854	1608
Medicaid	8917	288	8629
Medicare	539	689	-150
Others	2178	776	1403
All payers	7709	2858	4851

Source: BBER estimates based on 2011 Medical Expenditure Panel Surveys

2.2.2.6 Effects of Improving Breastfeeding Rate on Annual Medical Expenses attributable to obesity

We estimated the differences in the ovary cancer prevalence rate and direct total annual medical expenses for the entire NM female population of ages 25 year or more. We utilized various sources for the key parameters in estimating the ovary cancer prevalence rate and direct medical expenses. We used the relative risk ratio from Luan et al. (2013). The current prevalence rate of breast cancer was obtained from CDC's website ("Cancer - United States Cancer Statistics (USCS) Data - 2010 State vs. National Comparisons," 2013)

Table 2.19 Differences in breast cancer prevalence rate and total medical expenditures

	Difference in breast cancer prevalence rate and medical expenses (if 10% more women breastfeed)
Prevalence rate	0.31
	[-0.5, 1.11]
Private Insurance	7,951
	[-12,920.52, 28,822.69]
Medicaid	5,721
	[-9,296.72, 20,738.83]
Medicare	4,31.35
	[-7,525.95, 16,788.65]
Others	8,580
	[-13,942.97, 31,103.55]
All payers	11,383
	[-18,498.16, 41,265.12]

Notes: Prevalence rates are in 100,000 and expenses are in $ for entire NM population of female adults. Confidence intervals are estimated using the confidence intervals of RR.

Source: Estimated by Bureau of Business and Economic Research, UNM

2.2.3 Cost Estimation of the Maternal Illnesses Associated with Suboptimal Breastfeeding (based on Bartick et al. methodology and data)

Due to the lack of data, BBER used literature associated with lactation and maternal health and analyzed the health outcomes and cost expected for a New Mexico cohort of 15-year-old females followed to age 70 years. Predictions projected the health and cost for the group up until their 70th year. In 2013, this cohort included 14,013 individuals. BBER analysis was based on methodology and data used by Bartick et al[32]. Table 2.20 summarizes the information used by Bartick et al. in their simulation model. Using Monte Carlo simulations, 90% of mothers were expected to breastfeed for at least 1 year with outcomes under the 2008 one year breastfeeding rate of 23%. Considering direct costs, indirect costs, and costs of premature death (before age 70 years), Bartick et al. modeled cases for breast cancer, premenopausal ovarian cancer, hypertension, type 2 diabetes mellitus, and myocardial infarction (MI, or heart attack). They estimated the direct health cost and indirect cost of morbidity and premature mortality. However, in this study BBER would like estimate preventable death counts only, without a value of statistical life.

To obtain indirect costs for breast cancer and ovarian cancer, Bartick et al. applied the ratio from the National Institute of Health for indirect to direct costs of cancer of 0.229. They obtained the direct cost of invasive breast cancer data from the National Cancer Institute which ranged from $23,867 for a year of diagnosis in women aged 65 years or older, to $97,490 for the final year of life in women younger than 65 years. The same source was used to obtain the direct cost of premenopausal ovarian cancer, which ranges from $102,147 for the year of diagnosis to $8,578 for years after the year of diagnosis and $154,638 for the final year of life. Cost estimates were in 2011 dollars. To obtain the cost of type 2 diabetes, Bartick et al. used secondary sources[33]. Microvascular direct cost were estimated at $3,557 and $893 for microvascular indirect cost. They obtained the direct cost of acute MI from secondary source[34]. The direct and indirect costs of MI were $13,426, and $1,506, respectively. The annual cost for coronary heart diseases varied between $1,599 and $5,782. Annual indirect costs varied from $434 to $648. Bartick et al. mentioned that they used a lowest and most conservative cost estimate.

They simulated the health and healthcare cost for a cohort of 100,000 15-year-old females in 2002. They modeled the cumulative life experience for this cohort through age 70 years. Each year, the subjects were statistically predicted to give birth, breastfeed for 0-18 months, and/or develop one of the five health conditions or dying.

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[32] Bartick M.C, A.M. Stuebe, E. B. Schwarz, C. Luongo, A. Reinhold and E.M. Foster. *Cost Analysis of Maternal Disease Associated with Suboptimal Breastfeeding.* Obstetrics and Gynecology vol 122(1), 2013.

[33] Caro J.J., A.J. Ward, J.A. O'Brien. 2002. Lifetime costs of complications resulting from type 2 diabetes in the U.S. Diabetes Care, vol 25(3): 476-81.

[34] Kauf TI, E.J. Velazquez, D.R. Crosslin, W.D. Weaver, R. Diaz, C.B. Granger, et. al. 2006. The cost of acute myocardial infarction in the new millennium: evidence from a multinational registry. Am Heart vol 151: 206-12.

Table 2.20 Information used by Bartick et al. in their simulation models

Condition	Source	Measure of Association	Effect on Maternal Risk of Condition	Measure of Lactation	Maximum Duration of Lactation With Effect on Condition in Model	Cost Estimates (in 2011 dollars)
Breast cancer	Collaborative Group 2002	Relative risk	4.3% (2.9-5.8%)	Per year lifetime	4 year lifetime	$23,863 for year of diagnosis in women aged 65 years or older to $97,490 for the final year of life in women younger than 65
Premenopausal ovarian cancer	Table 2, Danforth el al, 2007	Relative risk	0.66 (0.46-0.96) 0.82 (0.54-1.24) 0.76 (52-1.11) 0.96 (0.76-1.21) 1.0 (referent)	18 or more mo lifetime 12-17 mo lifetime 7-11 mo lifetime 1-6 mo lifetime Never	18 mo lifetime	$102,147 for the year of diagnosis to $578 for years after the year of diagnosis and $154,658 for the final year of life (before 65)
Type 2 diabetes mellitus	Table 5, Stuebe et al, 2005	Hazard ratio	0.53 (0.40-0.70) 0.76 (0.59-0.98) 0.76 (0.58-0.99) 0.78 (0.57-1.06) 1.03 (0.80-1.35) 1.0 (referent)	More than 23 mo lifetime From 11 to 23 mo More than 6 to 11 mo lifetime From 3 to 6 mo Any lacatation from 0 to 3 mo lifetime Never	24 mo lifetime; risk reduction lasts 15 y after the woman's last birth	Direct cost: $3,557 per year; Indirect cost: $892 per year
Hypertension	Table 3, Stube et al, 2011	Hazard ratio	1.0 (referent) 1.07 (0.99-1.17) 1.09 (1.02-1.18) 1.19 (1.11-1.28) 1.21 (1.12-1.30) 1.22 (1.13-1.32)	12 or more mo per birth 9 to less than 12 mo per birth 6 to less than 9 mo per birth More than 3 to less than 6 mo per birth More than 0 to 3 mo per birth Never	12 mo per birth for up to four births	direct cost:998 per year; indirect cost $98 per year
MI, mycardial infarction	Table 3, Stube et al, 2009	Hazard Ratio	0.66 (0.49-0.89) 0.89 (0.71-1.1) 0.96 (0.76-1.21 0.98 (0.8-1.21) 0.94 (0.79-1.12) 1.0 (referent)	More than 23 mo More than 11 to 23 mo More than 6 to 11 mo More than 3 to 6 mo More than 0 to 3 mo Never	24 mo lifetime risk reduction last 30 y after the woman	Direct cost for acute MI $13,426; indirect cost $1506; After MI, annual ongoing cost for coronary heart disease vary between $1,599 and $5,782; yearly indirect cost: $434 to $648

Source: Bartick et al. 2013

Table 2.21 presents the incidence of maternal illnesses at one year breastfeeding rate of 23% and 34%. the latter is considered as the optimal breastfeeding goal in Healthy People 2020 set by

U.S. Department of Health and Human Services. BBER used the mean difference with one year breastfeeding rate change from 23% to 34% and applied to the New Mexico 15 year old female population in 2013. As indicated in the last column of Table 2.21, there is significant reduction in hypertension (401 incidences), breast cancer (37 incidences) , and MI (104 incidences). Increasing 11% of one year breastfeeding rate would prevent 33 deaths in New Mexico. Bartick et al model found that at national level, 34% breastfeeding in one year would prevent 8.5% (95% CI 3.9-12.7%) of maternal MI, 5.5% (95% CI 4.6-6.6%) of maternal hypertension and 4.3% (95% CI 3.5-5.3%) of the breast cancer.

Table 2.21 Lifetime incidence of maternal conditions at 1-year breastfeeding rate of 23% (in 2008) and 1-year breastfeeding rate of 34%

Diseases	Current rates of breastfeeding, cases/1000 women*	Optimal breastfeeding, cases/1000 women**	Mean difference with change from current to optimal breastfeeding, cases/1000 women (95% CI)	Excess Annual Cases of New Mexico Maternal Diseases Resulting from Suboptimal Breastfeeding (95% CI)
Breast Cancer	61	58.3	2.65 (2.1-3.2)	37 (29-45)
Premenopausal ovarian cancer	0.581	0.566	0.02 (-0.01-0.05)	0 (0-1)
Hypertension	515.7	487.1	28.60 (23.3-34.3)	401 (327-481)
Type 2 Diabetes melitus	67.3	65	2.38(-0.42-4.3)	33 (-6-60)
MI	86.8	79.4	7.41(3.4-11.2)	104 (48-157)
Death before age 70 year	66.1	63.8	2.33(-0.04-4.2)	33 (-1-59)

*Bartick et al. used 2008 1-year breastfeeding rate of 23%. **2020 objectives for breastfeeding in 1-year was 34.1%.

Source: Bartick et al. 2013 for estimation of current rate of breastfeeding and optimal breastfeeding per 100 women and excess annual cases for new mexico are based on 14,013 15-year old New Mexico women per year

Table 3.16 shows the preventable incidences and direct and indirect cost estimates in 2013 dollars at 3% discount rate. BBER converted direct and indirect cost used by Bartick et al. into 2013 dollars for each health condition. Since they estimated cost of life time health condition of 15-year-female cohorts using a different discount rate (0%, 3% and 5%), BBER used a 3% discount rate in this analysis. Among the maternal illnesses associated with suboptimal breastfeeding, hyper tension accounts for the highest expenditures, with $2.8 million (43% of cost savings). The second highest cost savings was estimated for MI ($1.7 million or 25%). Type 2 diabetes accounts for nearly a million dollar savings. Based on Bartick et al. methodology and data, we estimated 33 preventable deaths (from those five causes) and $6.6 million cost savings in 2013 as a result of an 11% increase in breastfeeding rate at one year. In Bartick et al. estimation, using 3% discount rate, the average cost of premature death was $4.15 million. If the same value of statistical life is applied to New Mexico premature deaths (i.e. 33), it would be $137 million every year in 2011 dollars.

Table 2.22 Preventable incidences and direct and indirect cost estimates in 2013 dollars at 3% discount rate

Cost estimation	Preventable Incidences	Direct cost	Indirect cost	Total direct cost	Total indirect cost	Total Cost
Breast Cancer	37	$21,784	$4,988	$808,925	$185,226	$994,151
Premenopausal ovarian cancer	0.2	$109,699	$25,260	$23,430	$5,395	$28,825
Hypertension	401	$6,465	$635	$2,591,074	$254,444	$2,845,518
Type 2 Diabetes melitus	33	$26,129	$6,338	$871,431	$211,384	$1,082,816
MI	104	$13,121	$3,044	$1,362,456	$316,074	$1,678,530
Death before age 70 year	33					
Total cost						$6,629,839

Source: Estimated by BBER using Bartick et al.'s estimates in Table 2.16

References

Arenz, S., Rückerl, R., Koletzko, B., von Kries, R., 2004. Breast-feeding and childhood obesity—a systematic review. International Journal of Obesity 28, 1247–1256. doi:10.1038/sj.ijo.0802758

Axelsson, I.E.M., Ivarsson, S.A., Raiha, N.C.R., 1989. Protein Intake in Early Infancy: Effects on Plasma Amino Acid Concentrations, Insulin Metabolism, and Growth. Pediatric Research 26, 614–615. doi:10.1203/00006450-198912000-00020

Bartick, M.C., A.M. Stuebe, E.B. Schwarz, A.G. Reinhold, E.M. Foster, 2013. Cost Analysis of Maternal Diseases Associated with Suboptimal Breastfeeding. Obstetrics and Gynecology, vol 122(1).

Beyerlein, A., Kries, R. von, 2011. Breastfeeding and body composition in children: will there ever be conclusive empirical evidence for a protective effect against overweight? The American Journal of Clinical Nutrition 94, 1772S–1775S. doi:10.3945/ajcn.110.000547

Brew, B.K., Kull, I., Garden, F., Almqvist, C., Bergström, A., Lind, T., Webb, K., Wickman, M., Marks, G.B., 2012. Breastfeeding, asthma, and allergy: a tale of two cities. Pediatric Allergy and Immunology 23, 75–82. doi:10.1111/j.1399-3038.2011.01229.x

Burgess, S.W., Dakin, C.J., O'Callaghan, M.J., 2006. Breastfeeding Does Not Increase the Risk of Asthma at 14 Years. Pediatrics 117, e787–e792. doi:10.1542/peds.2005-1753

Cancer - United States Cancer Statistics (USCS) Data - 2010 State vs. National Comparisons [WWW Document], 2013. URL http://apps.nccd.cdc.gov/uscs/statevsnational.aspx (accessed 7.3.14).

Crume TL, Bahr TM, Mayer-Davis EJ, et al, 2012. Selective protection against extremes in childhood body size, abdominal fat deposition, and fat patterning in breastfed children. Archives of Pediatrics & Adolescent Medicine 166, 437–443. doi:10.1001/archpediatrics.2011.1488

Dogaru, C.M., Nyffenegger, D., Pescatore, A.M., Spycher, B.D., Kuehni, C.E., 2014. Breastfeeding and Childhood Asthma: Systematic Review and Meta-Analysis. Am. J. Epidemiol. kwu072. doi:10.1093/aje/kwu072

Eichenfield, L.F., Hanifin, J.M., Beck, L.A., Lemanske, R.F., Sampson, H.A., Weiss, S.T., Leung, D.Y.M., 2003. Atopic Dermatitis and Asthma: Parallels in the Evolution of Treatment. Pediatrics 111, 608–616. doi:10.1542/peds.111.3.608

Eidelman, A.I., Schanler, R.J., Johnston, M., Landers, S., Noble, L., Szucs, K., Viehmann, L., 2012. Breastfeeding and the Use of Human Milk. Pediatrics 129, e827–e841. doi:10.1542/peds.2011-3552

Fewtrell, M.S., 2011. Breast-feeding and later risk of CVD and obesity: evidence from randomised trials. Proceedings of the Nutrition Society 70, 472–477. doi:10.1017/S0029665111000589

Fomon, S.J., Ziegler, E.E., Nelson, S.E., Frantz, J.A., 1995. What is the safe protein-energy ratio for infant formulas? The American Journal of Clinical Nutrition 62, 358–363.

Gale, C., Logan, K.M., Santhakumaran, S., Parkinson, J.R., Hyde, M.J., Modi, N., 2012. Effect of breastfeeding compared with formula feeding on infant body composition: a systematic review and meta-analysis. The American Journal of Clinical Nutrition 95, 656–669. doi:10.3945/ajcn.111.027284

Garofalo, R.P., Goldman, A.S., 1998. Cytokines, Chemokines, and Colony-Stimulating Factors in Human Milk: The 1997 Update. Biology of the Neonate 74, 134–142. doi:10.1159/000014019

Gdalevich, M., Mimouni, D., Mimouni, M., 2001. Breast-feeding and the risk of bronchial asthma in childhood: A systematic review with meta-analysis of prospective studies. The Journal of Pediatrics 139, 261–266. doi:10.1067/mpd.2001.117006

Greer, F.R., Sicherer, S.H., Burks, A.W., 2008. Effects of Early Nutritional Interventions on the Development of Atopic Disease in Infants and Children: The Role of Maternal Dietary Restriction, Breastfeeding, Timing of Introduction of Complementary Foods, and Hydrolyzed Formulas. Pediatrics 121, 183–191. doi:10.1542/peds.2007-3022

Grote, V., von Kries, R., Closa-Monasterolo, R., Scaglioni, S., Gruszfeld, D., Sengier, A., Langhendries, J.-P., Koletzko, B., 2010. Protein Intake and Growth in the First 24 Months of Life: Journal of Pediatric Gastroenterology and Nutrition 51, S117–S118. doi:10.1097/MPG.0b013e3181f96064

Guilbert, T.W., Wright, A.L., 2012. Does Breastfeeding Impact Lung Function and Asthma Risk? American Journal of Respiratory and Critical Care Medicine 185, 801–802. doi:10.1164/rccm.201202-0239ED

Günther, A.L., Buyken, A.E., Kroke, A., 2007. Protein intake during the period of complementary feeding and early childhood and the association with body mass index and percentage body fat at 7 y of age. Am J Clin Nutr 85, 1626–1633.

Hamosh, M., 2001. Bioactive Factors in Human Milk. Pediatric Clinics of North America 48, 69–86. doi:10.1016/S0031-3955(05)70286-8

Harder, T., Bergmann, R., Kallischnigg, G., Plagemann, A., 2005. Duration of Breastfeeding and Risk of Overweight: A Meta-Analysis. American Journal of Epidemiology 162, 397–403. doi:10.1093/aje/kwi222

Ip, S., Chung, M., Raman, G., Chew, P., Magula, N., DeVine, D., Trikalinos, T., Lau, J., 2007. Breastfeeding and maternal and infant health outcomes in developed countries. Evid Rep Technol Assess (Full Rep) 1–186.

Koletzko, B., Kries, R. von, Monasterolo, R.C., Subías, J.E., Scaglioni, S., Giovannini, M., Beyer, J., Demmelmair, H., Anton, B., Gruszfeld, D., Dobrzanska, A., Sengier, A., Langhendries, J.-P., Cachera, M.-F.R., Grote, V., 2009. Can infant feeding choices modulate later obesity risk? The American Journal of Clinical Nutrition 89, 1502S–1508S. doi:10.3945/ajcn.2009.27113D

Kull, I., Almqvist, C., Lilja, G., Pershagen, G., Wickman, M., 2004. Breast-feeding reduces the risk of asthma during the first 4 years of life. Journal of Allergy and Clinical Immunology 114, 755–760. doi:10.1016/j.jaci.2004.07.036

Li, R., Fein, S.B., Grummer-Strawn, L.M., 2008. Association of Breastfeeding Intensity and Bottle-Emptying Behaviors at Early Infancy With Infants' Risk for Excess Weight at Late Infancy. PEDIATRICS 122, S77–S84. doi:10.1542/peds.2008-1315j

Li, R., Fein, S.B., Grummer-Strawn, L.M., 2010. Do Infants Fed From Bottles Lack Self-regulation of Milk Intake Compared With Directly Breastfed Infants? Pediatrics 125, e1386–e1393. doi:10.1542/peds.2009-2549

Lustig, R.H., 2001. The neuroendocrinology of childhood obesity. Pediatric Clinics of North America 48, 909–930. doi:10.1016/S0031-3955(05)70348-5

Mandhane, P.J., Greene, J.M., Sears, M.R., 2007. Interactions between breast-feeding, specific parental atopy, and sex on development of asthma and atopy. Journal of Allergy and Clinical Immunology 119, 1359–1366. doi:10.1016/j.jaci.2007.01.043

Manning, W.G., Newhouse, J.P., Duan, N., Keeler, E.B., Leibowitz, A., 1987. Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. The American Economic Review 77, 251–277.

McCrory, C., Layte, R., 2012. Breastfeeding and risk of overweight and obesity at nine-years of age. Social Science & Medicine 75, 323–330. doi:10.1016/j.socscimed.2012.02.048

Metzger, M.W., McDade, T.W., 2010. Breastfeeding as obesity prevention in the United States: A Sibling Difference Model. American Journal of Human Biology 22, 291–296.

National Center for Health Statistics (US), 2011. Health, United States, 2010: With Special Feature on Death and Dying, Health, United States. National Center for Health Statistics (US), Hyattsville (MD).

Oddy, W.H., 2012. Infant feeding and obesity risk in the child. Breastfeeding review: professional publication of the Nursing Mothers' Association of Australia 20, 7–12.

Ogden CL, Carroll MD, Kit BK, Flegal KM, 2012. Prevalence of obesity and trends in body mass index among us children and adolescents, 1999-2010. JAMA 307, 483–490. doi:10.1001/jama.2012.40

Owen, C.G., Martin, R.M., Whincup, P.H., Davey-Smith, G., Gillman, M.W., Cook, D.G., 2005a. The effect of breastfeeding on mean body mass index throughout life: a quantitative review of published and unpublished observational evidence. The American Journal of Clinical Nutrition 82, 1298–1307.

Owen, C.G., Martin, R.M., Whincup, P.H., Smith, G.D., Cook, D.G., 2005b. Effect of Infant Feeding on the Risk of Obesity Across the Life Course: A Quantitative Review of Published Evidence. Pediatrics 115, 1367–1377. doi:10.1542/peds.2004-1176

Savino, F., Fissore, M.F., Liguori, S.A., Oggero, R., 2009. Can hormones contained in mothers' milk account for the beneficial effect of breast-feeding on obesity in children? Clinical Endocrinology 71, 757–765. doi:10.1111/j.1365-2265.2009.03585.x

Sears, M.R., Greene, J.M., Willan, A.R., Taylor, D.R., Flannery, E.M., Cowan, J.O., Herbison, G.P., Poulton, R., 2002. Long-term relation between breastfeeding and development of atopy and asthma in children and young adults: a longitudinal study. The Lancet 360, 901–907. doi:10.1016/S0140-6736(02)11025-7

Sievers, E., Oldigs, H.-D., Santer, R., Schaub, J., 2002. Feeding Patterns in Breast-Fed and Formula-Fed Infants. Annals of Nutrition and Metabolism 46, 243–248. doi:10.1159/000066498

Silvers, K.M., Frampton, C.M., Wickens, K., Pattemore, P.K., Ingham, T., Fishwick, D., Crane, J., Town, G.I., Epton, M.J., 2012. Breastfeeding Protects against Current Asthma up to 6 Years of Age. The Journal of Pediatrics 160, 991–996.e1. doi:10.1016/j.jpeds.2011.11.055

Ventura, A.K., Beauchamp, G.K., Mennella, J.A., 2012. Infant regulation of intake: the effect of free glutamate content in infant formulas. The American Journal of Clinical Nutrition 95, 875–881. doi:10.3945/ajcn.111.024919

Wright, A.L., Holberg, C.J., Taussig, L.M., Martinez, F.D., 2001. Factors influencing the relation of infant feeding to asthma and recurrent wheeze in childhood. Thorax 56, 192–197. doi:10.1136/thorax.56.3.192

3. Business Survey

As part of the cost-benefit analysis of breastfeeding in New Mexico, BBER surveyed New Mexico businesses regarding the cost and availability of nursing room, maternity leave, flex-time, their knowledge about the laws pertaining to the use of breast-pumps in the workplace, and employees' performance. BBER conducted this survey by using Survey Monkey, an internet-based platform from mid-January to the end of April, 2014. The basic purpose of the business survey was not only to collect data, but also to inform businesses about employee management practices and breastfeeding support needed for their employees. It served as an advertisement for breastfeeding support policy in workplaces in New Mexico. As a result, the survey instrument was relatively longer than most business surveys.

With this report BBER will shed light on the knowledge of New Mexico businesses on the laws pertaining to the use of breast pumps in the workplace, their support to nursing employees, cost and availability of nursing room, maternity leave, flexi-time, etc. to the report also addresses the following questions:

- What is the cost for businesses to provide breastfeeding support to their employees?
- Are businesses aware of the laws related to the use of breast pumps in the workplace?
- Do businesses provide nursing space(s) for their breastfeeding employees?
- What kind of breastfeeding-related support do businesses provide for their employees?
- Do businesses provide paid/unpaid maternity leave?
- Is paid maternity leave contingent upon having sufficient balances of annual/sick leave? Or are there separate benefits to cover the cost of maternity leave?
- Are businesses aware of what makes a workplace "breastfeeding friendly"?
- What is the value of productivity loss that accommodates the needs of the breastfeeding employee?
- Are businesses aware to the value in increased productivity from employee job satisfaction due to working in a supportive environment?

3.1 Survey Sample

To produce a representative sample of New Mexico businesses, BBER separated businesses into six categories based on their number of employees. These categories are as follows:

- 1 to 4 employees
- 5 to 10 employees
- 11 to 50 employees
- 51 to 100 employees
- 101 to 250 employees
- 251 or more employees

As a survey sample, BBER included all the largest employers, 50% of the employers who employ 51 to 250 people, 20% of employers who employ 10 to 50 people and 10% of the employers who employ 4 to 10 people and 2.5% from the employers who employ less than 5 people. BBER used the modified Dillman survey method with one pre-notification, a survey message, and one reminder notice. Once the survey was finalized, BBER sent pre-notification emails to 15,441 New Mexico businesses and business departments. BBER found that many emails were invalid, expired or not updated; as a result, the sent e-mails either bounced back or did not reach to the intended respondents. BBER had no way to knowing how many surveys actually reached to intended respondents. Business contact addresses were collected using various databases, including Dun & Bradstreet, InfoUSA, and email-list.com. BBER sent survey messages with the Survey Monkey link to the businesses and/or their departments a week after the pre-notification email was sent. Follow up emails were sent to non-respondent businesses after two to three weeks of the first mailing. BBER received 268 usable survey responses from New Mexico businesses.

3.2 Survey Results

3.2.1 About Respondent Businesses

Table 3.1 presents comparison of percentages between the survey sample and New Mexico businesses population. A total of 268 businesses identified their primary industry. Professional and business services accounted for 26% of the sample, followed by educational services (16%), health care and social assistance (10%), manufacturing (7%) and government (7%) (Table 3.1). Professional and business services and retail trade account for a largest share (12% each) followed by health care (11%), construction (10%) and accommodation and food services (7%). When comparing the survey sample percentage with the New Mexico business establishments' percentage, we found that some sectors are overrepresented (such as educational services, manufacturing) and some sector are underrepresented (such as retail trade and construction). Therefore, we cautiously generalize our results to the New Mexico business population.

Table 3.1 No. of Businesses by Sector in the Sample and Population

NAICS Industry	Survey Sample		New Mexico	
	No. of Businesses	Percent	No. of Businesses	Percent
Professional and Business Services	70	26%	6,612	12%
Educational Services	44	16%	799	1%
Health Care and Social Assistance	27	10%	5,977	11%
Manufacturing	20	7%	1,666	3%
Government	19	7%	3,764	7%
Retail Trade	15	6%	6,385	12%
Finance and Insurance	12	4%	2,722	5%
Information	12	4%	928	2%
Construction	9	3%	5,573	10%
Arts, Entertainment, and Recreation	8	3%	701	1%
Wholesale Trade	8	3%	2,992	5%
Accomodation and food services	7	3%	4,084	7%
Transportation, Warehousing and Utilities	6	2%	1,488	3%
Other Category	11	4%	11,794	21%
Grand Total	268	100%	55,485	100%

Source: Sample data was obtained from business survey conducted by Bureau of Business and Economic Research; and New Mexico business establishment numbers were obtained from New Mexico Department of Workforce Solutions' QCEW unit

Bureau of Business & Economic Research, University of New Mexico, 2013

presents the respondent-businesses by city. Many businesses operate in more than one cities. Most respondent businesses operate in City of Albuquerque (169) followed by Santa Fe (46), Las Cruces (30), and Rio Rancho (10). Our sample represents many other cities such as Los Alamos, Farmington, Alamogordo, Roswell, Clovis, Bloomfield, etc.

Table 3.3 and Table 3.4 present the percentage of female employees by sector and employment category, respectively according to the survey. Across the businesses, 40% of the employments are reported to be taken by women in New Mexico which 7% lower than what reported by Bureau of Labor statistics in 2012. This shows that women are underrepresented in this survey. The survey indicates that 66% of workers in the "healthcare" sector are women. Other businesses that employ women in larger proportions include finance and insurance (51%), “arts, entertainments, and recreation” (47%) and educational services (42%). Women in construction and wholesale businesses comprise less than 20%. Overall, small businesses employ a higher proportion of women compared to larger businesses. Businesses with 50 or less employees have a larger share of female employees (50% or more) compared to businesses with 51 to 200 employees (46%) and businesses with 201 or more employees (38%). (Table 3.4).

Table 3.2 No. of Respondents by City

City	No. of Businesses*
Albuquerque	169
Santa Fe	46
Las Cruces	30
Rio Rancho	10
Los Alamos	9
Farmington	9
Alamogordo	8
Roswell	5
Clovis	5
Bloomfield	4
Bernalillo	4
Carlsbad	4
Taos	4
Gallup	4
Other cities	47
Total	358

*No. of businesses are counted more than once if they operate in more than one cities
Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.3 Percentage of Female Employment by Sector

NAICS Sector	No. of Businesses	Total Employment	Female Employment Percent
Health Care and Social Assistance	27	3,569	66%
Finance and Insurance	12	1,176	51%
Arts, Entertainment, and Recreation	8	598	47%
Educational Services	44	21,368	42%
Government	19	3,555	41%
Manufacturing	20	529	41%
Transportation, Warehousing and Utilities	6	905	39%
Accomodation and food services	7	1,782	35%
Information	12	363	34%
Professional and Business Services	70	16,519	32%
Retail Trade	15	391	31%
Wholesale Trade	8	464	19%
Construction	9	243	15%
Other Category	11	2,021	38%
Grand Total	268	53,483	40%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.4 Percentage of Female Employees by Employment Category

Employment Category	No. of businesses	Total employment	Female employment	Female employee percent
Less than 5	19	45	27	60%
5 to 10	41	313	162	52%
11 to 50	110	2,750	1,366	50%
51 to 200	53	5,517	2,516	46%
201 or more	45	44,858	17,134	38%
Grand Total	268	53,483	21,205	40%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

3.2.2 Awareness about the Breastfeeding Related Laws

Nearly all responding businesses -95% - reported that they are aware of the legal right to breastfeed in public (Table 3.5). 89% of small businesses with less than 5 employees reported that they are aware of the law, whereas 98% of the larger businesses with 201 or more employees reported that they were aware of the law.

Overall, only 56% of businesses reported that they are aware of the New Mexico workplace breast milk pumping law (Table 3.6). The reported level of awareness, however, increases with size of business. Only 37% of businesses with less than 5 employees reported that they are aware about this law, whereas 74% of larger businesses with 201 or more employees reported that they are aware of the law. This shows that creating awareness about the law is equally important as passing the law.

Table 3.7 presents the number of businesses who reported that "they know about what makes a workplace breastfeeding friendly". Overall, 65% of the businesses reported that they know about it. Larger businesses with 201 or more employees reported more awareness (77%) compared to small business with 5 to 10 employees (56%). Information is perhaps more transparent in businesses with less than 5 employees than larger businesses.

Table 3.5 Are you aware that mothers have a legal right to breastfeed in public?

Employment Size	No	Yes	Total	Percent
Less than 5	2	17	19	89%
5 to 10	2	39	41	95%
11 to 50	4	103	107	96%
51 to 200	4	46	50	92%
201 or more	1	42	43	98%
Grand Total	13	247	260	95%

Source: Business survey conducted by Bureau of Business and Economic Researcl
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.6 Are you aware of the New Mexico workplace breastmilk pumping law?

Employment Size	No	Yes	Total	Percent
Less than 5	12	7	19	37%
5 to 10	19	22	41	54%
11 to 50	56	51	107	48%
51 to 200	16	33	49	67%
201 or more	11	32	43	74%
Grand Total	114	145	259	56%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.7 Do you know what makes a workplace breastfeeding friendly?

Employment Size	No	Yes	Total	Percent
Less than 5	6	13	19	68%
5 to 10	18	23	41	56%
11 to 50	44	63	107	59%
51 to 200	13	37	50	74%
201 or more	10	34	44	77%
Grand Total	91	170	261	65%

Source: Business survey conducted by Bureau of Business and Economic Resear
Bureau of Business & Economic Research, University of New Mexico, 2014

3.2.3 Breastfeeding Support

When asked “Does your entity have a space(s) for employees to nurse or express breast milk for their babies?", 260 businesses responded (Table 3.8). Across all businesses, 72% responded with 'yes'. A higher proportion (80% or more) of business with 51 or more employee reported that they have a space for nursing or to express breast milk. Table 3.9 shows the reported “yes” responses to the same question by sector. As expected, manufacturing and construction sector businesses reported the lowest number of 'yes' compared to other sectors. Surprisingly, the government sector was found to be the third lowest sector to report their 'yes' to the same question.

Table 3.8 Does your entity have a space(s) for employees to nurse or express breastmilk for their babies?

Employment Size	Yes/No	Counts	Percentage of 'Yes
Less than 5	Yes	11	58%
	No	8	
5 to 10	Yes	27	66%
	No	14	
11 to 50	Yes	73	68%
	No	34	
51 to 200	Yes	41	84%
	No	8	
201 or more	Yes	35	80%
	No	9	
Total	Yes	187	72%
	No	73	
Grand Total		260	

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.9 Does your entity have a space(s) for employees to nurse or express breastmilk for their babies?

NAICS Industry	No	Yes	Percent of 'Yes'
Professional and Business Services	16	53	77%
Educational Services	13	29	69%
Health Care and Social Assistance	5	20	80%
Government	7	10	59%
Information	2	10	83%
Manufacturing	10	10	50%
Retail Trade	5	10	67%
Finance and Insurance	2	9	82%
Arts, Entertainment, and Recreation	1	7	88%
Wholesale Trade	2	6	75%
Accomodation and food services	2	5	71%
Construction	4	5	56%
Transportation, Warehousing and Utilities	2	4	67%
Other Category	2	9	82%
Grand Total	73	187	72%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.10 presents the number of female employees and nursing spaces by employment size. The total number of nursing spaces for all businesses with less than 5 employees and all businesses with 5 to 10 employees were virtually the same (25 and 26, respectively) despite the total number of all employees of all businesses with 5 to 10 employees being 7 times the total employees of all businesses with less than 5 employees. Additionally, the ratio of female employee/nursing space for businesses with less than 5 employees is 1:1, while for businesses with 5 to 10 employees the ratio is 6:1. This correlation continues as businesses increase in size: the ratio of female employee/nursing space for businesses with 11 to 50 employees is 20:1, for businesses with 51 to 200 employees the ratio is 43:1, and for businesses with 201 or more employees the ratio is 107:1. As expected, larger businesses reported having higher number of nursing spaces than smaller businesses. However, the number of female employees to nursing space ratio is higher for larger employers. Larger employers generally have an advantage over smaller employer to provide nursing space because of economies of scale. In other words, more mothers can utilize the same space for nursing their baby or to express milk.

Table 3.11 presents data on breastfeeding related supports provided by the businesses. The 187 businesses that provided nursing space for employees were asked the specifics of their breastfeeding related support and encouraged to check all that applied. Of the 187 businesses that claimed to provide nursing space for employees, the vast majority (176 businesses) said that "nursing employees were allowed flexible breaks to express milk or nurse their children. In addition, 170 businesses said employees could "store their milk in the staff refrigerator". A large number of businesses also said that "employees were permitted to breastfeed their children" as well as "a private space (not a bathroom) was provided where employees could express milk" (139 businesses and 130 businesses, respectively). And 121 businesses said that they offered "flexible return to work policy (part-time, job-sharing, telecommuting, flex time, etc.)" and 116 businesses said "the nursing room was a multi-use room". Options that resulted in nearly no responses included "employees are provided with names of lactation consultants and other breastfeeding resources" (20 businesses), "a written copy of the business's breastfeeding support policy and education is provided to all staff" (15 businesses), "on-site childcare is available (10 businesses), "breastfeeding / parent support group are offered" (10 businesses), and "prenatal breastfeeding classes are offered" (8 businesses) .

Table 3.9 presents data concerning whether businesses from different sectors have space for employee to nurse or express breast milk for their babies. Of the 260 NAICS Industry businesses, 72% claimed to provide a space(s) for employee to nurse or express breast milk . Within each specific responding industry, at least 50% of businesses claimed to provide space to nurse and expressing breast milk. The most common occurrence of availability was within "Arts, Entertainment, and Recreation" in which 88% of businesses answered positively and only one business responded negatively. Additional industries that had a high percentage of business that provided space included "Information" (83%), "Finance and Insurance" (82%), "Health Care and Social Assistance" (80%), and "Other Category" (82%). In addition, industries such as "Professional and Business Services" (77%), "Wholesale Trade" (75%), and "Accommodation and Food Services" (71%), more represented the average. The lowest percentage of positive responses came from "Educational Services" (69%), "Retail Trade" (67%), "Transportation, Warehousing and Utilities" (67%), "Government" (59%), "Constructive" (56%), and "Manufacturing" (50%).

Table 3.10 Number of Female Employees and Nursing Spaces by Employment Size

Employment Size	No. of Businesses	No. of Employees	No. of Nursing Spaces	No. of Female Employees	Female employee-nursing space ratio
Less than 5	19	45	25	27	1
5 to 10	41	313	26	162	6
11 to 50	110	2,750	70	1,366	20
51 to 200	53	5,517	58	2,516	43
201 or more	45	69,232	182	19,534	107
Grand Total	268	77,857	361	23,605	65

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.11 No. of Businesses Providing Breastfeeding Support

Breastfeeding related support	No. of businesses
Employees are permitted to breastfeed their children on	139
Nursing employees are allowed flexible breaks to express milk or nurse their children.	176
A private space (not a bathroom) is provided where employees may express milk.	130
The nursing room is a multi-use room.	116
Employees may store their milk in the staff refrigerator.	170
On-site childcare is available.	10
Prenatal breastfeeding classes are offered.	8
Breastfeeding / parenting support groups are offered.	10
Employees are provided with names of lactation consultants and other breastfeeding resources.	20
We offer flexible return to work policy (part-time, job sharing, telecommuting, flex time, etc.)	121
A written copy of the business's breastfeeding support policy and education is provided to all staff.	15

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

3.2.4 Maternity Leave

Maternity leave refers to the period of time that a new mother takes off from work following the birth of her baby. When asked "how many days of unpaid maternity leave may an employee take in a year with rights to return to work", 172 businesses responded to the question (Table 3.12). Among those, 3% reported that they do not provide any maternity leave for their employee. This number could be higher because many non-respondents may fall under this category. 11

businesses reported that they provide maternity leave of 10 to 30 days. Nearly half of the businesses (48%) reported that they provide unpaid maternity leave of 51 to 60 days. Only 13% of businesses reported that they provide unpaid maternity leave of 61 days or more. 19% of businesses reported that they have no fixed policy.

Table 3.12 How many days of unpaid maternity leave may an employee take in a year with rights to return to work?

Unpaid maternity leave days	No. of businesses	Percent
Not at all	6	3%
10 to 30	11	6%
31 to 50	10	6%
51 to 60	82	48%
61 and more	23	13%
Don't know	7	4%
No fixed policy	33	19%
Total	172	100%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.13, Table 3.14, and Table 3.15 present the number of paid maternity leave days, condition of getting paid maternity leave, and average number of paid and unpaid maternity leave an employee may take in a year. As reported by the respondent businesses, 30% of the businesses have a provision of maternity leave which is not contingent on having sufficient balances of annual/sick leave. However, this percent may be much lower than this because many businesses did not respond to this question. This is indicated by the responses to follow up question "is there a separate benefit to cover the cost of maternity leave?". Only 16% businesses reported that there was a separate benefit to cover the cost of maternity leave.

Table 3.16 presents the data on average paid and unpaid maternity leave by size of business. Despite the large variation in business size and total number of businesses from each category surveyed, the range of "allowable average unpaid leave days" was relatively small, in which the lowest number of days came from business of 5 to 10, allowing, on average, 55 days, and the largest number of days came from business of 51 to 200, allowing, on average, 64 days. The overall average was 60 days.

Nearly identically, of the 184 businesses that provided paid maternity leave, 41% had 11-50 employees, 20% had 51 to 200 employees, 17% had 201 or more employees, and 14% had 5 to 10 employees, respectively (Table 3.16). Only 8% had less than 5 employees. Unlike unpaid maternity leave, however, there is a direct correlation to the size of the business to the number of "allowable average paid leave days": as the business increases in size, so does the number of

average paid leave days. Businesses of less than 5 employees averaged 22 days, businesses of 5 to 10 employees averaged 23 days, businesses of 11 to 50 employees averaged 30 days, businesses of 51 to 200 employees averaged 52 days, and businesses of 201 or more employees averaged 55 days. The overall average was 37 days (Table 3.16)

Of the 179 businesses that responded, 41% allowed their employees to take paid maternity leave "based on [the employee's] accrued leave balance." 22% of businesses allowed their employees to take "11 to 30" paid maternity leave days. The remaining results are split fairly evenly amongst "31 to 60", "Not at all", "2 to 10", "61 or more", "No fixed policy", and "Don't know" with 9%, 7%, 6%, 6%, 5%, and 3%, respectively (Table 3.13).

Table 3.13 How many days of paid maternity leave may an employee take in a year?

Paid maternity leave days	No. of Businesses	Percent
Not at all	13	7%
2 to 10	10	6%
11 to 30	40	22%
31 to 60	17	9%
61 or more	10	6%
Based on accrued leave balance	74	41%
No fixed policy	9	5%
Don't know	6	3%
Total	179	100%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Of the 178 responses, half or more of each business, regardless of size, confirmed paid maternity leave was contingent upon sufficient balances of annual/sick leave. 81% of businesses with 51 to 200 employees confirmed the necessity of sufficient annual/sick leave, and businesses with 11 to 50 and 201 or more employees confirmed 70% and 69%, respectively. The smallest business sizes confirmed the smallest percentages, with businesses with 5 to 10 and businesses with less than 5 employees confirmed the necessity of sufficient annual/sick leave at 64% and 50%, respectively. Overall, 70% of all businesses confirmed paid maternity leave was contingent upon sufficient balances of annual/sick leave (Table 3.14).

Of the 180 responses, only 25% of businesses with 51 to 200 employees indicated there was a separate benefit to cover the cost of maternity leave (Table 3.15). Similarly, 21% businesses with less than 5 employees also confirmed separate benefits. Businesses of 11 to 50 employees and 5 to 10 employees confirmed separate benefits with 16% and 12%, respectively. Only 3% of businesses with 201 or more employees confirmed separate benefits. Overall, 16% of all business confirmed a separate benefit to cover the cost of maternity leave.

Table 3.14 Is this paid maternity leave contingent on having sufficient balances of annual/sick leave?

Employment Size	No	Yes	Percentage of business who say 'Yes'
Less than 5	6	6	50%
5 to 10	9	16	64%
11 to 50	22	50	69%
51 to 200	7	29	81%
201 or more	10	23	70%
Grand Total	54	124	70%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.15 Is there a separate benefit to cover the cost of maternity leave?

Employment Size	No	Yes	Percentage of business who say 'Yes'
Less than 5	11	3	21%
5 to 10	23	3	12%
11 to 50	63	12	16%
51 to 200	27	9	25%
201 or more	28	1	3%
Grand Total	152	28	16%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.16 Average Unpaid and Paid Maternity Leave by Size of Business

Employment Size	Unpaid maternity Leave		Paid maternity leave	
	No. of Businesses	Allowable average leave days	No. of busineses	Allowable average leave days
Less than 5	19	57	15	22
5 to 10	41	55	26	23
11 to 50	109	59	75	30
51 to 200	53	64	36	52
201 or more	43	59	32	55
Total	265		184	
Average	-	60		37

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

3.2.5 Maternity Leave Provision in Developed Countries

As more women have entered the workforce, maternity leave has increasingly gained greater importance. The median number of weeks of paid leave for mothers among OECD countries was 16 weeks in 2013. Table 3.17 displays the maternity leave duration and source of funding in OECD Countries. Among them, Australia and United Kingdom ranked the highest in providing paid maternity leave for 52 weeks followed by Norway (35 weeks), Slovakia (34 weeks), and Czech Republic (28 weeks). Most countries provide such support through their social security programs or social insurance programs. The United States is one of the few industrialized nations that do not provide paid family leave for new parents. Some parents can take time off under the Family and Medical Leave Act of 1993, which guarantees eligible employees at companies with more than 50 employees 12 weeks of unpaid, job-guaranteed leave for the birth of a child or care of a newborn, adoption of a child, to care for an immediate family member with a serious health condition, or to take medical leave for a serious health condition. As a result, more than 49.3 million employees (44.1%) in US are not eligible for job-protected maternity leave (Jorgensen and Appelbaum[35], 2014). According to this study "young men with high school degrees or less had the lowest rate of FMLA eligibility of all the demographic groups". These numbers would even be larger if it includes self-employed people. Therefore, a job-protected maternity leave mandate may be important to cover all types of jobs and people.

According to the International Labour Organization (ILO), maternity protection is "a fundamental human right and an indispensable element of comprehensive work–family policies… it is crucial to promoting maternal and child health and preventing discrimination against women in the workplace." The intention of maternity protection regulation is to allow women to integrate their reproductive and productive functions positively and to advance corresponding choices in career goals and personal success, without compromising health or economic security.

Mandated maternity leave could provide an opportunity for a new-born baby to have the full-time care of the mothers for initial stage of child's life. This may improves the child's life outcomes which is in turn beneficial to society. There is plenty of literature that supports this hypothesis. For example, using data from Norway, Dahl *et. al*[36] assessed the case for paid maternity leave focusing on parents' responses to a series of policy reforms in Norway which expanded paid leave from 18 to 35 weeks. They attempted to answer four key questions about maternity leave.

[35] "Expanding Federal Family and Medical Leave Coverage: Who Benefits from Changes in Eligibility Requirements?" February 2014, Center for Economic and Policy Research. http://www.cepr.net/documents/fmla-eligibility-2014-01.pdf

[36] "What is the case for paid maternity leave?" By G.B. Dahl, K.V. Loken, M. Mogstad, K.V. Salvanes, NBER Working Paper 19595. http://www.nber.org/papers/w19595.pdf

- "Does paid leave increase available parental time with children, or does it simply crowd out unpaid leave?"
- "What effect does paid leave have on a broad range of child, parent and family outcomes?
- "How do any benefits compare relative to costs?
- "Are there progressive or regressive distributional effects?

Table 3.17 Maternity Leave Duration and Source of Funding in Developed Countries

Country	Duration of maternity leave (in national legislation)	Amount of maternity leave cash benefits (% previous earnings)	Source of funding of maternity leave cash benefits
Australia	52 weeks (parental leave)	18 weeks at the federal minimum wage level	Social security (public funds – federal government)
Austria	16 weeks	100%	Social security (social insurance)
Belgium	15 weeks	82% for the first 30 days; 75% for the remainder (up to a ceiling)	Social security (social insurance)
Canada	17 weeks (federal)	55% for 15 weeks up to a ceiling	Social security (social insurance)
Chile	18 weeks	100% up to a ceiling	Social security (social insurance)
Czech Republic	28 weeks	70%	Social security (social insurance)
Denmark	18 weeks	100%	Mixed (public funds and employer)
Estonia	140 days (20 weeks)	100%	Social security (social insurance)
Finland	105 working days (18 weeks)	70%	Social security (social insurance)
France	16 weeks	100% up to a ceiling	Social security (social insurance)
Germany	14 weeks	100%	Mixed (social insurance for a flat rate benefit and employer liability)
Greece	119 days (17 weeks)	100%	Social security (public insurance and public funds)
Hungary	24 weeks	70%	Social security (social insurance)
Iceland	3 months	80%	Social security (social insurance)
Ireland	26 weeks paid (plus 16 weeks unpaid)	80% up to a ceiling for 26% weeks	Social security (social insurance)
Israel	14 weeks	100% up to a ceiling	Social security (social insurance)
Italy	5 months (22 weeks)	80%	Social security (social insurance)
Japan	14 weeks	66.70%	Social security (social insurance)
Korea, Republic of	90 days (13 weeks)	100%	Mixed (two-thirds employer; one-third social insurance
Luxembourg	16 weeks	100%	Social security (social insurance)
Mexico	12 weeks	100%	Social security (social insurance
Netherlands	16 weeks	100% up to a ceiling	Social security (social insurance)
New Zealand	14 weeks	100% up to a ceiling	Social security (public funds - State)
Norway	35 (or 45) weeks	100% (or 80% for 45 weeks)	Social security (social insurance)
Porland	26 weeks	100%	Social security (social insurance)
Portugal	120 (150) days (17 or 21 weeks)	100% (or 80% for 150 days)	Social security (social insurance)
Slovakia	34 weeks	65%	Social security (social insurance)
Slovenia	105 days (15 weeks)	100%	Social security (social insurance)
Spain	16 weeks	100%	Social security (social insurance)
Sweden	14 weeks	80%	Social security (social insurance)
Switzerland	14 weeks	80% up to a ceiling	Social security and mandatory private insurance (50% employer; 50% employee)
Turkey	16 weeks	66.70%	Social security (social insurance)
United Kingdom	52 weeks	6 weeks paid at 90%; lower of 90%/flat rate for weeks 7-39; weeks 40-52 unpaid	Mixed (employers reimbursed up to 92% by public funds)
United States	**12 weeks (federal)**	**Unpaid**	**No federal programme**

Source: International Labor Organization. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_242615.pdf

Their conclusion for the first question was that additional maternity leave caused an increase in mother's time spent at home after birth, without a reduction in family income. Second, expansion of paid maternity leave "had little effect on a wide variety of outcomes, including children's school outcomes, parental earnings, and participation in the labor market in the short or long run, marriage and divorce". Third, the paid maternity leave resulted in regressive transfer of payments. That means it did not support the low income families. Fourth, it did not impact on future parents tax payments and benefit receipt. The study concludes that "the large increases in public spending on parental leave imply a considerable increase in taxes, at a cost to economic efficiency."

3.2.6 Flexible Work Hours

Of the total 184 business responses, nearly 80% reported that they provide "Part-time" and nearly 70% provide "Flex-time" options for a flexible work environment (Table 3.18). According to this survey, 50% provide staggered hours/shift work, 47% provide working at home/teleworking and only 26% and 15% provide "comp time" and "compressed hours" options for a flexible work environment, respectively).

Table 3.18 No. of Businesses Providing Flexible Work Environment

Flexible working arrangement	No. of Businesses
Part-time	145
Flex-time	125
Staggered hours/shift work	93
Compressed hours	29
Comp time	48
Working at home /Teleworking	86

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.19 presents responses about the main constraints to provide flexible work hours for nursing employees. Of the 81 businesses that responded to this question, 41 businesses showed their "concerns about treating employees equally", 38 businesses reported that they were concerned about "loss of productivity", 26 businesses have their concern about the abuse of policies and so on.

Table 3.19 In your view, what are the main constraints to providing flexible working hours for nursing employees in your entity?

Constraints	No. of Businesses
Concerns about treating employees equally	41
Loss of productivity	38
Resentment from co-workers	27
Concerns about abuse of policies	26
Difficulty with supervision	19
Concerns about reactions of customers and clients	16

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

3.2.7 Cost-Benefit of Breastfeeding Support to Businesses

Table 3.20 shows that whether businesses have any idea about medical cost difference between breastfeeding employees and formula feeding employees. Of the 254 respondents, the vast majority "didn't know" totaling 90%. About 7% said "yes", saying that their breastfeeding employees indeed had lower costs, and 4% said "no".

Table 3.20 Research has shown that there are lower medical costs and health insurance claims for breastfeeding employees and their infants (relative to formula-fed). Is this true for your entity?

Employment Size	Yes	No	Don't know	Grand Total
Less than 5	4	0	15	19
5 to 10	2	1	35	38
11 to 50	9	5	92	106
51 to 200	1	1	48	50
201 or more	1	2	38	41
Grand Total	17	9	228	254
Percent	7%	4%	90%	100%

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.21 presents the reported average monthly value of productivity loss to accommodate the needs of a breastfeeding employee. A majority of the businesses (54%) said that they did not incur any cost to accommodate the needs of a breastfeeding employees. 14 businesses (12%) reported the average monthly value of productivity loss between $6 to $1,000 per month. When both categories were combined, the data indicate an average loss $67 per month. Finally, nearly one fourth of the businesses reported that they have no idea about the loss of productivity.

Table 3.21 Average monthly value of productivity loss to accommodate the needs of a breastfeeding employee

Average monthly value	No. of Businesses	Percent
$0	65	54%
$6	1	1%
$10	2	2%
$200	3	3%
$300	2	2%
$450	1	1%
$500	1	1%
$600	1	1%
$750	1	1%
$800	1	1%
$1,000	1	1%
Don't know	27	23%
N/A	14	12%
Total	120	100%
Average monthly value	$67	

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

When asked to estimate the long-term average monthly value of increased productivity from employee job satisfaction due to working in a supportive environment, 86 businesses responded (Table 3.22). A majority (60%) reported that they "do not know but save a lot". Nearly one fifth of the businesses reported that they "do not know" and 13% (11) businesses provided average monthly value of increased productivity up to $5,000. The average of reported average monthly value of increased productivity is $1,320. This number may be too high for many business who employ minimum wage workers but even if one fourth of this is true, it would be very large ($330*785,000 = $259 million). When compared with productivity loss of $67 (Table 3.21), this amount is nearly 20 times higher. This shows that businesses can benefit significantly by providing supportive environment to their employees including breastfeeding employees.

Table 3.22 Long-term average monthly value of increased productivity from employee job satisfaction due to working in a supportive environment

Average monthly value	No. of Businesses	Percent
$0	1	1%
$10	1	1%
$450	1	1%
$600	1	1%
$900	1	1%
$1,000	1	1%
$1,125	2	2%
$1,313	1	1%
$3,000	1	1%
$5,000	1	1%
Don't know	15	17%
Don't know but save a lot	52	60%
N/A	8	9%
Grand Total	86	100%
Average of average monthly value	$1,320	

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 3.23 presents estimated average monthly and annual cost of maintaining nursing spaces for New Mexico businesses. The businesses who reported that they provide nursing space for breastfeeding employees were asked to estimate the cost of providing nursing space such as breast pumps, furnishing, refrigerator, rental, utilities, etc. Since many businesses used multi-purpose room for this purpose, they did not have additional expenses. Fewer businesses (36 to 47) provided the cost information. Please see appendix .. for details.

According to the Bureau of Labor Statistics, women accounted for 47.8% of all employees in 2012. Using the same percentage, it is estimated that there were 375,000 women in the workforce in New Mexico. BBER survey shows 71% of businesses have a space(s) for employee to nurse or express breast milk for their babies. It is estimated that each nursing space is shared by 65 women including non-nursing women in New Mexico. Using this ratio, BBER estimated a total 4,097 nursing spaces in New Mexico. This does not mean that businesses provided those many dedicated rooms for nursing employees. This simply means that 71% of New Mexico businesses are accommodating nursing employees need by providing clean, private, non-bathroom space including multipurpose rooms, offices, etc.

On average, 71% of New Mexico businesses are spending $87 per month per nursing space. Annual cost of 4,097 nursing spaces is estimated to be $4.2 million (Table 3.23). This number is very small if compared with the conservative estimate of the long-term average monthly value

($330*785,000=$259 million) of increased productivity from employee job satisfaction due to working in a supportive environment.

Table 3.23 Estimated average annual cost of nursing spaces for New Mexico businesses

Cost Item	One time cost	Average monthly cost	Number of nursing spaces*	Annual cost	Assumptions
Breast pump	$50	$2.08	5,740	$143,505	A breast pump lasts for 2 years
Nursing room furnishings	$321	$3.34	5,740	$230,325	Furnitures last for 8 years
Refrigerator	$265	$3.15	5,740	$217,307	A refrigerator lasts for 7 years
Nursing space rent	-	$57	5,740	$3,926,295	
Utility cost	-	$21	5,740	$1,446,530	
Total		$87		$5,963,963	

*Number of nursing spaces is estimated using New Mexico female employee percent times number of total New Mexico employment divided by female employee/nursing space ratio. ((785,448*47.8%)/65)

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A Cost Estimation of Nursing Space(s)

Appendix A. 1 Breast pump cost

Breast pump cost ($)	No. of Business
$0	17
$50 to $400	4
N/A	9
Already had	4
Total	34
Average cost ($)	50

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A. 2 Nursing-space furnishing cost

Furnishing cost	No. of Business
$0	20
$10 to $100	5
$200 to $500	5
$501 or more	7
Already had	4
N/A	5
Total	46
Aveage cost ($)	321

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A. 3 Cost of refrigerator

Cost of Refrigerator	No. of Businesses
$0	15
$50 to 500	13
$501 or more	9
Already had	4
N/A	5
Total	46
Average Cost ($)	265

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A. 4 Nursing space rental cost

Rental Cost	No. of Businesses
$0	21
$25 to 500	6
Shared	5
N/A	6
Total	38
Average Rental cost ($)	57

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A. 5 Nursing space utility cost

Utility Cost ($)	No. of Businesses
$0	17
10	2
25	4
65	1
150	1
200	1
Included in office expenses	6
N/A	5
Total	37
Average Cost ($)	21

Source: Business survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Appendix A. 6 Survey Participants Comments

- *Getting set locations for nursing mother's has been a challenge, but not because nursing mothers are seen as low value - instead because of a lack of understand of the needs that the nursing mothers have as well as availability of resources. We have a large campus so we will always have to deal with case by case situations to meet needs but it has been very important to establish at least some permanent spaces to help in that education/awareness. We now have a standard and specs for adding nursing spaces as new buildings are added, a standard way to inform managers of the need and plans to create "multi-use" spaces that give nursing mother's priority but also sever as a place for an employee to take a short break to stretch or a few minutes of relaxation or biofeedback. If formulas are available to calculate questions 26 and 27 - please share them - this would help with the argument for maintenance of corporate space for nursing mom's and potential for things like on site day-care. Additionally, for question 18 we can get health care cost - but currently would not have data on who breast fed vs formula fed.*
- *Accommodating breast-feeding may or may not be happening. But I don't think anyone here, especially our supervisors, even care.*
- *We are a hospital and we encourage employed pregnant mothers to breast feed.*
- *We have very few instances, however, we do all possible to accommodate.*
- *I breastfed in the work place I was treated unfairly and unkindly while working at **.*
- *This is an important question for employees and staff morale. Unfortunately, we are a nonprofit, in a crowded facility, with no capital funding to create separate spaces. We are working hard not to create a break room, and this could accommodate nursing mothers who work for us or who visit our **. We could put chairs in a couple of restroom/locker areas, but these are common, open areas and not private.*
- *As a woman who breastfed her own children, this is near and dear to my heart. That said, the tone of this survey was a turn-off. If you are hoping to encourage employers to be breast-feeding friendly, this will not be helpful. We are a business. We have requirements to which we must adhere or we will cease to be a business. As a business, we only have so much space and we are bursting at the seams. To have a dedicated breastfeeding room isn't going to happen. It can't happen, we don't have the space. That said, we do have spaces that can and do serve more than one function. We will make REASONABLE ACCOMMODATIONS to assure breastfeeding moms are able to do what they need to do. We will NOT purchase breast pumps! (Really??) That is mom's responsibility. No business should be required to do anything more than make reasonable accommodations to meet this need. It's too easy to sit in an office at a university and judge when you are not actually trying to work out all these details. You do more to harm your cause that way. (See, you made me feel all defensive and I SUPPORT BREASTFEEDING!) Take note.*

- *I am not in a supervisory role, so I do not know answers to a lot of these questions. I did not breastfeed when I returned to work, so my knowledge is very limited.*
- *We provide our employees the ability to pump in their personal offices by providing a secure/private atmosphere if they choose to.*
- *In 2 years, we have only had one employee give birth and request breastfeeding assistance. This is not really an issue for us.*
- *We are a predominantly male workforce environment. As a result we have not been faced with breast feeding issues. We would create a supportive environment if the situation presented itself.*
- *We have a limited-term contractor who also needs breastfeeding rooms and we included her in our numbers above.*
- *No employees who have babies or young children right now, but that could change, of course.*
- *We have never had an employee with the desire to breast feed or pump however would be willing to accommodate though it seems to also require a daycare arrangement in the office which is a bigger problem. I would be interested in becoming more aware of the possibilities in the event that there is an employee with the desire to breast feed.*
- *We have not experienced any difficulty accommodating new mothers.*
- *As a small company with mostly male employees and female employees over child bearing age, we are not often in the situation of needing to accommodate a breastfeeding mother, but we would accommodate a breastfeeding mother to the best of our ability, complying with applicable laws, within reason and without negatively affecting our business.*
- *We do not & have not had any women of child bearing age for a long time so this survey was very difficult to answer properly.*
- *We are a small business with only 3 female employees - 2 of which are family members. Unfortunately this survey does not really pertain to our business.*
- *Understand, we have a primarily male staff (engineering tends to fall that way), our female employees are all beyond their child-rearing times. That said, our male employees benefit greatly from flexible schedules/etc. for dealing with sick children, healthy children, etc. I have formulated my responses on that basis.*
- *Questions are not well written; they do not accommodate answers that do not elicit the desired responses you are seeking*
- *I found it hard to assign dollar values to savings and expenses.*
- *We have had one breast feeding employee in 20 years. Provided office space and refrigeration, flexible work hours. Not an issue.*
- *Given the chance, and request, I would gladly work with any female employee who wanted to pump breast milk. In our manufacturing/ institutional environment it would not be feasible to bring baby to work, though we would allow some flexibility with schedule.*

- *Company has not had a pregnant employee in over ten years. If and when issue arises we will strive to accommodate an employee.*
- *This survey was a bit confusing, especially for someone who is not a mother and does not currently work with anyone who is nursing. I think this survey would garner more useful data if it were targeted more specifically towards HR people or nursing moms OR the questions were more general. Thanks for your work!*
- *I personally was a nursing mother last year. I had my baby in April 2013 retuned to work in June with baby and received privacy while nursing or staff would still come in my office I just covered myself. When baby didn't like being covered I shut my office door and covered window with white paper which would let staff and consumers know I was breast feeding. It was a supportive work environment. Unfortunately due to my position I started working late and was only apply to nurse my baby for 6 months. Some is better than none though.*
- *We don't have nursing employees.*
- *In the last 10 years, we have only had one person need time to pump.*
- *To small a company to be investing time in something that will not affect us. If things change, we are open to that.*
- *Have no experience w/ employees breastfeeding, however, spouses of employees have availed themselves of our facility for breastfeeding. We are small company that tries to accommodate most employee needs.*
- *This really does not apply since we don't have employees that are breast feeding. If we did we would work with them to maintain their employment.*
- *The only breastfeeding employee we have had has been one of the owners (me!). However, we treat all employees the same way that we treat ourselves. IOW, if an employee were to become pregnant or begin breastfeeding while under our employ, we would accommodate that person in every way possible. We have extended similar leaves of absence to employees dealing with personal and family matters. Our breastfeeding space is my office. I have offered it to customers as well, although we also support breastfeeding in public in our store, and always offer not only my private office (which I vacate while the mother uses it so she has total privacy), but also a chair or couch out in the bookstore --- whichever makes her most comfortable.*
- *The majority of our staff is beyond child bearing years. IF the situation changes, our office would work to the best of its ability to support a breastfeeding mother.*
- *All offices have doors that lock for privacy. Some mothers have driven to (near-by) child care locations to nurse their infants. Mothers may work at home (with hired child care assistance) to allow frequent feeding schedule.*
- *As mentioned above, we have not had anyone breast-feeding in the 12 years that I've worked with this company, and I'm not sure the issue has ever come up. However, we have flexible work spaces and I assume it would be accommodated should the need arise.*

- *This company is mostly male; however, I am female and I was able to breastfeed and bring my babies to work with me while I breastfed. I did not have a separate room, but I have an office with a door and all I had to do was close the door when I needed to feed the baby or pump. I was very grateful to be able to share this time with my children. It is very hard to put a value on the long-term increased productivity that I have experienced. I have been here for 15 years and had 3 children while I have worked here. I brought two of the three to work with me while they were infants, and I was able to share that special time with them.*
- *We have two nursing mothers out of 14 employees! We know that keeping the babies healthy and happy makes everyone healthy and happy.*
- *Stupid questions about dollars. Focus on the law and health benefits*
- *We advocated on behalf of the legislation to protect breastfeeding employees in the workplace.*
- *I am currently breastfeeding and taking my daughter to work. My work has been very flexible with this but this will change soon. It has been difficult to keep up with work and there are many days in which I have to work extra hours but it has been worth it to have her here with me. I am much more satisfied with my work having her here and am able to be more productive in that way.*
- *We are a small firm so it is easier to work with our employees on an individual basis than a 100 person or 1000 person firm.*
- *We work hard to work on value for our employees and have done well.*
- *We don't have women employees due to lifting requirements*
- *We are a small company, we have rarely had women with young children work for us, we offer flexibility on a case-by-case basis depending on the employee's sales.*
- *I am answering these questions for our department only. We are an offsite location and I am not familiar with their set up. We have not had any breast feeding employees; however, would accommodate as necessary in order to make the transition easier on the employee(s).*
- *While I was an independent contractor at the Massage Therapy Training Institute, I gave birth to two children, two years apart. I was able to bring both children to work with me. They slept in a wrap while I worked, nursed on demand, and were cared for by myself and the rest of the community here at the school. This has contributed immensely to my dedication and loyalty to this business. Students often bring their children into the school while they are in class or working in the student clinic. One of our independent contractors is a certified infant massage instructor, another has been a certified professional midwife for decades, and the owner of the school was a stay at home father for many years. The environment here is incredibly supportive of family and all that it entails, including breastfeeding.*
- *Both women who work here have older children and will not be nursing in the near future.*

- *We have a few employees and each has their own office, so they can have privacy if they need it. We are flexible on break times, but depending on the position they might have to work from the office in order to do their job.*
- *I do not think we've ever had a nursing mother on staff. We would accommodate if/when this should occur. In general at our company, if employees behave responsibly and get their work done they are treated like grownups and have as much flexibility as they need.*
- *State Government should replace the workplace regulations poster with an online certificate of completion where the business owner or delegate must watch videos, take periodic surveys and yield to an exam regarding workplace laws. This would be more productive than this poster. Of course one of the online courses would target breastfeeding. Also, perhaps your organization can start a contest whereby employers submit breastfeeding policies, gaining further breastfeeding awareness and good public relation for business.*
- *We had one employee who used a breast-pump in her office several years ago. This seemed to work well. I am not a manager and I do not know what our rules are on maternity leave, etc.*
- *I own my business and have one female employee; neither of us plan on having children.*
- *I know the boss breast fed while on the job. I also know one of her other employees from a long time ago had maternity leave and flexible work hours etc. while breastfeeding.*

4. Survey of Mothers

The University of New Mexico's Bureau of Business and Economic Research (BBER) conducted a study called "benefit-cost analysis of improving New Mexico's breastfeeding rate" to estimate cost and benefit of breastfeeding and formula feeding. Women over 18 years of age with at least one child less than 5 years of age were asked to participate. The survey was conducted in May to June, 2014. The survey was designed and uploaded to the Survey Monkey website. Survey questions were pretested and refined after two separate focus group discussions with breastfeeding and formula feeding mothers. Focus group participants were asked to fill out the survey and give their feedback on the survey. A focus group discussion report is presented in separate section below.

The main objective of the survey was to understand mothers, their work-life balance, work hours, breastfeeding challenges and duration, childcare cost, their level of satisfaction as a mother, satisfaction on their health, their youngest child health, and satisfaction on their family's financial health.

Due to the lack of mothers' contact addresses, BBER could not make a random sample of New Mexico mothers. BBER relied on convenience sampling which is a non-probability sampling technique where mothers were selected because of their convenient accessibility through social media such as *facebook*, emails, WIC clinic, and referrals. BBER compared educational attainment and race and ethnicity of respondent mothers and New Mexico women age 25 or over.

4.1 Focus Group Discussions

BBER and the New Mexico Breastfeeding Task Force held two focus groups – one with breastfeeding mothers only (held March 27, 2014) and a second with a mix of mothers who were either currently formula feeding, had fed formula in the past, switched from breastfeeding to formula-feeding, or supplemented with formula (held May 16, 2014). The primary purpose of these focus groups was to ensure the survey we had developed for mothers was clear and would yield the types of information and data we required, and whether there were key issues we had omitted. The focus groups also served as a means of acquiring additional understanding of the challenges mothers face in their feeding and parenting decisions. A total of 8 women attended the first focus group, while 5 mothers and 2 fathers attended the second focus group.

As expected, the focus groups led to modifications of the mother's survey, although the modifications were minor. As hoped, the focus groups also yielded more in-depth understanding of the broad spectrum of issues faced by mothers in their feeding and parenting decisions. Below we have summarized the comments and insights shared by mothers regarding parenting and feeding.

Mothers who worked prior to the birth of their child were asked if they received any maternity leave. Responses indicate that due to a lack of maternity leave, most mothers must use accumulated sick and annual leave in order to stay home with their baby. No focus group attendee was able to spend more than three months at home with their newborn child.

Only one mother received actual maternity leave. The mother worked for a private company and was given one month of paid maternity leave. Other mothers stayed home with their infant child between two weeks and three months. One mother did not work either before or after her child was born, and was therefore unconstrained in the amount of time spent with her newborn. Mothers were asked whether their partners were able to take any leave when their child was born. Responses indicate that paternity leave is scarcer than maternity leave.

Of the five partners associated with the participants in the second focus group, only two were given paid leave. One of the two works for a family company and was given three weeks of paid leave, while another was given one month of leave. One father was allowed to take two weeks of unpaid leave to be with his newborn child, while another did not work either before or after her child was born, and was therefore unconstrained in the amount of time he spent with his newborn.

Mothers who had breastfed were asked when they stopped breastfeeding and why. Breastfeeding durations ranged from a few months to 1.5 years. Reasons for using formula ranged from child being given formula in the NICU to convenience. Responses suggest that hospitals, lactation consultants, daycares, and others can play important roles in supporting and enabling breastfeeding.

One mother breastfed only for a couple of weeks, as she and her baby had difficulty establishing a solid latch and thus switched to formula. The strong desire some babies have for their mothers to hold them and interact with them while breastfeeding has caused some to resist accepting breast milk from a bottle. As a consequence some babies ultimately discontinue breastfeeding when they begin attending daycare. At least two mothers stated that they have supplemented with formula due to insufficient breast milk production. One such mother exclusively breastfed for 3 months and subsequently supplemented with approximately 10 percent formula until her child was 18 months old. The other such mother stated that formula was introduced to her baby by the hospital while the baby was in the NICU. One mother indicated that she breastfed exclusively for more than 2 months, but that her baby weaned himself at 4 months and ultimately she found formula feeding to be more convenient.

We asked mothers about where they found support as a new mom. Families, partners, early childhood development programs, and work environments were all mentioned as important sources of support. One mother stated that nurses at the hospital helped her establish breastfeeding, and subsequently called on numerous occasions to offer support. One mother cited weekly home visits from the City of Albuquerque's Early Head Start Program as an important

source of support. Another mother cited the importance of the socialization, developmental, educational, and breastfeeding support she received through New Mexico's Home Visiting program. The work environment was noted as an important source of support by a mother who works in a group comprised mostly of women of childbearing age, and who was given time and space to pump at work.

In addition to asking about important sources of support, we also asked where support was lacking. Responses indicate that daycare centers have room for improvement both in terms of supporting breastfeeding mothers and providing quality care (particularly to infants under the age of one). One mother was working and attending school when her child was just 8 weeks old. She found that daycares do not provide quality care for children under the age of one; her baby was left sitting in a chair or lying down most of the time, and was not given tummy time. She felt her young baby needed more one-on-one time, and found that the bond she shared with her baby was harmed by his time in daycare. As a consequence she removed her child from daycare and placed him in the care of a friend while at work and school.

4.2 Survey Respondents

Table 4.1 demonstrates the level of education of survey responders compared to the overall education of women in New Mexico. Within the 372 total responds, a full third "graduated from college" (33%) and nearly a quarter completed professional degrees, a Master's degree or Ph.D. (24%). Only 14% completed "2 to 3 years of college" or an associate degree. When comparing the survey sample percentage with the New Mexican women levels of education, we found that some levels of education are overrepresented (specifically that of a higher level of education, with a Bachelor's degree or higher) and some levels of education are underrepresented (such as New Mexicans with only a high school education or "some college"). Therefore, we would like to only tentatively postulate our results as representative of the overall education of the New Mexico population.

Table 4.1 Educational attainment of surveyed mothers and New Mexico's women

Education level	Survey Sample		New Mexico	
	Responses	Percentage	Count	Percentage
Below high school	34	9%	211,788	16%
Graduated from high school	47	13%	360,327	26%
Some college	28	8%	77,980	6%
2 to 3 years college and associate degree	53	14%	354,947	26%
Graduated from college	122	33%	202,552	15%
Completed graduate school	88	24%	152,736	11%
Total	372	100%	1,360,330	100%

Source: Sample data was obtained by survey conducted by Bureau of Business and Economic Research; and New Mexico population numbers were obtained from the U.S. Census Bureau, 2012
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 4.2 demonstrates the ethnicity, or ethnicities, of the survey sample compare to the overall ethnicity or ethnicities of New Mexicans as a whole. Responders were asked to check all ethnicities they felt applied. Within the 308 total responds, nearly half were "white alone" (45%) while "White alone, not Hispanic or Latino" (37%) and "Hispanic or Latino" (38%) were nearly as common. When comparing the survey sample percentage with the New Mexico ethnicity percentages, we found that "White Alone" or "Hispanic or Latino" were underrepresented, but overall "White alone, not Hispanic or Latino" was not wholly dissimilar, nor were the less common New Mexico ethnicities, such as "American Indian, Alaska Native", "Black or African American" or "Asian." Therefore, we would still like to remind caution about any conclusive assumptions about the overall ethnic implications upon the New Mexico population.

Table 4.2 Survey sample and New Mexico ethnicity

Ethnicity	Survey Sample		New Mexico	
	Responses	Percentage	Count	Percentage
White alone	140	45%	1,734,959	83%
White alone, not Hispanic or Latino	114	37%	829,944	40%
Hispanic or Latino	116	38%	980,085	47%
American Indian, Alaska Native	16	5%	212,699	10%
Black or African American	5	2%	50,047	2%
Asian	5	2%	33,365	2%
Total	308	-	2,085,287	-

Source: Sample data was obtained by survey conducted by Bureau of Business and Economic Research; and New Mexico population numbers were obtained from http://quickfacts.census.gov/

Bureau of Business & Economic Research, University of New Mexico, 2014

A total of 262 responders described their age (Table 4.3). The vast majority of responders were either “21 to 30” years of age (45%) or “31 to 40” years of age (45%). The remaining 10% was split evenly between mothers “20 or less” years of age (5%) or “41 or above” years of age (5%).

Table 4.3 What is the age of the mother?

Age in years	Responses	Percentage
20 or less	13	5%
21 to 30	119	45%
31 to 40	117	45%
41 or above	13	5%
Total	262	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

A total of 275 responders described their marital status (Table 4.4). Over 68% of responders were “Married” and 23% were “Single”. The remaining responders fell under “Other” (7%), “Divorced” (1%), or “Separated” (1%).

Table 4.4 What is your current marital status?

Marital status	Responses	Percentage
Married	186	68%
Single	64	23%
Divorced	4	1%
Separated	2	1%
Other	19	7%
Total	275	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 4.5 displays the average of different variables by ethnicity. On average, Hispanic White women work relatively longer hours compared to women from other groups. Anglo-White women, on average, earn more compared to other women. In terms of “ever breastfeeding percent”, all groups of women have high percentages (94% or more). “Ever breastfeed percent” of Anglo-White mothers is 98% and non-White Hispanic mother is 94%. On average, non-White non-Hispanic household income is lower than any other. The percentage of married women was highest in Anglo-White (82%) and lowest in non-White non-Hispanic (45%). However, this difference may be due to small sample size (only 20) of non-White non-Hispanic.

Table 4.5 Averages by Ethnicity

Variable	NonWhite NonHispanic		NonWhite Hispanic		AngloWhite		Hispanic White	
	N	Average	N	Average	N	Average	N	Averae
Work hours/week	55	16.6	115	17.2	114	14.6	24	17.5
Monthly wage/salary	54	$1,337	114	$1,434	113	$1,666	24	$1,431
Age of child in months	71	11	116	19	114	18	26	17
Proportion of 6 month older children	71	42%	116	80%	114	68%	26	65%
Professional percent	55	36%	116	41%	114	46%	26	50%
Everbreastfeed percent	31	97%	109	94%	111	98%	26	96%
BF days	46	243	106	307	113	555	26	469
Currenlty only breastfed	27	22%	110	23%	112	46%	26	54%
Currently only formulafed	27	11%	110	18%	112	7%	26	4%
Age of mother	17	31	109	29	111	32	25	30
Education	20	14	111	14	114	16	26	15
No. children below 5	20	1.55	111	1.38	114	1.52	26	1.35
HH income	18	$3,334	91	$3,931	107	$5,229	25	$3,847
Percent married	20	45%	116	54%	114	82%	26	81%

Source: Estimated by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

4.3 Survey results

4.3.1 Rating of Child's health

Of the 329 responses to "Rate your youngest biological child's overall health (from birth through today)", (Table 4.6) the results were overwhelmingly positive. A total of 43% answered "Immaculate, perfect. No health complications whatsoever" (141 responders) and 44% answered "Very healthy, almost no complications" (145 responders). Only 13% answered the most neutral option, "Healthy, some non-serious complications" (43 responders). There were nearly no responses for "Somewhat ill, frequent complications" and "Very ill, frequent serious complications" (0%, each, respectively). This finding is consistent across a wide array of factors, including race/ethnicity, income, age, etc.

Table 4.6 Rate your youngest biological child's overall health (from birth through today)

Overall health status	Responses	Percentage
Immaculate, perfect. No health complications whatsoever.	141	43%
Very healthy. Almost no complications.	145	44%
Healthy. Some non-serious complications.	43	13%
Somewhat ill. Frequent complications.	2	0%
Very ill. Frequent serious complications.	1	0%
Total	329	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Responders were questioned "Has your youngest biological child ever had any of the following illnesses?" (Table 4.7) and asked to check all that applied. The vast majority of the 321 responses answered "none of the above" with 218 responses. Most other responses fell under "otitis media (ear infection)" with 15% and "viral gastroenteritis (or stomach flu)" with 12%. Bronchiolitis (4%) was reported to a lesser degree. There were no responses to "diabetes" and "obesity" (0%, each, respectively).

Table 4.7 Has your youngest biological child ever had any of the following illnesses? Please check all that apply.

Disease	Responses	Percentage
Obesity	0	0%
Diabetes	0	0%
Bronchiolitis	14	4%
Viral Gastroenteritis, (Or stomach flu)	39	12%
Otitis media (ear infection)	48	15%
Necrotizing enterocolitis (NEC)	3	1%
None of the above	218	68%
Total	321	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.2 Child's Age

The 329 responders answered, "what is the age of your youngest biological child?" (Table 4.8) A full 53% of children were 12 months or younger, with 12% of total responders' children being

less than one month. Commonality of age group decreased as age increased, with a significant 20% of responders describing their children as “1 to 2 years” of age and 14% of responders describing their children as “2 to 3 years” of age. Small numbers of responders had children above this threshold, with only 6% of responders describing their children as “3 to 4 years” of age, 5% of responders describing their children as “4 to 5 years” of age.

Table 4.8 What is the age of your youngest biological child?

Age	Responses	Percentage
Less than 1 Month	38	12%
1 to 6 Months	73	22%
7 to 12 Months	64	19%
1 to 2 Years	67	20%
2 to 3 Years	47	14%
3 to 4 Years	20	6%
4 to 5 Years	20	6%
Total	329	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.3 Employment and Childcare

Of the 329 responders, a large section (43%) answered that they did not work (Table 4.9). The largest section of working responders worked between “31 to 40” hours per week (25%). There were mostly scattered responses for the remaining categories, with 9% for “11 to 20” hours per week, 6% for “up to 10” hours per week, 7% for “21 to 30” hours per week, 4% for “41 or more” hours per week.

Table 4.9 How many hours do you work per week?

Hours per week	Responses	Percentage
Don't work	143	46%
Up to 10	20	6%
11 to 20	29	9%
21 to 30	23	7%
31 to 40	82	27%
41 or more	12	4%
Total	309	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

For those who did not work, BBER did not ask the reason for staying home. However, the Working Mother Research Institute have produced a survey report (2011) which asked "why moms stay home". They surveyed more than 3,700 women to find out who ends up at home. Their results are presented in Table 4.10. The top reasons cited in their survey were children's need (44%), the cost of childcare (35%), birth of additional children (19%), spouse's expectation to stay home with children (19%) and lack of flexibility in start/stop time at work (12%).

Table 4.10 Why Moms Stay Home

Factors	Percentage
The needs of my children	44%
Cost of child care	35%
The salary I earned did not justify the cost of working □	26%
Long-standing desire to be a stay-at-home mom	20%
Birth of additioanl children	19%
My spouse/partner expected me to stay home with children	19%
Lack of flexibility in start/stop time at work	12%
Lack of high-quality child care	9%
Lack of part-time work options	8%
Having to work more than 40 hours a week	7%
Lack of support from my manager	5%
Lack of meaningful part-time work	5%
Other family members expected me to stay home □	5%
The amount of travel required by my job	5%
Lack of paid parental leave	3%
Discrimination against working moms by my employer at the time	3%
Lack of support from my co-workers	2%

Source: Working Mother Research Institute,
http://www.wmmsurveys.com/WhatMomsChoose.pdf

A total of 237 responders described their career in general terms (Table 4.11). 62% described their career as simply "Professional", while 19% were either "administrative" or "secretarial". The remaining 19% fell under various miscellaneous categories.

Table 4.11 How would you categorize your career?

Career	Responses	Percentage
Professional	148	62%
Admin/secretarial	44	19%
Other	45	19%
Total	237	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

There were 312 responses to "what is your current hourly salary rate" (Table 4.12). Majority (51%) of them did not work. 4% of responders made "less than $10" per hour. The results leaned towards the more affluent responders, with 14% making "$10-15" per hours and a full 19% making "$16-30" per hour. The top 12% of responders made "$31 dollars or more" per hour.

Table 4.12 What is your current hourly salary rate?

Rate (Per Hour)	Responses	Percentage
Don't work	158	51%
Less than $10	12	4%
$10-15	45	14%
$16-30	59	19%
$31+	38	12%
Total	312	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 4.13 displays labor force participation rate, average work hours, and average monthly income of mothers by child's age. As expected, mothers with younger children are less likely to be in the labor force than mother with older children. The labor force participation rate of mother with children under 6 months old (33%) was lower than the rate of those whose youngest child were 6 months or older. Average work hours per week and the average monthly income of mothers with young children were lower than mothers with older children.

Table 4.13 Labor force participation rate, average work hours per week and average monthly income by child's age

Child's age	Total number	Labor force participation rate	Average work hours/week	Average monthly income
0-6 months	90	33%	25.3	$2,539
6-12 months	61	48%	32.6	$2,993
12-24 months	57	65%	28.8	$2,922
> 24 months	79	62%	27.8	$2,786
Total	287	49%	28.5	$2,812

Source: Mother survey conducted by Bureau of Business and Economic Research, UNM

A total of 264 answered whether or not their "decision … to return to work was influenced by childcare costs" (Table 4.14). Responds were fairly split, with 48% saying "yes" and 52% saying "no".

Table 4.14 Was your decision regarding whether to return to work influenced by childcare costs?

Response	Total	Percent
No	137	52%
Yes	127	48%
Total	264	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

There were 103 estimations by responders of their monthly childcare expenses if they were working full time (Table 4.15). About a third, each, estimated $501 to $800 per month (33%) and $801 or more per month (32%), respectively. Only 20% estimated their childcare expenses to be $301 to $500 per month and 15% estimated $300 or less per month.

Table 4.15 If you are not currently working, please estimate what your monthly childcare expenses would be if you were working full time.

Range (Dollars)	Responses	Percentage
up to $300	15	15%
$301 to $500	21	20%
$501 to $800	34	33%
$801 or more	33	32%
Total	103	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

A total of 194 responders answered the question, "If you are currently breastfeeding, would you increase the number of hours you are working if you were to discontinue breastfeeding?" (Table 4.16) Of the total, 166 responders said "no" (86%), while the remaining 28 said "yes" (14%).

Table 4.16 If you are currently breastfeeding, would you increase the number of hours you are working if you were to discontinue breastfeeding?

Answer	Total	Percent
No	166	86%
Yes	28	14%
Total	194	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

The questioning continued, "if yes, by how many hours per week?" (Table 4.17) Nearly half of the 39 who responded answered "up to 10" hours per week (49%). The remainder was fairly split between "10 to 20" hours per week (28%) and "20 or more" hours per week (23%).

Table 4.17 If yes, by how many hours per week

Range (in hours)	Responses	Percentage
up to 10	19	49%
10 to 20	11	28%
20 or more	9	23%
Total	39	100%

Source: Estimated by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.4 Breastfeeding

Responders were questioned “Did you breastfeed your youngest biological child?”(Table 4.18) and 278 answers were received. The vast majority of the responses were “Yes” (91%), with only minor responses to “Yes but only briefly (less than a month)” (4%), and “No” (5%).

Table 4.18 Did you breastfeed your youngest biological child?

Answer	Responses	Percentage
No	11	4%
Yes	254	91%
Yes but only briefly (less than a month)	13	5%
Total	278	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

The following question asked “how long did you breastfeed?” (Table 4.19) More than 3 out of 4 responders breastfed for “181 days or more” (77%). About 1 in 10 responders breastfed for “31 to 90” days (11%), 9% of responders breastfed for “91to 180” days, and only 6% of responders breastfed for “1 to 30” days.

Table 4.19 How long did you breastfeed?

Range (in Days)	Responses	Percentage
1 to 30	17	6%
31 to 90	28	11%
91 to 180	25	9%
181 or more	205	77%
Total	266	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Responders were asked to describe how their youngest biological child was currently fed (Table 4.20). About 57% said “breast milk” or other options. Nearly one third said “only breast milk”, while only 11% said “formula only”.

Table 4.20 How is your youngest biological child fed now?

Answer	Responses	Percentage
Breast milk and others	168	57%
Only formula	32	11%
Only breast milk	96	32%
Grand Total	296	100%

Source: Estimated by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Table 4.21 presents baby feeding pattern by age. Nearly 60% of the mothers who had 0-6 months old baby reported they exclusively breastfed. Only 17% of that age category reported that they feed formula. Formula use was more common in the 6-12 months category (29%) and had a pronounced drop-off with a total of only 2% of mothers still using formula exclusively.

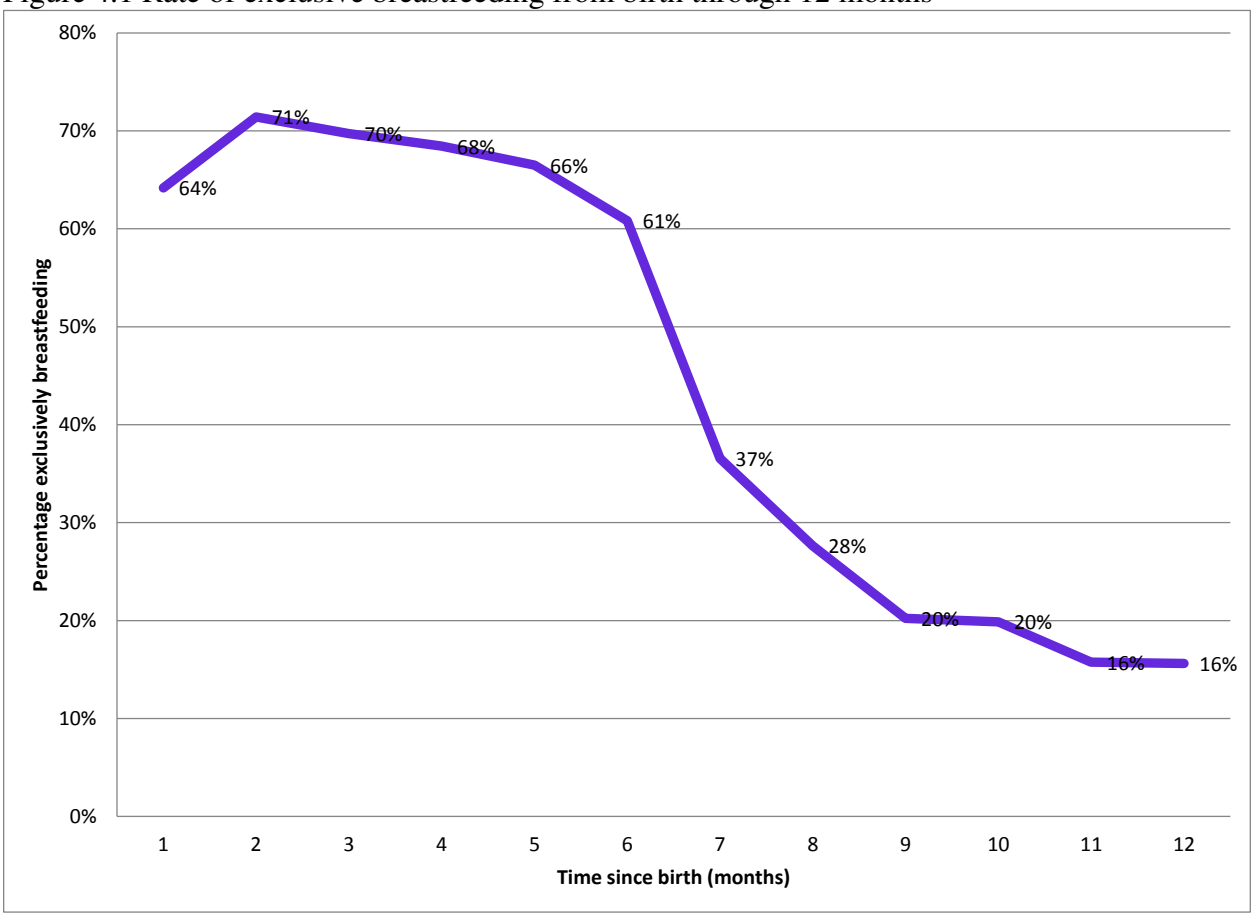
Table 4.21 Baby Feeding Patterns by Age

Feeding pattern	Age of baby at the time of survey			
	0-6 n=70	6-12 mo n=56	12-24 mo n=53	>24 mo n=66
Only breast	59%	46%	30%	0%
Only formula	17%	29%	2%	0%
Both and/or solid	24%	25%	68%	100%
Total	100%	100%	100%	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Figure 4.1shows the rate of exclusive breastfeeding from birth through 12 months. About 71% are breastfeeding at the end of second month, yet only 16% breastfeed after one year. Unexpectedly, the exclusive breastfeeding rate for the first month was 7% lower than the second month. This may be due difficulties in breastfeeding initiation during the introductory period.

Figure 4.1 Rate of exclusive breastfeeding from birth through 12 months



Source: Survey conducted by Bureau of Business and Economic Research

Table 4.22 presents leading reasons for mothers discontinuing breastfeeding. This table is borrowed from the report of National Survey of Women's Childbearing Experiences, which was conducted by Childbirth Connection in 2013. Mothers expounded how they intended to feed their newborn as they approached the end of their pregnancy and how they were actually feeding their newborn a week after giving birth.

Table 4.22 Mother's leading reasons for not establishing and for discontinuing breastfeeding (check all that apply)

Base: intended to breastfeed at end of pregnancy among follow-up LTM lll mothers n=614		Base: breastfeeding at one week among follow-up LTM lll mothers n=551	
Reasons cited by 8% or more mothers for not breastfeeding at one week		Reasons cited by 8% or more mothers for not breastfeeding at time of survey	
My baby had difficulty nursing	31%	I had trouble getting breastfeeding going well	39%
It was too hard to get breastfeeding going	23%	Formula or solid food was more convenient	22%
Formula was more convenient	23%	I fed my baby breast milk as long as I had planned	22%
I didn't get enough support to get breastfeeding going	17%	My baby stopped nursing; it was the baby's decision	18%
I didn't plan to breastfeed much anyway, as I planned to go back to my paying job soon	13%	I was working at a paying job or school, and other people were feeding the baby	9%
I had to take medicine and didn't want my baby to get it through breast milk	12%	I did not have enough help to work through the challenges	8%
I tried breastfeeding and didn't like it	12%	I had to take medicine and didn't want my baby to get it through breast milk	8%
It was too hard with my own health challenges	12%		
After the birth, I changed my mind about wanting to breastfeed	9%		

Source: Listening to Mothers III, a survey conducted by Childbirth Connection: www.childbirthconnection.org

4.3.5 Maternal Wellbeing

Responders were asked to rate their satisfaction with "being a mother", their own health, their youngest biological child's health, and their family's financial stability. (Table 4.23) Options for rating included "Very satisfied", "satisfied", "neither satisfied nor dissatisfied", "dissatisfied", and "very dissatisfied".

The responders were overwhelming "very satisfied" being a mother (91%). Secondarily, another 8% were "satisfied". Almost no responders were "neither satisfied nor dissatisfied" (1 responder, totaling overall as 0%), and there for no responses for "dissatisfied" and "very dissatisfied" (Table 4.23). Since the responses were not distributed to other categories level of satisfaction, BBER did not analyze those responses further.

Responders were split on their own health, while still remaining largely positive: 44% were "very satisfied" and 40% were "satisfied" (Table 4.23). Similarly, "neither satisfied nor dissatisfied" (8%) and "dissatisfied" (8%) were also split. A small percentage, however, were also "very dissatisfied" (1%).

There is a strong positive correlation between responders' satisfaction in "being a mother" to their satisfaction with their youngest biological child's health (Table 4.23). The responders were overwhelming "very satisfied" with their youngest biological child's health (79%). Secondarily, another 20% were "satisfied". Almost no responders were "neither satisfied nor dissatisfied" (1%). No responders were "dissatisfied" or "very dissatisfied". This shows that, in general, respondent mothers seemed very satisfied or satisfied with their life situations.

Easily the most varied answered from Table 4.23 came from the rated satisfaction of their "family's financial stability". It was the only question in which the most positive option, "very satisfied" was not the most chosen response. "Satisfied" was by far the most common response (40%), with "very satisfied" (22%) and "dissatisfied" (20%) yielding very similar results. Only 17% were "neither satisfied nor dissatisfied". The financial stability of the responder's family yielded the most "very dissatisfied" answers amongst the four questions asked in this manner (6 responders, totaling overall as 2%).

Table 4.23 How satisfied are you?

Level of Satisfaction	Being a mother	Percent	Your Health	Percent	Child's Health	Percent	Financial Stability	Percent
Very satisfied	256	91%	121	44%	215	79%	59	22%
Satisfied	23	8%	109	40%	53	20%	109	40%
Neither satisfied nor dissatisfied	1	0%	23	8%	3	1%	46	17%
Dissatisfied	0	0%	21	8%	0	0%	54	20%
Very dissatisfied	0	0%	1	0%	0	0%	6	2%
Total	280	100%	275	100%	271	100%	274	100%

Source: Survey conducted by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

Responders were questioned "who provides support to you in your role as a mom?" and were asked to check all that applied (Table 4.24). Since each responder was able to select any applicable answer, the results were quite large. Results were split fairly even amongst "Partner(s)" (36%), "[their] parents" (27%) and "Friends" (24%). The least number of responds came with "Neighbors" (5%) as well as more specific and miscellaneous answers (7%).

Table 4.24 Who provides support to you in your role as a mom?

Support	Responses	Percentage
Friends	236	61%
Partner(s)	354	91%
Your parent(s)	266	68%
Neighbor(s)	51	13%
Other	68	17%
Total	390	

Source: Estimated by Bureau of Business and Economic Research
Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.6 Determinants of Weekly Hours of Work and Monthly Income of New Mexico Mothers

When asked to indicate whether they currently work, and if so, how many hours they typically work in a week, BBER received responses from 448 mothers. To make it representative sample of New Mexico, some survey responses from mothers with higher educational attainment and white race were omitted from the list. The survey indicated that only 54% of the mothers work for remuneration who have a child less than 5 years old (Table 4.9). The work-hour distribution of those who work is as follows: -more than 30% of the mothers work 31 hours or more, 15% work less than 20 hours per week and 7% work between 21 to 30 hours.

Descriptive statistics of the variables used in regression analysis are presented in Table 4.25. The average number of work hours of mothers per week was 16 (SD=17.7) and average monthly wage or salary of mother was $1,506 (SD=2003) including those who do not work at all. The average household income was $4,454. Of the mothers in the sample, 43% were white including Hispanic White and 67% were married with average age of 30. The average number of days of breastfeeding for the youngest child was 408 (SD=330). The average number of children below 5 were 1.45 and average age of youngest child was 17 months.

Table 4.25 Descriptive Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
Work Hours	309	16.14	17.72	0	60
Monthly salary/wage ($)	306	1506	2003	0	7895
Education	271	14.80	2.49	11	22
White percent	328	43%	0.50	0	1
Breasfeeding days	292	408.03	330.07	0	1634
Married percent	276	67%	0.47	0	1
Age	262	30	6.25	17	54
No. of children below 5	271	1.45	1.05	0	15
HH income (,$000)	241	4.45	3.12	0	20
Child's age in months	329	16.86	16.44	0	84

Source: Estimated by Bureau of Business and Economic Research

Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.6.1 Results

4.3.6.1.1 Weekly Work Hours

Censored multiple regression model, a standard model used in labor supply analysis, was utilized to identify important predictors of work hours. This technique is appropriate because it allows us to take into consideration those mothers that do not work, but might otherwise work if they did not have children. Furthermore, because the data on non-working mothers show that they worked "zero" hours, this technique also allows for the estimation of the number of hours she would work if she did not have children. Table 4.26 presents the parameter estimates for each predictor variable, its standard error and statistical significance level. All the variables except child's age are found to be significant at 5% level. This means that if we repeat this experiment 100 times, we are likely to get similar results 95% of the time.

Educational attainment is found to be significant to determine weekly work hours. Controlling other factors (such as ethnicity, length of breastfeeding, mother's age, number of children, and household income), every one year increase in educational attainment results in an increase in 3.6 hours of work. Compared to a mother, who completed a bachelor's degree with the mother, who completed high school, the former is likely to work 14.4 hours more than the later. This shows that the opportunity cost of mothers with higher educational attainment is also higher. In addition, a white mother works nearly 11 hours less (on average) than the nonwhite mother, holding other factors constant. This may be due to higher household incomes of white mother or cultural factor associated with longer time of breastfeeding. The length of breastfeeding is found to be highly significant and negatively associated with weekly work hours. Controlling other factors, roughly every 3 months more of breastfeeding is associated with one hour decrease in

weekly work hours. This shows that breastfeeding poses a cost to the mothers in terms of her work hours, although the magnitude of the impact seems to be relatively small.

Controlling other factors, married mothers work nearly 12 hours less compared to single, divorced, separated or other category. This shows that married mothers may afford to work longer hours and married women have more resources (financial or otherwise) that can be used to care for the children. Mother's age is positively associated with weekly work hours. Each additional year of age results in 0.6 hours of additional work in a week. Number of children below 5 is negatively associated with the weekly work hours. In this case, each additional child below 5 results in reduction of 8.2 hours of weekly work. We tested whether income is associated with more work hours or not. Our results show that higher income family work longer hours compared to lower income family. Every one thousand dollar additional monthly income is associated with additional 1.2 hours of work per week. This may be due to higher income is associated with higher educational attainment.

Table 4.26 Determinants of Weekly Work Hours of New Mexico Mothers

Variable	Parameter Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	-53.76	12.63	-4.26	<.0001
Child age in months	0.13	0.10	1.33	0.1851
Educational attainment	3.61	0.71	5.08	<.0001
White=1, else=0	-10.92	3.37	-3.24	0.0012
Length of breastfeeding in days	-0.01	0.01	-2.66	0.0079
Married=1, else=0	-11.89	3.86	-3.08	0.0021
Mother's age	0.61	0.30	2.04	0.0416
No. of children	-8.24	2.78	-2.96	0.003
HH Income	1.22	0.53	2.32	0.0202

Source: Estimated by Bureau of Business and Economic Research

Bureau of Business & Economic Research, University of New Mexico, 2014

4.3.6.1.1 Monthly Wage or Salary Income

The same censored multiple regression model was utilized to estimate the predictors of monthly wage and salary of mothers. All the variables except child's age and marital status of mothers are found to be significant. Educational attainment is found to be the one of the greatest contributors to the monthly income. Controlling other factors, every additional year of schooling causes an increase additional monthly income of $515. Mothers' ethnicity was found to be significant determinant of her monthly income. Controlling other factors, 'White' mothers earn $1009 less than their non-White counterparts. This is due to less hours of work by the white mothers. As expected, length of breastfeeding is found to be significant and negative. Each additional day of

breastfeeding results in reduction of $1.65 monthly income. In other words, one more month of breastfeeding is associated with reduction of monthly income of $50.

The model predicted that, holding other factor constant, a married mother earns $687 less compared to single, divorced or separated mothers. However, this variable is not statistically significant. As expected, mother age is associated with higher earning and is statistically significant. Age is associated with experience. Every additional year of age of mother is associated with additional $97 monthly income. Having children under 5 is found to be statistically significant and negative. Each additional child under 5 results in reduction of $779 monthly income. We were not sure the direction of causality of higher household income on mother's monthly income. It is found to be positive and significant. Every additional thousand dollars household income is associated with additional $177 monthly income. Our analysis shows that there is motherhood cost together with breastfeeding cost. Motherhood costs are associated with child's age, and number of young children, and marriage. Controlling other factors, the coefficient (-$1.65) associated with length of breastfeeding is clearly a cost of breastfeeding to a mother. Each additional day of breastfeeding results in reduction of $1.65 monthly income.

Table 4.27 Determinants of Monthly Wage and Salary of Mothers

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|
Intercept	-7777	21	-366.79	<.0001
Child's age in months	9.7	10.9	0.89	0.371
Educational attainment	515	62	8.26	<.0001
White=1, else=0	-1009	378	-2.67	0.008
Length of breastfeeding	-1.65	0.60	-2.73	0.006
Married=1, else=0	-687	435	-1.58	0.114
Mother's age	97	31	3.16	0.002
No. of children	-779	299	-2.61	0.009
HH income	177	59	3.02	0.003

Source: Estimated by Bureau of Business and Economic Research

Bureau of Business & Economic Research, University of New Mexico, 2014

5. Cost Benefit Analysis of Breastfeeding on New Mexico Medicaid Program

Medicaid is a public program that provides free healthcare coverage for low-income children and adults. This is the largest source of funding for medical and health-related services for people with low income in the United States. Medicaid in New Mexico is jointly funded by the state and federal government and managed by the state. According to the Center for Medicaid and CHIP Services, a total of 635,321 people in New Mexico have enrolled in Medicaid by then end of April 2014. Only 38% of New Mexicans have employer-sponsored health insurance, compared to a national average of 48%[37]; therefore, importance of Medicare in New Mexico is immense. New Mexico ranks one the highest uninsured state where 21% of the population does not have health insurance. A total of 71,200 children (13%) below 19 did not have health insurance in FY12. In the case of low income children, only 10% were covered by employer sponsored insurance and 68% were covered by Medicaid (Table 5.1). Relatively large proportion (18%) of low income children did not have health insurance in FY12.

Table 5.1 No. of children and low income children by health insurance provider FY12

Provider	No. of children	Percent	No. of low income children	Percent
Employer	188,900	35%	30,600	10%
Medicaid	252,400	47%	209,100	68%
Other private and public	25,800	5%	13,400	4%
Unisured	71,200	13%	54,900	18%
Total	538,300	100%	308,000	100%

Source: Kaiser Foundation, http://kff.org/other/state-indicator/children-0-18/

Table 5.2 presents NM Medicaid and CHIP income eligibility criteria. In these criteria, children under 19, pregnant women, parents and other adults are eligible if they have income below modified adjusted gross income (MAGI). According to Kaiser foundation, New Mexico spent more than $3.3 billion in Medicaid expenditure in FY10. In the same period, the United States spent more $363 billion in Medicaid. The distribution of Medicaid expenditure in New Mexico is as follows: Aged 50%, disabled 31%, adult 19% and children 48%. In New Mexico, 70% of the Medicaid expenditure is born by federal government and rest 30% is by the state (Table 5.4); whereas in the national level, only 57% of the Medicaid expenditure is born by the federal government.

[37] Kaiser Foundation, http://www.nmvoices.org/fpp_attachments/medicaid-economy-update-9-10.pdf

Table 5.2 New Mexico State Medicaid and CHIP income eligibility, 2014

Age	Modified Adjusted Gross Income (MAGI) group	Household Size 1	Household Size 4
Ages 0-1	300%	$2,918	$5,963
Ages 1-5	300%	$2,918	$5,963
Ages 6 - 18	240%	$2,334	$4,770
Pregnant Women	250%	$3,277	$4,969
Parents	133%	$1,293	$2,643
Other adults	133%	$1,293	$2,643

Source: Medicaid http://www.medicaid.gov/AffordableCareAct/Medicaid-Moving-Forward-2014/Medicaid-and-CHIP-Eligibility-Levels/medicaid-chip-eligibility-levels.html

Table 5.3 Medicaid payment in New Mexico and United States by enrollment group

Enrollment group	New Mexico	Percent	United States	Percent
Aged	$1,664,037,713	50%	$81,507,921,594	22%
Disabled	$1,035,008,116	31%	$156,869,962,854	42%
Adult	$644,362,937	19%	$54,313,801,223	15%
Children	$1,591,062,324	48%	$76,622,220,542	21%
Total	$3,343,408,766	100%	$369,313,906,214	100%

Source: Kaiser Foundation http://kff.org/medicaid/state-indicator/payments-by-enrollment-group/

Table 5.4 Federal and state share of Medicaid Expenditure FY12

	Federal Share	State Share	Total
Average of US states	57%	43%	100%
New Mexico	70%	30%	100%

Source: Kaiser Foundation http://kff.org/medicaid/state-indicator/federalstate-share-of-spending/

Medicaid spending is growing overtime (Table 5.5). It grew nearly 16 percent in New Mexico and 11% in US during FY1990-2001. It grew further in FY2001-2004 in nearly same rate. Unlike previous years' growth in New Mexico, Medicaid spending during FY10-12 reduced by two tenth of a percent.

Table 5.5 Average growth in Medicaid Spending

Year	US	New Mexico
FY1990-2001	10.9%	15.7%
FY2001-2004	9.4%	14.8%
FY2004-2007	3.6%	5.9%
FY2007-2010	6.8%	9.3%
FY2010-2012	3.3%	-0.2%

Source: Kaiser Foundation http://kff.org/medicaid/state-indicator/growth-in-medicaid-spending/

Most of the Medicaid spending in New Mexico in FY12 was accounted for by acute care services (88% or $3 billion) and 10% was accounted for by long term care and rest 2% was by Disproportional Share Hospital (DSH) payments. Of the $3 billion total acute care expenditure, 75% was spent on managed care & health plans, 12% was for inpatient hospital and rest 9% was spent for outpatient services and other services.

Table 5.6 Distribution of Medicaid Spending in New Mexico by Service (FY12)

Service Type	Amount	Percent
Acute Care	$3,030,062,248	88%
Long Term Care	$343,602,912	10%
DSH Payments	$56,394,276	2%
Total	$3,430,059,436	100%

Distribution of Medicaid spending on acute care services	Managed Care & amp; Health Plans	75%
	Inpatient Hospital	12%
	Outpatient Services	4%
	Other Services	4%
	Payments to Medicare	3%
	Physician, Lab and X-Ray	2%
	Prescribed Drugs	1%
	Total	100%

Source: Kaiser Foundation http://kff.org/medicaid/state-indicator/distribution-of-medicaid-spending-by-service/

Table 5.7 presents hospitalization counts and total expenditures by payer. A total 5,052 hospitalization occurred in New Mexico in 2011 with total expenditure of $208.6 million. Medicare accounted for 37% (or 1859) of hospitalization and born 44% ($92.6 million) of the cost. Medicaid ranked third in terms of number of hospitalization and total expenditures. Medicaid paid for 20% of the hospitalizations in New Mexico with $22.4 million expenditures.

Table 5.7 Hospitalization counts and total expenditures by payer category (FY11)

Payer Category	Hospitalization cases	Percent	Total amount	Percent
Medicare	1,859	36.7%	$92,651,104	44.4%
Private insurance	1,031	20.4%	$69,191,219	33.2%
Medicaid	1,014	20.0%	$22,408,742	10.7%
Other government	241	4.8%	$7,450,579	3.6%
Self pay/ no insurance	302	6.0%	$5,071,924	2.4%
Workers compensation	112	2.2%	$2,659,329	1.3%
County indegent funds	89	1.8%	$2,330,064	1.1%
Charity care	80	1.6%	$1,914,833	0.9%
CHAMPUS/Military/VA	129	2.5%	$1,626,391	0.8%
IHS/PHS	56	1.1%	$1,246,269	0.6%
Unknown	149	2.9%	$2,038,322	1.0%
Grand Total	5,062	100%	$208,588,776	100%

Source: New Mexico Department of Helath

Table 5.8 discusses the hospitalization counts of breastfeeding related illnesses by age category. Statistically, hospitalizations of adults compose the vast majority of hospitalizations (81%). Of the pediatric hospitalizations, occurrences within the age group of 1 to 5 years (9%) were about twice the number of hospitalizations from the individual categories of "less than 1 year" or "6 to 18 years" (5%, each, respectively). Of the illnesses that are related to breastfeeding, nearly 40% of total hospitalizations are diabetes. Bronchiolitis composes 30% of hospitalizations and breast cancer composes 11%.

Table 5.8 Hospitalization counts of breastfeeding related illnesses by age category

Illness	Age in years				
	Less than 1	1 to 5	6 to 18	19 and above	Grand Total
Breast Cancer	0	0	0	297	297
Bronchiolitis	177	282	23	349	831
Diabetes	0	0	17	1,066	1083
Necrotizing Enterocolitis	2	0	0	0	2
Obesity	0	0	18	31	49
Otitis Media	18	55	31	38	142
Overian Cancer	0	0	1	127	128
Viral Gastroenteritis	1	4	7	173	185
Not related with breastfeeding	66	105	132	2,042	2345
Grand Total	264	446	229	4123	5062

Source: New Mexico Department of Helath

Table 5.9 addresses hospitalization expenditures for breastfeeding related illnesses by age category. Again, “19 Years and above” is the category that dominates the overall percentage (92%). Of the pediatric categories, “Less than 1 Year” displays the highest expenditures, with $9,033,797 (4%). “1 to 5 Years” follows with an expenditure of $6,232,600 (3%). The lowest expenditure occurred within the “6 to 18 years” category, with $1,907,709 (1%). There is $86,774,386 in expenditures that are not related to breastfeeding. Amongst expenditures that are, indeed, related to breastfeeding, 72% are for diabetes, dominating other categories. The next highest level comes with bronchiolitis at 15% of total breastfeeding related expenditures.

Table 5.9 Hospitalization expenditures for breastfeeding-related illnesses

Illness	Age in years				
	Less than 1	1 to 5	6 to 18	19 and above	Grand Total
Breast Cancer	$0	$0	$0	$6,502,999	$6,502,999
Bronchiolitis	$8,362,691	$5,275,634	$350,111	$4,412,181	$18,400,617
Diabetes	$0	$0	$93,877	$87,273,957	$87,367,834
Necrotizing Enterocolitis	$108,769	$0	$0	$0	$108,769
Obesity	$0	$0	$5,392	$365,487	$370,879
Otitis Media	$74,001	$126,287	$25,176	$339,146	$564,610
Overian Cancer	$0	$0	$23,885	$5,190,082	$5,213,967
Viral Gastroenteritis	$1,179	$16,273	$30,557	$3,211,357	$3,259,366
Not related with breastfeeding	$487,157	$814,406	$1,378,711	$84,119,461	$86,799,735
Grand Total	$9,033,797	$6,232,600	$1,907,709	$191,414,670	$208,588,776

Source: New Mexico Department of Helath

Table 5.10 addresses Medicaid expenditures due to hospitalizations in specific age categories. Almost half of all Medicaid expenditures occur within the “19 Years and above” age category (47%). Nearly a third of all Medicaid expenditures occur within the “Less than 1 Year” age category (30%). A total of 19% of Medicaid expenditures are within the “1 to 5 Years” age category. Only 4% of Medicaid expenditures occur for those between the ages of “6 to 18 Years”. A full 47% of overall Medicaid expenditures occurred for bronchiolitis. The only other category is diabetes, accounting for 13% of total Medicaid expenditures.

Table 5.10 Medicaid expenditures due to hospitalization

Illness	Age in years				
	Less than 1	1 to 5	6 to 18	19 and above	Grand Total
Breast Cancer	$0	$0	$0	$1,264,210	$1,264,210
Bronchiolitis	$6,263,233	$3,802,159	$125,722	$357,612	$10,548,726
Diabetes	$0	$0	$69,346	$2,885,228	$2,954,574
Necrotizing Enterocolitis	$108,769	$0	$0	$0	$108,769
Obesity	$0	$0	$3,617	$173,833	$177,450
Otitis Media	$46,416	$85,111	$18,362	$34,154	$184,043
Overian Cancer	$0	$0	$23,885	$271,088	$294,973
Viral Gastroenteritis	$0	$10,098	$5,067	$485,045	$500,210
Medicaid Total	$6,418,418	$4,279,235	$917,229	$10,475,197	$22,408,742

Source: New Mexico Department of Health

According to the American Academy of Pediatrics[38], the total Medicaid expenditure for children's services (ages 0-20) was $1,091million in FY09 and per child expenditure was $2,990. As Table 5.9 shows, about 84% of Medicaid expenditures for hospitalizations occurred for breastfeeding-related illnesses. If we assume that 84% ($916 million) of the Medicaid expenditures for children was related to breastfeeding-related illnesses, then there could be a significant reduction in Medicaid expenditure as a result of increasing the breastfeeding rate. If only 5% of Medicaid cost can be reduced with the increasing breastfeeding rate, then New Mexico can save nearly $46 million a year. However, due to lack of illness specific data, BBER could not make any conclusion regarding the cost savings for the New Mexico Medicaid program.

[38] Medicaid state report: http://www.aap.org/en-us/professional-resources/Research/research-resources/Pages/Medicaid-State-Reports.aspx