January 2009

Pregnancy intention and breast feeding duration an analysis of the Oregon PRAMS 2005 dataset

Kaaren Nelson-Munson

Pregnancy Intention and Breast feeding Duration: An Analysis of the Oregon PRAMS 2005 Dataset

By

Kaaren Nelson-Munson

A Thesis

Presented to the Department of Public Health and Preventive Medicine

Oregon Health and Science University

In partial fulfillment of

The requirements for the degree of

Master of Public Health

In Epidemiology and Biostatistics

January 2009

Department of Public Health and Preventive Medicine

School of Medicine

Oregon Health and Science University

CERTIFICATE OF APPROVAL

This is to certify that the MPH thesis of

Kaaren A. Nelson-Munson

has been approved

Kenneth D. Rosenberg, MD, MPH

Rochelle Fu, PhD

Elizabeth Adams, PhD

TABLE OF CONTENTS

List of Tables

ABSTRACT

Background

Breastfeeding represents the healthiest form of nutritional intake for infants. Historical research indicates the benefits of breastfeeding include fewer infections, protection against chronic diseases, and financial savings over purchased infant formula. Research aimed at increasing breastfeeding rates has identified possible risk factors for early cessation of breastfeeding, including the maternal intention status of pregnancy. Several studies suggest that unintended pregnancies may be associated with a decreased likelihood of postpartum breastfeeding and nearly half of the pregnancies in the United States each year are unintended. Such studies, however, commonly regard mistimed and unwanted pregnancies as equivalent, finding that women with unintended pregnancies (mistimed and unintended) were less likely to breastfeed than women with intended pregnancies and failing to compare mistimed pregnancies to unwanted. Distinguishing breastfeeding outcomes between mistimed and unwanted pregnancies may inform and/or change health policies regarding women and infants. This study tests the hypothesis that postpartum Oregon women whose pregnancy was classified as unwanted are less likely to initiate breastfeeding and complete at least 8 weeks of non-exclusive (any) breastfeeding than for an infant whose pregnancy was classified as either mistimed or intended pregnancies.

Methods

Using the 2005 Oregon PRAMS data set, this cross-sectional study evaluated the relationship between pregnancy intention status and any subsequent breastfeeding duration of at least eight weeks postpartum (classified as binary: yes, no). STATA

(version 10.0) was used for analysis of data. Postpartum mothers' survey responses were classified according to a three-part pregnancy intention status (intended, mistimed, and unwanted). Simple logistic regression analysis was used to identify associations between breastfeeding and individual predictor variables. Backward elimination model-building removed statistically non-significant variables ($p > 0.10$) from the model based on highest insignificant p-values. Multivariate logistic regression was used to evaluate and control for risk factors known to influence breastfeeding, including age, marital status, race/ethnicity, SES, education, and parity. Sampling weights were accounted for in all analyses owing to the complex sampling design of PRAMS.

Results

The sample size for 2005 Oregon PRAMS analysis was 1,915 (response rate of 68.2% unweighted, 75.6% weighted). Among respondents, 75.3% breastfed ≥ 8 weeks. Breastfeeding prevalence according to pregnancy intention was 81.4% (intended), 67.5% (mistimed), and 57.6% (unwanted). Compared to women whose pregnancies were unwanted, women with mistimed pregnancies were significantly more likely to breastfeed (OR 1.99, 95% C.I.: 1.00, 3.96) as were women with intended pregnancies (OR 2.45, 95% C.I.: 1.27, 4.72). Covariates significantly associated with breastfeeding at eight weeks included maternal non-smoking at time of survey administration (OR 1.99, 95% C.I.: 1.19, 3.34), increasing maternal age ($p = 0.011$), absence of maternal postpartum depression (OR 1.85, 95% C.I.: 1.10, 3.12), and being married (OR 1.72, 95% C.I.: 1.15, 2.58).

Discussion

This study used a three-category pregnancy intention predictor variable to reveal

that the association between breastfeeding at eight or more weeks and unwanted pregnancies is significantly different from mistimed pregnancies. This study also confirmed a significant association between overall pregnancy intention and breastfeeding at eight weeks. Women with intended pregnancies were also more likely to breastfeed than those with mistimed pregnancies, although this finding was not significant.

This study's outcome provides useful data on how breastfeeding education and support dollars might be best targeted, by focusing on the 7.49% of pregnancies identified as unwanted instead of including the 30.4% that were merely mistimed. Given the greater potential risks and needs associated with unwanted pregnancies, this category should be emphasized in public health and pediatric research involving breastfeeding and/or pregnancy intention. Future studies should build on these data and evaluate the impact, outcome, and cost-benefit of incorporating pregnancy intention status into clinical counseling affects breastfeeding prevalence among unintended pregnancies. Subsequent cross-sectional studies may also choose to examine if decreasing the incidence of unwanted pregnancies within a community correlates with an increase in breastfeeding and improvement in community-wide health status measures.

Acknowledgments

I would like to thank Dr. Ken Rosenberg for providing the inspiration and guidance for this thesis. His experience and contributions were invaluable.

Dr. Liz Adams brought an extensive history, calm wisdom, and excitement about the topic, with unfailingly great counsel.

Dr. Rochelle Fu led me through the statistical wilderness both in coursework and my thesis project. She never failed to read all parts of the thesis critically, respond promptly, and deliver quality statistical direction. More than this, she was an unfailing source of support.

Thanks also to Mike Lasarev and Dr. Susan Prows, unofficial contributors to my project who spent hours working with me on questions, edits, direction, and encouragement. Both are a credit to their profession.

Thanks to the PHPM department, Dr. John Stull and Dr. Katie Riley for leading us through this public health journey.

Finally, thanks to the MD/MPH class of 2009, my family, and my spouse Peter, who helped see me through this process.

Background and Significance

Breastfeeding: Definition and Benefits

The many health benefits of breastfeeding for children and infants are well established.[46] However, the influx of infant formulas that began in the post-World War II United States decreased breastfeeding to only 25% of discharged newborns by 1967. With subsequent decades of societal change and public health campaigns, breastfeeding initiation and duration has slowly been increasing.[63]

Today, breast milk is regarded as the most complete, economic, and valuable form of infant nutrition. Breastfeeding in infancy is associated with superior immune function, with fewer illnesses such as upper and lower respiratory disorders,[18] urinary tract infection, otitis media,[48] bacterial meningitis[11], and gastrointestinal disorders.[19, 36] Furthermore, breastfeeding offers potential protection against sudden infant death syndrome (SIDS),[24] obesity, insulin-dependent diabetes,[26] asthma, atopic dermatitis, and other chronic and autoimmune diseases. Internationally, infants who are exclusively breastfed for at least six months exhibit lower mortality and fewer gastrointestinal illnesses than infants who are non-exclusively breastfed starting at three to four months.

Use of breast milk saves money otherwise spent on formula and contributes to the mother-infant emotional bond.[12, 9, 15, 39, 0] Examining the societal costs of formula feeding, a savings of $3.6 billion dollars could be achieved simply by increasing breastfeeding rates to 75% immediately postpartum and 50% at six months.[63] Experimental trials that increased breast-feeding support for mothers showed a significant direct reduction in infant gastrointestinal disorders and eczema.[58]

The protective benefits of breastfeeding extend beyond the infectious disease risk

and malnutrition associated with developing economic and social infrastructure. In the United States, breastfeeding is associated with a decreased risk of post-neonatal death. Studies conducted on 1988 National Maternal and Infant Health Survey (NMIHS) data concluded that over 700 post-neonatal deaths could be prevented each year in the United States. [8]

A meta-analysis of 20 controlled studies indicated that, even after adjusting for socioeconomic status and maternal education, breastfeeding was associated with significantly higher cognitive function levels than those seen in formula-fed infants and toddlers. This advantage manifested early, persisted throughout childhood and adolescence, and increased as the duration of breastfeeding increased. [2]

Mothers benefit from breastfeeding as well, with increased infant bonding, fewer scarce household resources devoted to formula, and protection against immediate re-impregnation. Specific advantages of breastfeeding include decreased postpartum bleeding, prolonged lactational amenorrhea [36] and a potential decreased risk of hip fractures[14] and ovarian and breast cancers. [54, 1] On the other hand, certain conditions prohibit or serve to discourage breastfeeding. Maternal illegal drug use, chemotherapy, and inborn errors of metabolism in the newborn all preclude using breast milk as a nutritional source. [1] Mothers in developed nations are advised not to breastfeed in certain situations including HIV-positive maternal status. [17]

Definitions of breastfeeding differ between various studies and it can be important to distinguish between exclusive and non-exclusive breastfeeding. Unless noted as exclusive, "breastfeeding" can vary from nearly always breastfeeding to only one feeding of breast milk in a day with formula supplementation. Exclusive breastfeeding in this

paper entails feeding an infant only human-produced breast milk. While the definition of non-exclusive breastfeeding connotes supplementation of breastmilk with any combination of dairy, synthetic formula, or juice, its use as a study variable typically implies 'any breastfeeding,' including infants fed exclusively and non-exclusively.

U.S. Trends in Breastfeeding: Prevalence and Practice

Based on the extensive research supporting breast milk for infants, the Healthy People 2010 initiative (HP 2010) has set goals highlighting the important role of breastfeeding for child health and maternal wellbeing. The HP 2010 report was developed by the United States Department of Health and Human Services to set decade-long national health standards and objectives for the general population. HP 2010 built on previous initiatives and set breastfeeding targets for 2010 at the U.S. Surgeon General's recommendations: 75% immediately postpartum, 50% at six months, and 25% at one year. [28]

The most current research indicates that, while breastfeeding rates continue to increase, the HP 2010 goals have not yet been realized. Between 1996 and 2001, the prevalence of non-exclusive breastfeeding increased to mid-century highs for initiation, at 69.5-71.4%,[1] and breastfeeding duration of six months, at 27.0-35.1%.[55, 38] While national breastfeeding initiation rates are nearing 75%, non-exclusive breastfeeding at 6 months remains well below the desired 50%. Exclusive breastfeeding rates also remain quite low and poorly quantified.

[1] The higher statistics originate from the 2002 National Immunization Survey (N=3444), and include exclusive breastfeeding rates for initiation (63.4%) and duration (13.3%). The lower statistics come from the most recent Ross Laboratories Mothers Survey (an infant formula producer; approximate N=390,000), who also measured rates for exclusive breastfeeding initiation (46.3%) and duration (17.2%).

The American Academy of Pediatrics recommends breastfeeding for at least 12 months. [46] The majority of breastfeeding mothers begin weaning, however, before the infant reaches 6-12 months of age. [17] Those women who initiate and continue breastfeeding repeatedly demonstrate common characteristics such as white ethnicity, [34] maternal age older than 25 years, [22] higher SES, [4] non-smoking, [10] and not employed outside the house. [3]

Factors that predict longer breastfeeding duration include a positive association with the mother's attitude toward breastfeeding. Research also indicates that a mother's satisfaction with breastfeeding has been the strongest and most consistent predictor of breastfeeding duration, [33] though this remains a difficult factor to measure preemptively. Negative associations are seen with maternal smoking, pacifier use, returning to work, and breastfeeding difficulties in the first month postpartum. [57]

Breastfeeding rates are generally lower for socially disadvantaged groups of women. [17] While increases in breastfeeding rates have averaged 2% per year since the 1970's, this increase was lower in groups with historically lower breastfeeding likelihoods. The lowest rates were found among young mothers (less than 20 years of age), African American women, [13] and women with low education (at or below high school level), primiparous, and employed at the time of the survey. [56, 17] The prevalence was highest among White or Hispanic, educated mothers, and those living in Mountain or Pacific states.

After the most common and rapid decline in postpartum breastfeeding, typically the first 4-8 weeks, [53] a particularly sharp decline occurs between the second and third months. This time corresponds to a period of increasing barriers to breastfeeding as

mothers return to work and school.[40] While employment does not deter mothers from initiating breastfeeding, returning to work is associated with a shorter duration of breastfeeding.[62] Further barriers to breastfeeding include perceived physical and emotional difficulties. Breastfeeding complications can be physical, such as sore nipples or poor coordination with infant, but also include maternal depression, isolation, sleep deprivation, and lack of support.[17] Smoking women are also less likely to initiate[21] and continue[30] breastfeeding, with the heaviest smokers being least likely to exclusively breastfeed.[25]

While the demographic characteristics associated with breastfeeding are frequently studied and cited, other evidence indicates that maternal attitude and intention may be more critical in determining maternal feeding habits.[41] Among a cohort of Australian women, those who had planned their pregnancy were significantly more likely to exclusively breastfeed for at least six months.[57] Several studies in the United States indicate that more than 50-75% of women actually decide whether or not to breastfeed before they become pregnant, and this highly correlates with actual breastfeeding practices in the postpartum interval.[37] Multivariate analysis indicates that the earlier the decision to breastfeed, the greater the probability of initiation and extended duration.[42] Such results indicate the need for further understanding and improvement of the factors surrounding maternal attitudes.[31]

Pregnancy Intention

One such important factor affecting maternal decision-making and attitude is the concept of pregnancy intention. Unintended pregnancies comprise nearly half (49%) of the 6.4 million pregnancies each year in the United States. That translated into 3.1

million unintended pregnancies in 2001, the most recent data available. Of unintended pregnancies resulting in a birth, nearly two-thirds are mistimed and one-third are unwanted. [7]

Among American women of childbearing age, close to half (48%) have had at least one unintended pregnancy, resulting in an unintended birth for one-third of these women. 42% of all unintended pregnancies end in abortion. [29] Women of lower socioeconomic status experience a four-fold increase in unintended pregnancies and a three-fold increase in abortions. [23]

All told, this results in more than 5 billion dollars in direct pregnancy-related medical costs with the average price of an unintended pregnancy totaling $1609. [61] Healthy People 2010 also seeks to decrease the prevalence of unintended pregnancies to less than 30%.[51] The creation of such a plan reflects the importance of intended pregnancies and the impact of unintended – mistimed and/or unwanted – pregnancies.

Unintentional pregnancies reflect not only failures in planning but are also associated with numerous negative health outcomes for the resulting infants. Women experiencing an unintended pregnancy are less likely to seek out prenatal care and, when they do, seek care at a later date. Infants whose birth was unintended have a higher mortality rate than infants of intended pregnancies. They average a lower birth weight and poorer overall child health and development.[52]

Assessment of Pregnancy Intention

The most commonly used measure of systematic pregnancy intention classifies pregnancies as either "intended" (wanted then or wanted sooner) or "unintended" (combining mistimed and unwanted pregnancies). Measures of pregnancy intention

attempt to categorize a woman's intentions in the time period prior to becoming pregnant, but are typically employed after pregnancy or even birth occurs. This tension has inspired scholarship on both the adequacy and validity of measuring a women's pregnancy intention, especially when using a dichotomous approach.

Pregnancy intention was first assessed systematically with the 1941 Indianapolis Study. Inspired by the concerns of that era, that the population might be entering a decline, the emphasis was placed on "excess fertility": whether the most recent pregnancy was unwanted (excess) or wanted.[6] Thus the survey classified fertility into four groups, depending on fertility and planning status: "number and spacing planned", "number planned", "quasi-planned" and "excess fertility."[6] Neither this initial endeavor nor the two subsequent 1950 and 1955 Growth of American Families Studies took pregnancy timing into account and the results gave no indication whether the pregnancy might have occurred sooner than wanted.[6]

With the beginning of the National Fertility Study (NFS) in 1965, the concept of fertility timing was introduced. The NFS further classified unwanted pregnancies into "Timing failures" if the mother or husband had wanted the child at a later time, or "Number failures" if the couple had not wanted any further pregnancies. Of the married women sampled by the NFS, only 26% demonstrated a successfully planned pregnancy, compared to a 32% probability of a number failure and 62% probability of a timing failure.

Although this focus on timing was not continued with the 1970 National Fertility Study as researchers chose again to focus on national fertility decline, it did highlight the lack of successful pregnancy planning and paved the way for the establishment of the

National Survey of Family Growth within the National Center for Health Statistics (NSFG). The NSFG has maintained a system enquiring about number and timing failures since its inception, [6] using the three-part (intended, mistimed, unwanted) definition of pregnancy intention since its inception in 1973, even though the degree and implication of mistiming is not typically reported. [56, α]

In its 1995 report, "The Best Intentions", the Institute of Medicine paid heed to the importance of terminology and its implications in the NFSG, citing the different risks and outcomes associated with unwanted pregnancies, compared to mistimed. The report recognized that not even a three-level pregnancy intention variable would accurately capture the complicated feelings surrounding intention.

The distinction between unintended and unwanted pregnancies is important (where the term 'unwanted' includes only those pregnancies not wanted at all) both for health planning and for judicious use of public health and healthcare resources. Unwanted pregnancies have been closely linked with many studies to negative outcomes. Because prevention of an unwanted conception means that no pregnancy or birth takes place, it matters less whether the relationship was causal or associated; the prevention will prevent the ill effects. Mistimed pregnancies, however, pose a more unsubstantiated question of timing. For these pregnancies, one must more closely differentiate whether the relationship is causal or merely associated. If it is not causal, then an intervention directed at mistimed pregnancies will merely change the pregnancy timing – not the outcome of interest.[5]

Current studies have questioned the validity of retrospective pregnancy intention

[α] Using the National Longitudinal Survey of Youth, Joyce, Kaestner, and Korenman examined the process of retrospective assessment of pregnancy intention in 2002. They concluded that the resulting estimates of number, or consequences of, unintended births were not misleading (Joyce 2002, p199).

measures, citing ambivalence among women, influence of male partners, cultural perspectives, and weak predictive value. Data examination has highlighted contradictions between pregnancy intention, failure of contraception, and the woman's reaction to becoming pregnant. For example, Trussell's 1999 study of NSFG data showed that among women reporting a contraceptive failure, 32% claimed this was also an intended pregnancy and 90% were or had been happy with the conception. [60]

PRAMS studies have traditionally used the single dichotomous category to represent pregnancy intention. However, recent literature examining PRAMS 1998 data from 15 states suggests that the risk of not breastfeeding is greater for unwanted pregnancies, compared to mistimed. Differences were noted for other demographic characteristics, especially tobacco, age and parity. [16, 49] While the proportion of women with unwanted pregnancies is much less than mistimed, the significance of an unwanted pregnancy suggests the need for alternate measures of comparison, such as the use of mistimed within a 3-part pregnancy intention variable. Though this approach may not be ideal, it theoretically would still capture those infants who are most at risk – namely, those born to women who persist in reporting their pregnancy as unintended even three to four months postpartum.

Breastfeeding and Pregnancy Intention

Prior research has shown a significant association between pregnancy intention and subsequent breastfeeding practices. In the United States, Dye et al's seminal study in 1997 found that women in the New York State region were less likely to initiate breastfeeding or to breastfeed exclusively for unintended pregnancies. This study used a PRAMS questionnaire on a large population of 27,700 hospitalized women to assess

pregnancy intention in the post-partum interval. Its main weakness stemmed from the use of only breastfeeding 'intention' data, collected before mothers discharged from the hospital, lacking corroboration with actual breastfeeding practices post-discharge. It is difficult to generalize an effect size from data collected before the women return to their home and work environments – environments where they will encounter additional factors known to alter breastfeeding rates and practice.[20] Furthermore, Dye's study examined only whether mistimed pregnancies differed from intended pregnancies. More useful for public health and medical planning is whether mistimed pregnancies differ from unintended pregnancies.

Several international studies have confirmed this association in Ghana, Peru, and in multi-country analyses.[9, 32] For example, Pérez-Escamilla, Cobas, Balcazar and Benin explored 1991-92 Peruvian Demographic and Health Survey data. Their results indicated that, among 8731 women, unplanned pregnancies had a negative impact on breastfeeding duration.[65] Their statistical analysis concludes that the variable for pregnancy intention may also serve as a proxy for breast-feeding motivation and attitude in the ante-partum and immediate post-partum interval,[47] an inference that appears in keeping with the extensive data correlating maternal attitudes toward breastfeeding with actual practice.[48]

Taylor and Cabral examined the association between pregnancy intention and actual breastfeeding practice using 1995 National Survey on Family Growth data. Their results showed a similar relationship to that seen in the study by Dye et al., with a stronger positive association observed for Caucasian vs. African American or Latina women. These data sampled only first-time mothers and were not generalizable to multiparous women. Results were also constrained by the lack of data on potential

confounders or effect modifiers, such as tobacco use, breastfeeding education, or breastfeeding support before or after pregnancy. [59]

D'Angelo et al. showed many important risk factors associated with unwanted pregnancies, especially that an increased risk of not initiating breastfeeding differed significantly between mistimed pregnancies and unintended, and between mistimed and intended pregnancies. Using 1998 combined PRAMS data from 15 states. The study, however, calculated only unadjusted relative risks and was not able to adjust for confounders such as age or socioeconomic status (income). Only breastfeeding initiation (any breastfeeding, $\geq$ 1 week) was examined. [16]

Kost et al. found similar results showing that unwanted pregnancies are less likely to initiate breastfeeding, but found no difference in the odds of breastfeeding between mistimed and intended pregnancies. Mistimed pregnancies were not compared to unintended pregnancies in their study, using both the 1988 National Maternal and Infant Health Survey and the 1988 National Survey of Family Growth. [35]

Breastfeeding and Pregnancy Intention in Oregon

Considerable interstate variation has been noted within PRAMS data on pregnancy intention[56] and the Oregon population differs on several accounts from the groups used in prior studies. Unintended pregnancies are lower in Oregon than in the populations previously studied with regards to breastfeeding. And at 94.2%, initial breastfeeding rates in Oregon[44] far exceed those found by Dye et al., and Taylor and Cabral's studies (59.4% and 48.5%, respectively).

In Oregon, pregnancy intention and breastfeeding represent health policy priorities. Over 204,000 Oregon women rely on publicly funded family planning clinics

for reproductive control, and Oregon ranks 9th in the nation for assisting women in preventing unintentional pregnancies. While the nation as a whole experienced a 4% increase of unintended pregnancies between 1995 and 2002, Oregon's proportion of unintended pregnancies decreased from 51% to 39.2%.[51] At 94.2%, Oregon supersedes the national average (71.4%)[43,44] for initial breastfeeding attempted. Better understanding the relationship between pregnancy intention and breastfeeding rates could improve the efficacy and efficiency of Oregon's health policies and give guidance to other states' progress in this area.

In this regard, it is important to know whether or not breastfeeding is associated with pregnancy intention status, in order to shape effective intervention programs and to allocate funds appropriately. The PRAMS survey represents a data set capable of answering this question. PRAMS is a cross-sectional survey that measures attitudinal, life-history and demographic data and health service-related factors including substance abuse, prenatal and breastfeeding education, and corroborates these with birth certificate-derived demographic data. With its large sample size and structural similarity to other states' PRAMS results, this database represents a feasible way to assess breastfeeding's relation to pregnancy intention while accounting for the unique attributes of Oregon's population. PRAMS also provides the data by which to assess a three-part pregnancy intention variable (intended, mistimed, unwanted) and its relationship to breastfeeding intention.

Review of Preliminary Oregon PRAMS Findings

Previous Oregon PRAMS analyses of breastfeeding habits suggested that unintentional pregnancy was a risk factor for failing to breastfeed. Data from the 1998-

99 PRAMS survey (Table 1) indicated that 83.6% of Oregon women initiated breastfeeding and 59.5% of Oregon women were still breastfeeding (exclusively or non-exclusively) at 10 weeks postpartum. According to univariate analysis from this data (Table 1), women with an unintended pregnancy were more likely to not breastfeed compared to women with an intended pregnancy (OR 1.47). While this association was not statistically significant upon multivariate analysis (OR 1.16, 95% C.I.: 0.81-1.67), changes in population over time and a more specific statistical analysis suggest further research is merited.[53]

Breastfeeding duration has traditionally been measured as a dichotomous, not linear variable. This requires the researcher to select a maximum number of weeks or months at which to assess breastfeeding duration. Typically, four weeks has been used in multi-state CDC PRAMS analyses, while Oregon PRAMS has examined duration at ten weeks. The most recent PRAMS analyses (1998-9) for which data is available on both breastfeeding duration (exclusive), and pregnancy intention show initial crude estimates of:

Intended Pregnancy –	60.3%
Mistimed Pregnancy –	27.4%
Unwanted Pregnancy –	10%
Any Breastfeeding, Duration 7-8 weeks –	68.8%
Any Breastfeeding, Duration >8 weeks –	64.9%

Table 1. Risk Factors for Not Breastfeeding at 10 weeks Postpartum, Oregon PRAMS 1998-1999: UNIVARIATE ANALYSIS

Maternal Characteristic	**Odds Ratio**	**(95% CI)**
Tobacco use (third trimester) vs. no tobacco use	2.08	(1.49, 2.94)

Unmarried vs. married	2.00	(1.04, 2.44)
Maternal Age <20 years vs. maternal age ≥ 20 years	1.96	(1.27, 3.03)
WIC Enrolled vs. not enrolled during pregnancy	1.61	(1.18, 2.22)
Medicaid coverage prior to pregnancy vs. no coverage	1.59	(1.04, 2.44)
Annual family income <$30,000 vs. ≥ $30,000	1.52	(1.10, 2.08)
Birth weight <2500g vs. ≥ 2500g	1.47	(1.11, 1.96)
Unintended pregnancy vs. intended pregnancy	1.47	(1.05, 2.04)

Study Rationale and Objectives

This project used recently collected Oregon Pregnancy Risk and Monitoring Survey (PRAMS) data to explore a potential relationship between pregnancy intention and postpartum breastfeeding. Specifically, it examined whether mistimed pregnancies had a different association with any breastfeeding at eight or more weeks postpartum, compared to unintended pregnancies, using a three-part variable of pregnancy intention (wanted, mistimed, unwanted). Such research could improve health outcomes for infants by identifying populations of women who are at the greatest risk for low breastfeeding practices, and who may benefit the most from additional health promotion and education interventions.

Methods

PRAMS

Study Design and Data Source

This cross-sectional study uses previously collected Oregon State Pregnancy Risk Assessment Monitoring System survey data, supplemented and corroborated with birth certificate data linked to each participant's infant. PRAMS is an ongoing population-based survey administered by the Oregon Department of Human Services, Office of Family Health in Portland, Oregon. The survey continuously collects data from women who have given birth in the prior 2-6 months. The goal is to identify maternal behaviors and conditions prior to, during, and after pregnancy that may influence the health of infants. These data include measures of pregnancy intention, breastfeeding knowledge, education, initiation, and duration. PRAMS data also identify high-risk groups of women and infants, monitor markers and shifts in health status, and measure the progress of policies and programs in improving maternal and child health.[45]

PRAMS began under the Centers for Disease Control and Prevention (CDC) in 1987 and serves as a model for 39 corresponding states' versions. Oregon's version of PRAMS has been utilized since 1998. Since 2002, Oregon's data has been collected under CDC protocol, allowing for multi-state comparison. National PRAMS surveillance in 2002 included 62% of total live U.S. births. [64]

Arrangement for the use and analysis of these data for this study has been coordinated between the Oregon Department of Human Services (DHS) and Oregon Health and Science University Department of Public Health and Preventative Medicine in partial fulfillment of the author's degree of Master of Public Health in Epidemiology and Biostatistics. Oversight has been provided by Kenneth D. Rosenberg, MD, MPH,

PRAMS Project Director in Oregon, as well as Elizabeth Adams, PhD, RD specializing in maternal and child health and nutritional epidemiology at OHSU, and Rochelle Fu, PhD in statistics, also faculty at OHSU.

Sampling Design and Weighting Methodology

PRAMS employs a stratified random sampling of mothers after a live birth and the results are subsequently weighted for interpretation. Weighting strategies include sampling weights (for the six strata that respondents are sampled from), non-response weights, and non-coverage weights. These three weights are multiplied together to form the final analysis weights.

Non-response weights account for groups of women with certain characteristics that may have lower response frequencies, incomplete/partial survey completion rates, and other design effects – when compared to respondents. Non-coverage weights adjust for circumstances in which some births are not represented in state birth certificate records, for reasons such as late processing or temporal clustering. Certain groups of women are oversampled to ensure adequate data collection within minority populations; this sampling is employed within six groups (Table 2).

Table 2. Ethnicity-based Sampling Groups

(1) Low birthweight (<2500g) Non-Hispanic White women
(2) Normal birthweight (≥2500 g) Non-Hispanic White women
(3) Hispanic women
(4) Non-Hispanic American Indian/Alaska Native women
(5) Non-Hispanic African American women
(6) Non-Hispanic Asian & Pacific Islander women

In PRAMS analysis, ethnicity and race are combined into one category: race/ethnicity. Independently, ethnicity is defined as Hispanic or non-Hispanic. Race is defined as:

(1) White
(2) American Indian/Alaska Native
(3) Black/African American
(4) Asian/Pacific Islander

For the purposes of PRAMS study, ethnicity and race are categorized into a single variable with five strata (Table 3).

PRAMS surveillance survey utilizes standardized data collection with validated methods. Please see Appendix A for complete data collection protocol.

Table 3. Oregon PRAMS 2005: Race

RACE	NUMBER RESPONDENTS[2]	WEIGHTED PROPORTION
NH[3] African American	229	2.08 %
NH[2] N American Indian / Alaskan Native	260	1.63 %
NH[2] Asian / Pacific Islander	303	5.47 %
Hispanic	438	20.28 %
White	680	70.55 %
Total	1910	100.00 %

[2] Unweighted
[3] NH = Non Hispanic

Subject Selection

Subject data comes from the 2005 cycle of the annually conducted PRAMS survey. DHS uses the PRAMS instrument each year to survey approximately 2000 postpartum Oregonian women (approximately 100-300 per month) from the more than 40,000 annual births. Subjects are sampled randomly using birth certificate records with oversampling for racial minority women. Subjects are contacted at approximately 3-4 months after delivery. If four months have already passed, a subject may still be considered eligible. Since not all birth certificates are filed and reported in a timely manner, inclusion into the survey will be considered if a subject has not been previously sampled, if her birth occurred no more than 180 days prior to survey administration, and provided that she would otherwise have been eligible for survey inclusion.

PRAMS Data Collection

A PRAMS survey is typically presented to approximately 2000 women each year. Subjects are initially contacted by mail or telephone at three to four months postpartum with a PRAMS paper survey and related descriptive materials. If no response is received, a second mailing is sent. If no response is received after the second mailing, attempts are made to reach the participant and administer the survey by phone. Oregon unweighted response rates average 65-75%. The official PRAMS CDC protocol, to which Oregon now adheres, is available on the CDC website (http://www.cdc.gov/PRAMS/) and included below as Appendix A.

Information pertaining to maternal race and ethnicity is obtained from birth certificate data. Birth certificate data are collected from mothers' medical records or self-reported declarations of race at the time of birth certificate application. Birth certificates also can

provide the infant's father's race/ethnicity data, if recorded. Birth certificate data is used for only for variables not otherwise obtainable from the PRAMS survey, with the exception for maternal age, which has shown to be more complete and reliable when taken from birth certificate data[27]. Some variables are available via birth certificate but not in PRAMS data (Table 4).

Table 4. Data to be collected from Birth Certificates

Maternal age	Parity
Maternal race/ethnicity	Infant birth weight
Marital status (not married, married)	Maternal education
Rural/Urban status of maternal county	Maternal delivery method

Sample sizes for each group are calculated based on the total number of Oregon births among Oregon residents within the previous calendar year. In 2005, PRAMS oversampled Oregon women for race/ethnicity and low birthweight Non-Hispanic White women. To sample mothers of twins or multiple gestations, only one of the infants was selected randomly before beginning the overall sampling process; its mother was advised to answer questions only about the sampled baby.

Data Management and Statistical Analysis

The full PRAMS 2005 dataset was obtained from the Oregon Department of Human Services in STATA format with all personal identifiers removed. Data was securely maintained in accordance with OHSU and Oregon DHS policies. OHSU's Institutional Review Board (IRB) was contacted, however secondary data analysis on previously collected de-identified PRAMS data, with no additional data collection, does not require separate IRB approval. All responses were analyzed using STATA 10.0.

Study Data Management

Variable Recoding

Variables were received as a STATA dataset and were kept in their original format or reformatted in order to consolidate data in cases where PRAMS methodology uses multiple questions to assess a single variable.

The outcome (dependent variable of interest), breastfeeding, was determined from a series of PRAMS questions on breastfeeding. A respondent who initiated breastfeeding and was still breastfeeding at the time of the survey, or had initiated breastfeeding and responded that she breastfed for at least eight weeks or longer was considered to have breastfed for at least eight weeks (Table 5).

Breastfeeding was categorized as: duration (non-exclusive) of breastfeeding ≥8 weeks, where the category of "non-exclusive" here includes any breastfeeding, whether exclusive or augmented by formula, water, solid food, etc. The steepest decline in breastfeeding occurs between 4 and 16 weeks postpartum. Although ≥11 weeks is the longest time period a PRAMS subject may indicate she was breastfeeding, 1-3% of PRAMS responses occur before the infant has actually reached 11 weeks of age. As an 8-weeks time period is typically used for national breastfeeding survey analysis, this period was used to mark breastfeeding duration.

The dependent variable (non-exclusive breastfeeding duration ≥ eight weeks) was recoded as 0/1 for compatibility with STATA's logistic regression analysis dependent variable requirements. For the first step in coding the variable from the original PRAMS questionnaire, duration of infant breastfeeding was determined (Questions 46 and 47). The patient was asked, "*Are you still breastfeeding or feeding pumped milk to your new*

baby?" If the mother answered yes, she was counted as breastfeeding ≥ 11 weeks. If she answered no, she was referred on (to Question 47) to give the length of time that she did breastfeed her infant. Non-exclusive breastfeeding of eight or more weeks' duration was coded as one; non-exclusive breastfeeding of less than eight weeks' duration was coded as zero. As this study deals only with 'any breastfeeding' (includes exclusive and non-exclusive breastfeeding), the determination of exclusivity was not necessary. Initial and Final coding for the dependent is detailed in Table 5.

Table 5. PRAMS questions, responses, and coding used to determine prevalence of breastfeeding at eight weeks.

PRAMS QUESTION	**POSSIBLE RESPONSES**	**INITIAL VARIABLE CODING**	**CODING FOR FINAL ANALYSIS**
CODING FOR BREASTFEEDING DURATION AT EIGHT WEEKS			
Q46. "Are you still breastfeeding or feeding pumped milk to your new baby?"	Yes ----------→	1= > 11 weeks -------→	*1 = Yes*
	No	2 = No	*Go to Question 47 (n/a)*
Q47. "How many weeks or months did you breastfeed or pump milk to feed your baby"	___Weeks, or ___Months	Continuous numbers reported	*0 = No, if responded ≤ 7 weeks* *1 = Yes, if responded ≥ 8 weeks*
	<1 week	0.5 = < 1 week	*0 = No*
FINAL VARIABLES FOR ANALYSIS	***Initial coding:***	***Final coding:***	
Non-exclusive Breastfeeding	*0 = < 8 weeks* *0 = < 1 week* *0 = not breastfeeding at time of survey* *1 =breastfeeding at time of survey* *1 = ≥ 8 weeks*	**0 = < 8 weeks** **1 = ≥ 8 weeks**	

The main independent variable examined was pregnancy intention at conception. Question 10 of the PRAMS survey inquires about pregnancy intention, asking women to recall how they felt about becoming pregnant just before they became pregnant. Question 10 has four possible answers: "*Thinking back to* just before *you got pregnant, how did you feel about becoming pregnant? [I wanted to be pregnant sooner, I wanted to*

be pregnant later, I wanted to be pregnant then, I didn't want to be pregnant then or at any time in the future].

Combining these responses, subjects are categorized into three groups: [4]

(1) Intended Pregnancy (wanting to be pregnant at that time or sooner)
(2) Mistimed Pregnancy (wanting to be pregnant at a later time)
(3) Unwanted Pregnancy (not wanting to become pregnant at any time in the future).

Missing responses and their distribution were examined for the independent and dependent variable of interest (Table 11).

Covariates:

Based on previous research [20], additional variables such as race, age, and marital status showed predictive possibilities in regard to breastfeeding duration (Table 6). These include maternal age, race/ethnicity, marital status, maternity leave, mode of birth delivery, maternal education level, maternal parity, low infant birth weight, maternal alcohol, drug or tobacco use during pregnancy, maternal viral or sexually transmitted infections, maternal poverty level/Medicaid coverage, maternal prenatal care, and maternal domestic violence during pregnancy.

PRAMS currently collects data on most of the aforementioned potentially confounding variables, as well as additional health-related variables. PRAMS questions and birth certificate variables examined in the statistical analysis, as well as variable initial and re-coding, are detailed in Table 7.

If a subject's data was missing for a potential confounder or predictor variable (responses of "don't know" and blanks), that subject's data was excluded from analysis only if the variable in question was used in the final model.

Table 6. Potential Confounding Variables

Age	Race/ethnicity	Marital Status
Infant Death	Maternity Leave	Mode of Birth Delivery
Maternal Education Level	Maternal Parity	Low Infant Birth Weight
Alcohol and Tobacco Use in Pregnancy	Maternal STI	Poverty Level/Medicaid Coverage
Drug Use in Pregnancy	Prenatal Care	Domestic Violence
Folic Acid Use	Oral Health	Rural/Urban Residence

Table 7. PRAMS questions and birth certificate variables, responses, and coding for variables used in statistical analysis:

ORIGINAL VARIABLE	POSSIBLE RESPONSES	CODING FOR NEW OR FINAL VARIABLE	SOURCE
Pregnancy Intention (Q10.)	I wanted to be pregnant sooner	1 = Intended	PRAMS
	I wanted to be pregnant then	1 = Intended	
	I wanted to be pregnant later	2 = Mistimed	
	I didn't want to be pregnant then or at any time in the future	3 = Unwanted	
Maternal Age at Delivery (years)	Continuous values reported	1 = < 20 years 2 = 20 - 24 years 3 = 25 – 34 years 4 = ≥ 35 years	Birth Certificate
Maternal Education	Continuous values reported	1 = < 12 years 2 = 12 years 3 = > 12 years	Birth Certificate
Marital Status	-Married/Separated -Unmarried/Divorced/ Annulled/Widowed	1 = Married 2 = Not married	Birth Certificate
Race	African American	1	Birth Certificate
	American Indian/ Alaskan Native	2	
	Asian/Pacific Islander	3	
	Hispanic	4	
	White (referent)	5	
Income	*Calculated as: Federal Poverty Level =(100*household income)/(9310 + [income given # dependenst])*3180)*	1 = < 200% FPL 2 ≥ 200% FPL	PRAMS
Parity	- No -Yes	1 = No 2 = Yes	PRAMS
Rural/Urban County of Residence	All counties in Oregon	1 = Rural 2 = Urban	Birth Certificate
Current tobacco use	1 = 41 cigarettes or more 2 = 21 to 40 cigarettes 3 = 11 to 20 cigarettes 4 = 6 to 10 cigarettes 5 = 1 to 5 cigarettes	1-5 → 1= Yes	PRAMS
	6 = Less than 1 cigarette 7 = None (0 cigarettes)	6, 7 → 2 = No	
Insufficient Dental Care *"How long has it been since you had your teeth cleaned by a dentist or a dental hygienist?"*	(1)- Within the past year *(less than 12 months)* (2) - 1 to less than 2 years *(12 to 23 mo)*	1 → 1 = No 2 → 1 = No	PRAMS
	(3) - 2 to less than 5 years *(24 to 59 mo)* (4) - 5 or more years *(60 or more mo)* (5) - Never	3 → 2 = Yes 4 → 2 = Yes 5 → 2 = Yes	
Domestic Violence[5] Q38-Abuse BEFORE pregnancy? Q39-Abuse DURING pregnancy.	1= Yes (*Q38.)* 2 = No (*Q38.)* 1 = Yes (*Q39.)* 2 = No (*Q39.)*	If *either* Q38 or Q39 = 1: 1 = Yes If *both* Q38 and Q39 = 2: 2 = No	PRAMS
Postpartum Depression *Q75a-Depressive sx postpartum* *Q75b-"no interest" post-partum*	1 = Always 2 = Often 3 = Sometimes 4 = Rarely	If *either* Q75a or Q75b=1 or 2: 1 = Yes If *neither* Q75a or Q75b=1 or 2:	PRAMS

[5] During pregnancy

	5 = Never	2 = No	
Low Birthweight *< 2800 g*	1 = Yes 2 = No	1 = Yes 2 = No	Birth Certificate
Method of Delivery	1 = Vaginal 2 = Non-vaginal	1 = Vaginal 2 = C-Section	Birth Certificate
Baby in ICU after birth	1 = No 2 = Yes	1 = No 2 = Yes	PRAMS
Alcohol during Pregnancy *During the last 3 months of your pregnancy, how many alcoholic drinks did you have in an average week?*	1 = 14 drinks or more a week 2 = 7 to 13 drinks a week 3 = 4 to 6 drinks a week 4 = 1 to 3 drinks a week	1-4 → 2 = Yes	PRAMS
	5 = Less than 1 drink a week 6 = Didn't drink then	5, 6 →1 = No	
Breastfeeding Health promotion *During any of your prenatal care visits, did a doctor, nurse, or other health care worker talk with you about… Breastfeeding?*	1 = No 2 = Yes	1 = No 2 = Yes	PRAMS

Statistical Analysis

Simple univariate analysis described the significance of each potential predictor and confounder variable with the outcome of interest: non-exclusive breastfeeding duration ≥ 8 weeks. Variable distributions were examined for age, income, and education to check for outliers. Crude odds ratios were calculated to determine the magnitude of association between pregnancy intention and breastfeeding and p-values were calculated to determine if these relationships are significant. Multivariate logistic regression was employed to model and examine the relationships between the categorical response variables of interest (non-exclusive breastfeeding duration ≥8 weeks) and pregnancy intention after adjusting for confounders (and covariates). The linearity of continuous variables was examined with locally-weighted scatter plot smoothing (Lowess). If a continuous variable's distribution did not appear suitably linear, the covariate was transformed into a categorical variable with reevaluation of its bivariate significance (p-value). Variables were included in the initial (full) multivariate model if their bivariate analysis was significant at the 0.25 level. Correlation between independent variables was examined for any concerning degree of correlation (> 0.90) to rule out collinearity.

Backward selection was used to select the variables in the multivariate model from the initial full multivariate model. Variables with low significance were sequentially removed if their p-value was greater than 0.10; variables with least significance (highest p-value) were removed first. If removal of a variable changed the odds ratio for the variable of interest by greater than 10%, the variable was retained in the model as a possible confounder.

The model was assessed both for main effects and potential interactions between the outcome of interest and other variables in the model. Goodness of fit was tested

using the *svylogitgof* function in STATA (Table 9). Lastly, this model was compared to a model formed by STATA's automated backward stepwise selection program.

Table 8. Oregon PRAMS 2005: Univariable evaluation of non-exclusive breastfeeding duration ≥8w by maternal characteristics

Covariate	Number that breastfed ≥8w [6]	Total number: (breastfed + did not breastfeed) *(n)*[1]	Proportion that Breastfed ≥8w (Un-weighted %)	Proportion that Breastfed ≥8w (Weighted %)	Crude OR (95% C.I.), p-Value (adjusted Wald test)		Overall *p*-Value[7]
Pregnancy Intention							
intended	799	1031	77.5%	81.4%	3.23 (1.75, 5.96)	.000	**.000**
mistimed	383	582	65.8%	67.5%	1.53 (.814, 2.88)	.186	
unwanted	73	136	53.7%	57.6%	Ref		
Maternal Age							
≤20	96	182	52.8%	45.7%	Ref		**.000**
21- 24	280	445	62.9%	84.7%	2.48 (1.47, 4.53)	.001	
25-34	699	898	77.8%	81.7%	5.31 (3.12, 0.02)	.000	
≥35	195	247	79.0%	79.2%	4.53 (2.31, 8.89)	.000	
Maternal Education							
< 12 years	253	408	62.0%	62.4%	Ref		**.000**
12 years	341	530	64.3%	69.7%	1.39 (.911, 2.11)	.127	
> 12 years	659	814	81.0%	83.5%	3.05 (2.03, 4.60)	.000	
Marital Status							
Not married	394	665	59.3%	61.3%	Ref		**.0020**
married	876	1107	79.1%	82.1%	2.30 (1.36, 3.89)	.002	
Mother's Race/Ethnicity							
NH African American	124	202	61.4%	59.9%	.456 (.315, .659)	.000	**.000**
NH Am. Ind./Alaska Native	154	244	63.1%	62.9%	.518 (.364, .736)	.000	
NH Asian/Pacific Islander	232	284	81.7%	80.6%	1.27 (.861, 1.86)	.229	

[6] Unweighted number of respondents (excludes those who did not know or chose not to respond).

[7] The overall p-value (based on an adjusted Wald f-test) indicates the general significance of a multi-category variable within the model. The category specific p-values, on the other hand, signify the significance of a given category compared to the referent category, but do not indicate whether the variable in its totality is significant within the model.

Hispanic	294	405	72.6%	72.3%	.796 (.577, 1.10)	.163	
NH White	464	633	73.3%	76.6%	Ref		
Income							
< 200% FPL	665	1007	66.0%	68.3%	Ref		.0000
≥200% FPL	525	636	82.6%	84.1%	2.45 (1.66, 3.60)	.000	
Parity							
first-born	537	758	70.8%	77.4%	Ref		.638
not first-born	709	982	76.0%	76.0%	1.09 (.70, 1.53)	.638	
Rural/Urban County of Residence							
rural	275	420	65.5%	67.8%	Ref		.0084
urban	996	1353	73.6%	77.9%	1.67 (1.13, 2.44)	.0084	
Maternal Smoking							
No	140	285	49.1%	54.9%	3.32 (2.55, 4.30)	.000	.000
yes	1111	1458	76.2%	78.9%	Ref		
Insufficient Dental Care							
yes	843	1134	74.3%	78.4%	Ref		.0191
no	418	620	67.4%	70.5%	.659 (.465, .934)	.0191	
Domestic Violence							
yes	55	97	56.7%	58.8%	Ref		.0153
no	1110	1480	75.0%	78.8%	2.00 (1.20, 5.63)	.0153	
Postpartum Depression							
yes	135	227	59.5%	59.7%	Ref		.0008
no	1130	1535	73.6%	77.2%	2.29 (1.41, 3.71)	.0008	
Low Birthweight[8]							
yes	234	346	67.6%	67.5%	Ref		.0126
no	1037	1427	72.7%	75.7%	1.50 (1.09, 2.06)	.0126	
Alcohol during Pregnancy							
No	673	946	71.1%	75.9%	Ref		.633
yes	78	101	77.2%	79.3%	1.22 (.544, 2.72)	.633	

[8] Low birthweight = birthweight < 2500 grams.

Table 9. Oregon PRAMS 2005: Multiple logistic regression model analysis of non-exclusive breastfeeding duration ≥ 8 weeks, with univariate analysis of preliminary model variables.

Model	Crude OR				**Model 8**- final			
Goodness of Fit test: F-stat					.819			
Variable	OR	95% C.I.			OR	95% C.I.		
		lower	upper	p		lower	upper	P-value
Pregnancy Intention				0.000 (overall[9])				0.0268 (overall)
Mistimed *compared to Unwanted*	1.53	0.81	2.88	0.186[10]	1.99	1.00	3.96	0.049
Intended *compared to Unwanted*	3.23	1.75	5.96	0.00	2.45	1.27	4.72	0.008
Intended *compared to Mistimed*	2.11	1.46	3.04	0.00	1.23	0.809	1.86	0.334
Maternal Age				0.00 (overall)				0.0011 (overall)
< 20	2.58	1.47	4.53	0.001	**Ref**	-	-	-
20-24	5.31	3.12	9.02	0.00	2.25	1.20	4.19	0.011
25-34	4.53	2.31	8.89	0.00	3.45	1.87	6.38	0.00
≥ 35	2.58	1.47	4.53	0.001	2.83	1.27	6.32	0.011
Marital Status								
Not married	Ref	-	-	-	**Ref**	-	-	-
Married	2.23	1.36	3.90	0.002	1.72	1.15	2.58	0.009
Rural/Urban County of Residence								
Rural	Ref	-	-	-	**Ref**	-	-	-
Urban	1.67	1.14	2.44	0.008	1.46	0.97	2.20	0.071

[9] The overall p-value (based on an adjusted Wald f-test) indicates the general significance of a multi-category variable within the model. The category specific p-values, on the other hand, signify the significance of a given category compared to the referent category, but do not indicate whether the variable in its totality is significant within the model.

[10] Category-specific p-values are based on tests of the t-statistic.

Maternal Smoking								
No	3.32	2.55	4.30	0.000	1.99	1.19	3.34	0.009
Yes	Ref	-	-	-	**Ref**	-	-	-
Postpartum Depression								
Yes	Ref	-	-	-	**Ref**	-	-	-
No	2.29	1.41	3.71	0.001	1.85	1.10	3.12	0.021
Income								
< 200% FPL	Ref	-	-	-				
≥200% FPL	2.45	1.66	3.60	0.00				
Maternal Education				0.000 (overall)				
< 12 years	Ref	-	-	-				
12 years	1.39	0.911	2.11	0.127				
≥ 12 years	3.05	2.03	4.60	0.00				
Maternal Race/ Ethnicity				0.000 (overall)				
African American	0.456	0.315	0.660	0.000				
Am. Ind./Alaska Native	0.518	0.364	0.736	0.000				
Asian/Pacific Islander	1.27	0.861	1.86	0.229				
Hispanic	0.796	0.577	1.10	0.163				
White	Ref	-	-	-				
Parity								
first-born	Ref	-	-	-				
not first-born	1.09	0.770	1.53	0.638				
Domestic Violence								
Yes	Ref	-	-	-				

no	2.60	1.20	5.63	0.015				
Insufficient Dental Care								
No	Ref	-	-	-				
Yes	0.659	0.465	0.934	0.019				
Low Birth weight								
Yes	Ref	-	-	-				
No	1.50	1.09	2.06	0.013				

Results

Sample Characteristics/Descriptive Statistics

Univariate and bivariate statistics are described in Table 8; all results in tables and the following text are calculated as weighted unless otherwise noted.

For Oregon's 2005 PRAMS survey, 2,806 surveys were sent out and 1,915 women responded for a 68.2% response rate (75.6% weighted). Overall, 62.1% of respondents identified their pregnancy as intended, 30.4% as mistimed, and 7.49% as unwanted.

The mean age of women responders was 27.5 years[11]. Of all respondents, 33.0%, were unmarried and 19.04% did not graduate from high school. In total, 70.6% of women were White, 20.3% were Hispanic, 5.47% were Non-Hispanic Asian/Pacific Islander, 1.63% were non-Hispanic American Indian/Alaskan Native, and 2.08% were non-Hispanic Black. The average income of surveyed women was 198%$^{\alpha}$ of the Federal Poverty Level, with 18.3% living at ≤50% FPL, 10.7% at 50-99% FPL, 24.6% at 100-199% FPL, and 46.2% at ≥200% FPL. For maternal county of residence, approximately 25.2% of women lived in a rural area. Postpartum depression symptoms were described by 11.3% of respondents. A minority (5.16%) of infants were cited by mothers as low birth weight upon delivery. Parity was expressed by 57.2% of respondents, endorsing at least one prior birth. 15.9% of women surveyed said they smoked. Dental care was lacking for 34.4% of women. Criteria for domestic violence were cited by 4.72% of women.

[11] Unweighted

Distribution of Breastfeeding: overall and by Maternal/Infant Characteristics

Of the 1,773 women providing valid responses to breastfeeding questions, excluding missing data responses, 75.3% breastfed their baby for at least eight weeks (see Table 10). As nearly all women were surveyed ten or more weeks postpartum, women still breastfeeding at the survey time were included in the group of women breastfeeding at least eight weeks.

The prevalence of any breastfeeding at eight or more weeks among categories of pregnancy intention was as follows: 81.4% (intended), 67.5%(mistimed), 57.6% (unwanted). The prevalence of such breastfeeding among subcategories of age was: 45.7% (≤ 20 years), 84.7% (21-24 years), 81.7% (25-34 years), and 79.2% (≥35 years). The prevalence of such breastfeeding among respondents living in rural counties was 67.8% and among respondents living in urban counties was 77.9%. For married respondents, the prevalence of breastfeeding was 82.1% compared to 61.3% for unmarried respondents. The prevalence of such breastfeeding among respondents currently smoking at the time of the survey was 54.9% and among respondents not smoking at the time of the survey was 78.0%. The prevalence of such breastfeeding among respondents with postpartum depression was 59%, and among respondents without postpartum depression was 77.2%. See Table 8 for complete listing of prevalences by variable.

Univariable Logistic Regression Analysis

Table 8 shows the un-weighted number of women breastfeeding at eight weeks according to maternal characteristics of interest, as well as un-weighted and weighted percentages of breastfeeding women according to each characteristic. The right-hand

columns display the crude odds ratio (OR), 95% confidence interval (C.I.), and p-value (at 0.05 level) for the association between each characteristic and breastfeeding at eight weeks. For variables with more than two categories, an overall variable p-value is provided as well as individual p-values and confidence levels for each level. The overall variable gives the variable's significance within the model; category-specific p-values give the significance of a particular level compared against the referent level. Missing responses regarding breastfeeding and their distribution by pregnancy intention were examined (Table 11) and felt to emulate the overall distribution of the independent and dependent variable of interest. Missing data were not included in crosstabs procedures or tests of variable significance.

Variables examined in univariable analysis included:

- Pregnancy intention
- Maternal age
- Maternal education
- Marital status
- Mother's race/ethnicity
- Income
- Parity
- Rural/Urban county of residency
- Maternal smoking
- Insufficient maternal dental care
- Postpartum depression
- Low infant birthweight
- Intra-pregnancy alcohol use

Breastfeeding of at least eight weeks' duration was significantly associated with pregnancy intention, maternal age, marital status, smoking, postpartum depression, income, maternal education, maternal race/ethnicity, maternal domestic violence, insufficient dental care, and low infant birth weight (all $p < 0.5$).

While maternal parity was not significantly associated with breastfeeding at eight weeks, it was included in the initial model given its historical and literature-cited role as a potentially confounding variable.

Table 10. Oregon PRAMS 2005: Distribution of breastfeeding duration.

BREASTFEEDING OUTCOME	n[12]	WEIGHTED PERCENT[13]	WEIGHTED PERCENT[14]
Duration ≥ 8 weeks (non-exclusive)	1271	77.11 %	75.31 %
BF non-exclusively < 8w	502	23.31 %	24.69 %
Missing[15]	142	5.58 %	-
Total	1915	100.00 %	100.00 %

Table 11. Oregon PRAMS 2005: Distribution of breastfeeding duration

Non-exclusively BF ≥ 8w:	INTENDED (weighted %)	MISTIMED	UNWANTED	MISSING	TOTAL
Missing	79 (55.63%)	41 (28.9%)	15 (10.6%)	7 (4.93%)	142 (100%)

Multivariable Logistic Regression Model Building

Table 9 shows the crude OR, adjusted final model OR, and p-values for the above maternal characteristics and breastfeeding at eight weeks as entered into a full multivariate model.

Age as a four-category variable was chosen because its continuous distribution did not demonstrate a linear relationship with non-exclusive breastfeeding. Particularly, the risk showed an increase with age when over 20 and then tended to decrease with ages over 35. Lowess-smoothed graphs of income were examined (as a continuous graph) which showed a highly linear relationship. Income as a two-level variable was chosen for analysis, resulting in a more significant p-value (0.64, compared to 0.88). Correlations between variables were examined, with the highest correlations associated with income

[12] Unweighted.
[13] Includes missing respondents.
[14] Excludes missing respondents.
[15] Missing data is included in this table for a complete description of the variable but is not used in crosstabs, modeling, or significance calculations.

and education, but none approaching a concerning level (<0.90). The use of both variables, together with another highly similar variable (age) resulted in one level of the variable age (20-24 years) dropping out of the model due to collinearity with another variable in the initial multivariate model. As these highly correlated variables were removed, all four levels of age were restored to the model.

The initial full multivariate model included 13 predictor variables: Pregnancy intention, Maternal Age (four levels), Maternal Education (three levels), Marital Status, Race, Income, Rural/Urban (county residence), Smoking, Insufficient Dental Care, Domestic Violence, Maternal Postpartum Depression and Low Birth Weight, including Parity, a variable that was not significant in bivariate analysis but represented a potential confounder. After each variable was removed, odds ratios were examined but no variable was found to represent a confounding influence, defined as changing the odds ratio by ten or more percent when removed from the model. None of the interactions terms tested were found to be significant in the multivariate model.

The modeled demonstrated a good fit, with a *svylogitgof* F-adjusted test statistic of 0.819. Under the null hypothesis that observed and expected values would be similar, the corresponding p-value was not significant ($p = 0.598$). Therefore the null hypothesis was not rejected and the model was deemed an appropriate fit. STATA's automated backward stepwise method for model building estimated a model with a similar subset of variables. All of this study's final variables were in STATA's stepwise model, which additionally retained the covariates of race and education. These added variables, however, were not included in their entirety, with STATA choosing to include only certain levels of multi-category variables such as race and education. When all levels

were included in the model, these variables were no longer significant. Therefore, compared to STATA's backward selection model, this multivariate model appeared similar but justifiable in its differences.

Thus the model used to describe the association between pregnancy intention and breastfeeding in this study includes the categorical variables of pregnancy intention, maternal age, marital status, rural/urban county of residence, smoking, and postpartum depression.

Breastfeeding at eight or more weeks was significantly associated with pregnancy intention (P = 0.0268). Women with mistimed pregnancies were more likely to breastfeed at eight or more weeks compared to unwanted pregnancies (OR 1.99, 95% C.I. 1.00, 3.96). Women with intended pregnancies were more likely to breastfeed than unwanted pregnancies (OR 2.45, 95% C.I. 1.27, 4.72). Women with intended pregnancies were slightly more likely to breastfeed ≥ 8 weeks, compared to mistimed pregnancies though this difference was not statistically significant (OR 1.23, 95% C.I.: .809, 1.86), (see Table 9).

In addition to pregnancy intention, multivariate analysis for this study found four significant risk factors for not breastfeeding at eight weeks. Regarding maternal age, breastfeeding at eight weeks increased with age (P = 0.0011), though this was not an exact linear association. Women between 20-24 years of age were more likely to breastfeed than women younger than 20 years (OR 2.25, 95% C.I. 1.20, 4.19)[16]. Women aged 25-34 years were the most likely to breastfeed (OR 3.45, 95% C.I. 1.87, 6.38)

[16] All odds ratios (OR) have been adjusted for other covariates in the model.

compared to women in the youngest age group. Women older than 35 years were more likely to breastfeed than women younger than 20 years (OR 2.83, 95% C.I. 1.27, 6.32.

Married women were more likely to breastfeed compared to unmarried women (OR 1.72, 95% C.I. 1.15, 2.58). This association was highly significant in the multivariate model ($p = 0.009$). Most significantly, mothers who smoked were less likely to breastfeed than mothers who did not smoke (OR 1.99, 95% C.I. 1.19, 3.34). Mothers who lacked postpartum depression were more likely to breastfeed than those who endorsed symptoms of depression (OR 1.85, 95% C.I. 1.10, 3.12)

Women residing in urban counties at the time of surveying were more likely to breastfeed than those living in rural counties (OR 1.46, 95% C.I. 0.97, 2.2). This was retained in the model given its analytical importance and significance at the 0.10 level, although it was not significant at the 0.05 level ($p = 0.071$).

Discussion

Breastfeeding at 8 weeks and Pregnancy Intention

In this population-based PRAMS sample of Oregon women, the use of a three-level pregnancy intention predictor variable revealed that women with mistimed pregnancies were significantly more likely to be breastfeeding at eight or more weeks postpartum compared to women with a unwanted pregnancies. These findings support the study hypothesis that unwanted pregnancies associated with lack of breastfeeding altogether and/or earlier breastfeeding cessation than pregnancies that are simply mistimed and that these categories should be analyzed separately for future public health and pediatric research.

Results also uphold previous published research findings that the more intended a woman's pregnancy, the more likely she is to breastfeed for nontrivial duration of time. The results demonstrate a crude trend, where intended pregnancies are breastfed more than mistimed pregnancies, which are breastfed more than unwanted pregnancies.

The importance of terminology is alluded to, but not adhered to, in the 1995 Institute of Medicine's seminal report on unintended pregnancies.[5] In this publication the authors noted that the categories of 'mistimed' and 'unwanted' were not necessarily equivalent, either statistically or causally. Yet their study still reported most findings in terms of 'unintended' and 'intended', focusing attention (and resources) on the 40-60% (mistimed + unwanted pregnancies) rather than the 7-10% in the highest risk group (unwanted only).

The results of this study of 2005 PRAMS data show it would be erroneous to assign one risk and probable breastfeeding outcome to two clearly different risk groups.

Although the group of women with unwanted pregnancies was the smallest, at 7.49% of PRAMS respondents surveyed (136 women), the association with non-breastfeeding at ≥ 8 weeks was revealed to be significantly greater than for women with mistimed or wanted pregnancies. This decrease in breastfeeding can be addressed from several angles, including primary prevention of more unwanted pregnancies and more focused directing of scarce resources (such as breastfeeding support, health promotion education, and follow-up nutrition, general health and contraceptive counseling) to the high risk women who describe their pregnancy as unwanted.

The study also indicates that despite increasing national trends in breastfeeding initiation and duration, the effect of pregnancy intention on breastfeeding outcomes remains relevant. Most of the seminal studies on pregnancy intention and breastfeeding outcomes were done at least a decade ago and/or mainly with East Coast populations, factors associated with historically and geographically lower breastfeeding prevalence. With breastfeeding initiation exceeding 90% in Oregon, it is no small thing to point out that pregnancy intention still matters in determining breastfeeding results.

These study results also suggest other outcomes associated with pregnancy intention, such as prenatal care, low birth weight, and child health and development, may similarly differ between mistimed and unwanted pregnancies. By targeting resources toward unwanted pregnancies more assiduously, preventive and supportive programs may affect more than just breastfeeding rates. The need for comprehensive, well-focused family planning programs is also supported, to preempt such pregnancies before conception.

Risk Factors for Not Breastfeeding at 8 Weeks

The significant risk factors associated with breastfeeding duration at eight or more weeks included maternal age, marital status, maternal smoking, and postpartum depression. Age and marital status are closely linked in this population and age especially may reflect the differing work expectations, environment, and social obligations of women, both younger and older than beyond the most common childrearing time period. Smoking status has been repeatedly cited in previous studies for its association with lower breastfeeding initiation and earlier cessation. Though no immediately causal link is apparent from these data, the timing of cigarette smoking throughout the day may conflict or compete with an infant's repeated need to breastfeed. It does, however, represent a clear opportunity for intervention. Depression and depressive symptoms have not been as thoroughly studied in the past, perhaps owing to the temporality of postpartum depression. If most postpartum depression symptoms abate within two to three months, this would not be captured in a study looking at longer-range breastfeeding duration. Like maternal smoking, depression is something that can and should be screened for, with the added potential benefit of assisting breastfeeding duration.

Relationship Between Pregnancy Intention and Breastfeeding: Comparison with the Literature

The statistics drawn from the Oregon 2005 PRAMS data set show pregnancy intention (intended: 62.1%, mistimed: 30.4%, unwanted: 7.49%) to be analogous to

recent Oregon PRAMS results. For 2002-04, these ranges included: intended (45.6 - 60.8%), mistimed (32.3 – 46.9%), unwanted (6.4 – 7.5%).[43] CDC PRAMS 1999 multistate results show similar findings, with estimates of mistimed (27-36%) and unwanted (6-14%) pregnancies.[17]

Breastfeeding ≥ 8 weeks was endorsed by 75.3% of all women. This is analogous to Oregon PRAMS 1998-99 data, showing 68.8% non-exclusive (any) breastfeeding at 7-8 weeks postpartum. Oregon PRAMS previous statistics are higher on average than what are found in other areas of the country, and in recent years have been typically analyzed at ten weeks.

The adjusted findings also agree with corresponding previous studies. The pioneering study in this field, by Dye et al., [20] demonstrated that mistimed pregnancies were significantly different from intended. This PRAMS 2005 study, however, showed that mistimed pregnancies are significantly different from *unintended* pregnancies.

Whereas Dye et al. only looked at breastfeeding intentions prior to hospital discharge, this study demonstrates that the actual breastfeeding practices differ between mistimed and unintended pregnancies. Based in the West Coast, the higher breastfeeding prevalences among women in all categories may simply reflect the regional variation from Dye's East Coast, New York population.

Furthermore, the fact that this study concurs with Dye's study on breastfeeding intention allows us to conclude that breastfeeding intention likely begins before childbirth and translates into actual practice differences.

[17] Data from 17 states, not including Oregon.

Compared to Taylor et al.,[18] this study showed a stronger association of not breastfeeding associated with mistimed and unwanted pregnancies. This may be related to Taylor et al.'s use of a later breastfeeding duration outcome (sixteen weeks) or the NSFG data collection protocol, which collects data up to five years after a child's birth. Furthermore, NSFG is unable to adjust for maternal tobacco use, one of the strongest confounders in this PRAMS study and previous breastfeeding research.

This study's definition of pregnancy intention also differed from Taylor et al., whose NSFG data set factored in the woman's use of contraception into pregnancy intention. For their study, a woman's pregnancy was intended if she had stopped using birth control in order to become pregnant. A pregnancy was unwanted if the woman had gotten pregnant while using contraception and had not wanted to ever have a(nother) baby. It is unclear from their methods how the study dealt with incongruent reports of pregnancy intention (for example: not wanting to have a baby yet not using contraception).

Why are Mistimed Pregnancies Breastfed Less Than Intended Pregnancies?

The results described above suggest that, when all other life factors such as age and marital status are held equal, the planning and foresight required for a intended pregnancy align with breastfeeding ambitions. Could pregnancy intention be a proxy measure for breastfeeding intention? Although pregnancy intention is difficult to quantify, breastfeeding intention is equally challenging to measure methodically. Both

[18] Data from 17 states, not including Oregon.

represent nebulous surrogate measures for the mother and child's emotional, socio-economic, historical, and situational milieu.

The concurrence between PRAMS postpartum breastfeeding and Dye et al.'s prospective plans for breastfeeding suggest that the antepartum period may be most important. This, however, would not clearly explain why unwanted pregnancies have other undesired health and development outcomes. One hypothesis of this paper regards breastfeeding at 8 weeks as a proxy for relationship bonding between mother and infant. A mother that is desirous of a pregnancy may be more willing to attend emotionally and physically to her infant, heeding public health messages. Since mistimed infants are still wanted, perhaps at least some foresight has gone into their presence.

Alternatively, pregnancy intention may be a proxy for other, immeasurable (or unmeasured) factors in the mother's life. The question becomes: if pregnancy intention is indeed a proxy, can we manipulate it with improved family planning efforts? Here again, the distinction between mistimed and unwanted pregnancies becomes crucial. If merged into the same variable, better contraceptive education and access are less likely to improve breastfeeding, at least not as dramatically.

Study Strengths

There are two main strengths to this study. Firstly, the PRAMS survey represents a unique and widely respected data set especially capable of answering the questions specific to this research effort. The cross-sectional survey measures attitudinal, life history and demographic data and health service-related factors including substance abuse, prenatal and breastfeeding education, and corroborates these with birth certificate-

derived demographic data. Conversely, previous studies have used proxy measures of breastfeeding (such as prospective breastfeeding plans instead of retrospective breastfeeding reports) or have had data sets lacking in key covariates. While most variables were not ultimately included in this model, the breadth of the PRAMS survey allowed for initial consideration and systematic assessment of most known covariates regarding breastfeeding duration.

Secondly, this study was able to combine a wide breadth of known and possible covariates with a three-part pregnancy intention variable to examine the difference between mistimed and unwanted pregnancies. Previous studies have largely used two-part pregnancy intention variables (combining mistimed and unwanted into one category: 'unintended') or compared mistimed pregnancies with intended pregnancies.

Study Limitations

Central to the study design are the limitations inherent in a large observational, cross-sectional study with modest response rate. Furthermore, a cross-sectional study is limited to measures of association, which cannot be immediately accepted as causation. The PRAMS format is justifiable in its ability to provide consistent and validated information unique to Oregon women, while still generalizable to other states that use the same questionnaire. Results are particularly pertinent to states on the West Coast and in the Pacific Northwest that use the same, or similar, survey instrument and share regionally higher levels of breastfeeding.

Formulation of the covariates could be improved. As discussed in the introduction, the temporal ascertainment of pregnancy intention is problematic, especially when the survey question about conception is administered two to six months

postpartum. Reassuringly, the PRAMS 2005 distribution of responses for pregnancy intention was very similar to Dye et al., who used PRAMS to determine pregnancy intention in the immediate postpartum period, before the mother was discharged from her hospital labor stay.

Breastfeeding at eight weeks may not be long enough to truly demonstrate the health benefits associated with long-term breastfeeding. Recommendations by the American Academy of Pediatricians cite at least six months of breastfeeding, at minimum. However, most nutritionists agree that any breastfeeding at all is better than no breastfeeding.

The category of mistimed pregnancies could also be better characterized to differentiate those whose timing was months off target, compared to years. Pregnancy intention also needs to better reflect the inconsistencies associated with contraceptive use, partner preference, and employment pressures. PRAMS studies could incorporate questions regarding happiness and satisfaction with pregnancy into the variable formation.

Using a dependent variable of 'any breastfeeding', compared to 'exclusive breastfeeding' may weaken the true association between pregnancy intention and breastfeeding outcomes. Yet previous studies have shown similar associations for 'any breastfeeding' and 'exclusive breastfeeding' regarding pregnancy intention. Furthermore, the results yield practical information for the social and medical practitioners working with young mothers, as "any breastfeeding" accounts for more mothers than "exclusive" breastfeeding alone.

Alcohol use remains an important confounder that, due partly to low response rates, was not used in the model. While it may represent a confounder in the relationship between pregnancy intention and breastfeeding, the stigma attached makes it difficult to collect reliable data on alcohol use in pregnancy or to use in modeling.

Many other variables may affect breastfeeding rates, yet were too closely aligned with the decision to breastfeed for use in the multivariate model. Such factors include pacifier use in the hospital, breastfeeding in the first hour, and breastfeeding education provided in the hospital. From a theoretical perspective, it remains difficult to tease out association from reverse causation during this time period, as both likely exist.

The study excludes all blank responses and responses of "I don't know" from analysis. Although this could skew results, it would likely only bias them toward the null hypothesis. Previous Oregon PRAMS analyses examining pregnancy intention did not show a change in significance between including these responses and excluding them[27].

The prospect of recall bias is concerning for pregnancy intention assessment. Again, this is still likely to have biased towards the null. If, after giving birth, women are more likely to claim their pregnancy was intended, this would only decrease an observed association between pregnancy intention and breastfeeding. Arguably, the standardized survey format has the potential to elicit more honest responses than in-person alternatives.

It is also possible that some respondents wished to claim they are breastfeeding due to a perception of breastfeeding as the preferred medical expectation of behavior. Also likely, however, is that respondents become habituated to non-breastfeeding over time, and thus will be more likely to answer honestly about their infant feeding habits in

the postpartum months compared to antepartum.

Both the prospect of family situations (already breastfeeding an infant) and medical conditions, such as Sheehan's syndrome or prior breast surgery, represent potential but rare causes of an inability to breastfeed precluding the mother from making a choice to breastfeed. Similarly, neonatal intensive care admission was examined in the model, yet neonatal morbidities that might prevent breastfeeding were not available for adjustment.

Lastly, there is no explicit information collected by PRAMS on illicit substance abuse during pregnancy. In prior studies , however, this has not been shown to be a significant factor on breastfeeding practices. [20]

Public Health Implications

Given the significant relationship between mistimed and unwanted pregnancies and duration of breastfeeding, social and public health services for breastfeeding should support the group at greatest potential risk: unwanted pregnancies. Future studies should attempt to use at least three-part pregnancy intention variable (intended, mistimed, unwanted) for research gathering and policy implications. Such a reconfiguration of perspective may better direct resources to those in greatest need – namely, the pregnancies described as unwanted. This new tri-categorization measure of pregnancy intention would require educating many public health and pediatric researchers in the meaning of the term, *mistimed pregnancies.*

Future Research

While this study has clearly defined a greater association between unwanted pregnancies and decreased breastfeeding at eight or more weeks, less clear, however, is how to address women with mistimed pregnancies. While this study confirms a significantly different risk compared to mistimed pregnancies and an increased, but not significant, risk compared to intended pregnancies, causation has yet to be decided.

Pregnancy intention categories should be analyzed separately for public health and pediatric research, with further improvement in the classification of pregnancy intention. A longer duration of breastfeeding is also needed, to better compare to the AAP and Healthy People 2000 guidelines.

Subsequent studies may also seek to examine if decreasing the incidence of unwanted pregnancies within a community correlates with an increase in breastfeeding. Or, more simply, analyses could examine the self-proclaimed use of contraception among mistimed pregnancies to determine if access, use, or contraceptive failure played a major role.

Conclusions

This study analyzed the prevalence, predictor variables, and association of pregnancy intention with any breastfeeding at eight or more weeks postpartum. Based on the results, mistimed pregnancies – and their related cluster of affiliated maternal behaviors - have been shown to be significantly different from unwanted pregnancies in their association with breastfeeding duration, despite having been historically merged into a single category with high risk for many poor outcomes. The prevalence of breastfeeding

in Oregon also reflects prior research on the region for all three categories of pregnancy intention. The strength of this study lies in its ability to analyze a population-based sample, weighted to reflect Oregon's population of pregnant women and similar Western, Pacific Northwest, and Mountain states. By more accurately defining the population at greatest risk and need for appropriate interventions, future research studies and programs may both better direct funding and tailor education and health promotion efforts to improve the health status of mothers and babies.

Appendix A

References

1. American Academy of Pediatrics, 1997, in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

2. Anderson JW, Johnstone BM, Remley DT. Breast-feeding and cognitive development: A meta-analysis. Am J Clin Nutr. 1999;70(4):525-35.

3. Bick et al., 1998, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

4. Bourgoin et al., 1997; as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

5. Brown SS, Eisenberg L. The best intentions: Unintended pregnancy and the well-being of children and families. National Academy Press; 1995.

6. Campbell AA, Mosher WD. A history of the measurement of unintended pregnancies and births. Matern Child Health J. 2000 Sep;4(3):163-9.

7. Chandra A, Martinez GM, Mosher WD, Abma JC, Jones J. Fertility, family planning, and reproductive health of U.S. women: Data from the 2002 national survey of family growth. Vital Health Stat 23. 2005 Dec;(25):1-160.

8. Chen A, Rogan WJ. Breastfeeding and the risk of postneonatal death in the united states. Pediatrics. 2004 May;113(5):e435-9.

9. Chinebuah B, Perez-Escamilla R. Unplanned pregnancies are associated with less likelihood of prolonged breast-feeding among primiparous women in Ghana. J Nutr. 2001 Apr;131(4):1247-9.

10. Clements et al., 1997, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

11. Cochi et al., 1986, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

12. Colley Gilbert BJ, Johnson CH, Morrow B, Gaffield ME, Ahluwalia I. Prevalence of selected maternal and infant characteristics, pregnancy risk assessment monitoring system (PRAMS), 1997. Morbidity & Mortality Weekly Report. CDC Surveillance Summaries. 1999;48(5):1-37.

13. Colley, Johnson, Morrow, Gaffield, & Ahluwalia, 1999; Ryan, Rush, Krieger, & Lewandowski, 1991, as cited in Dennis CL. Breastfeeding initiation and duration:

A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

14. Cumming and Klineberg, 1993, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

15. Cunningham AS, Jelliffe DB, Jelliffe EF. Breast-feeding and health in the 1980s: A global epidemiologic review. J Pediatr. 1991 May;118(5):659-66.

16. D'Angelo DV, Gilbert BC, Rochat RW, Santelli JS, Herold JM. Differences between mistimed and unwanted pregnancies among women who have live births. Perspectives on Sexual and Reproductive Health. 2004;36(5):192-7.

17. Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

18. Dewey KG, Heinig MJ, Nommsen-Rivers LA. Differences in morbidity between breast-fed and formula-fed infants. J Pediatr. 1995 May;126(5 Pt 1):696-702.

19. Duncan et al., 1993; Owen et al., 1993, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

20. Dye TD, Wojtowycz MA, Aubry RH, Quade J, Kilburn H. Unintended pregnancy and breast-feeding behavior. Am J Public Health. 1997 Oct;87(10):1709-11.

21. Edwards, Sims-Jones, & Breithaupt, 1998; Sayers, Thorton, Corco-

22. Evers et al., 1998, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

23. Finer LB, Henshaw SK, 2006, as cited in Trussell J. The cost of unintended pregnancy in the united states. Contraception. 2007;75(3):168-70.

24. Ford et al., 1993, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

25. Ford et al., 1994, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

26. Gerstein, 1994, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

27. Goldmsith, Kimberley A (2004). Unintended childbearing and knowledge of emergency contraception: Analysis of the 1998-1999 Oregon PRAMS dataset. OHSU Graduate School Masters Thesis. Portland, Oregon: Department of Public Health and Preventive Medicine, Oregon Health and Science University.

28. Healthy People 2010, Breastfeeding, newborn screening, and service systems. Retrieved October 30, 2007, from HealthyPeople.gov Web site: http://www.healthypeople.gov/document/html/volume2/16mich.htm#_Toc494699668

29. Henshaw SK. Unintended pregnancy in the United States. Journal Watch Women's Health. 1998:46-29.

30. Hill & Aldag, 1996, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

31. Hill PD. Update on breastfeeding: Healthy people 2010 objectives. MCN Am J Matern Child Nurs. 2000 Sep-Oct;25(5):248-51.

32. Hromi-Fiedler AJ, Perez-Escamilla R. Unintended pregnancies are associated with less likelihood of prolonged breast-feeding: An analysis of 18 demographic and health surveys. Public Health Nutr. 2006 May;9(3):306-12.

33. Humenick, Hill, & Wilhelm, 1997, as cited in Hill PD. Update on breastfeeding: Healthy people 2010 objectives. MCN Am J Matern Child Nurs. 2000 Sep-Oct;25(5):248-51.

34. Jacobson, Jacobson, & Frye, 1991, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

35. Kost K, Landry DJ, Darroch JE. The effects of pregnancy planning status on birth outcomes and infant care. Fam Plann Perspect. 1998 Sep-Oct;30(5):223-30.

36. Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. Cochrane Database Syst Rev. 2002;(1):CD003517.

37. LeFevre M, Kruse J, Zweig S, 1987;, as cited in Losch, Dungy, Russell, & Dusdieker, 1995, as cited in Hill PD. Update on breastfeeding: Healthy people 2010 objectives. MCN Am J Matern Child Nurs. 2000 Sep-Oct;25(5):248-51.

38. Li R, Darling N, Maurice E, Barker L, Grummer-Strawn LM. Breastfeeding rates in the united states by characteristics of the child, mother, or family: The 2002 national immunization survey. Pediatrics. 2005;115(1).

39. Li R, Grummer-Strawn L. Racial and ethnic disparities in breastfeeding among united states infants: Third national health and nutrition examination survey, 1988-1994. Birth. 2002 Dec;29(4):251-7.

40. Li R, Zhao Z, Mokdad A, Barker L, Grummer-Strawn L. Prevalence of breastfeeding in the united states: The 2001 national immunization survey. Pediatrics. 2003 May;111(5 Part 2):1198-201.

41. Losch, Dungy, Russell, & Dusdieker, 1995, as cited in Hill PD. Update on breastfeeding: Healthy people 2010 objectives. MCN Am J Matern Child Nurs. 2000 Sep-Oct;25(5):248-51.

42. Losch, Dungy, Russell, & Dusdieker, 1995, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

43. Oregon PRAMS: Results. (2002). Retrieved September 20, 2008, from Oregon.gov. Web site: http://www.oregon.gov/DHS/ph/pnh/prams/9899qlist.shtml

44. Oregon PRAMS: Results. (2003). Retrieved September 20, 2008, from Oregon.gov. Web site: http://www.oregon.gov/DHS/ph/pnh/prams/9899qlist.shtml

45. Oregon PRAMS (2007). . Retrieved September 20, 2008, from Oregon.gov. Web site: http://www.oregon.gov/DHS/ph/pnh/prams/9899qlist.shtml

46. Pediatrics, AAOF. Breastfeeding and the use of human milk. Pediatrics. 1997;100(6):1035-9.

47. Pérez-Escamilla R, Cobas JA, Balcazar H, Benin MH. Specifying the antecedents of breast-feeding duration in Peru through a structural equation model. Public Health Nutr. 2007;2(04):461-7.

48. Pisacane, 1992, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

49. Pulley L et al 2002, p206-211, as cited in Santelli J, Rochat R, Hatfield-Timajchy K, Gilbert BC, Curtis K, Cabral R, et al. The measurement and meaning of unintended pregnancy. Perspectives on Sexual and Reproductive Health. 2003;35(2):94-101.

50. Raisler J. Breast-feeding and infant illness: A dose-response relationship? Am J Public Health. 1999;89(1):25-30.

51. Reproductive health program. (2007). In Joint Ways and Means Committee, 2007 Legislative Session Salem: Oregon Department of Human Services, Public Health Division.

52. Rosenberg, Kenneth D., Erica Dale and Alfredo P. Sandoval (2002, Nov 11). Prams: Improving access to emergency contraception. Retrieved October 30, 2007, from Oregon.GOV, Oregon PRAMS: Presentations Web site: http://www.oregon.gov/DHS/ph/pnh/prams/prepub/aphaec.shtml

53. Rosenberg, Kenneth D., Zhiwei Yu and Alfredo P. Sandoval (2001, Oct 22). Risk Factors for not Breastfeeding at 10 Weeks, Oregon, 1998-99. Retrieved October 31, 2007, from Oregon.GOV, Oregon PRAMS: Presentations Web site: http://egov.oregon.gov/DHS/ph/pnh/prams/prepub/apha01g.shtml

54. Rosenblatt and Thomas, 1993, as cited in Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

55. Ryan AS, Wenjun Z, Acosta A. Breastfeeding continues to increase into the new millennium. Pediatrics. 2002 Dec;110(6):1103-9.

56. Santelli J, Rochat R, Hatfield-Timajchy K, Gilbert BC, Curtis K, Cabral R, et al. The measurement and meaning of unintended pregnancy. Perspectives on Sexual and Reproductive Health. 2003;35(2):94-101.

57. Scott JA, Binns CW, Oddy WH, Graham KI. Predictors of breastfeeding duration: Evidence from a cohort study. Pediatrics. 2006 Apr;117(4):e646-55.

58. Sikorski J, Renfrew MJ, Pindoria S, Wade A. Support for breastfeeding mothers. Cochrane Database Syst Rev. 2002;(1)(1):CD001141.

59. Taylor JS, Cabral HJ. Are women with an unintended pregnancy less likely to breastfeed?. J Fam Pract. 2002 May;51(5):431-6.

60. Trussell et al 1999, p246-47 and 269, as cited in Santelli J, Rochat R, Hatfield-Timajchy K, Gilbert BC, Curtis K, Cabral R, et al. The measurement and meaning of unintended pregnancy. Perspectives on Sexual and Reproductive Health. 2003;35(2):94-101.

61. Trussell J. The cost of unintended pregnancy in the united states. Contraception. 2007;75(3):168-70.

62. Visness & Kennedy, 1997, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

63. Weimer J. The economic benefits of breastfeeding: A review and analysis, food assistance and nutrition research report no. 13. US Department of Agriculture, Economic Research Service, March. 2001.

64. Williams L, Morrow B, Shulman H, Stephens R, D'Angelo D, Fowler CI. PRAMS 2002 Surveillance Report. Atlanta, GA: Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 2006. http://www.cdc.gov/PRAMS/2002PRAMSSurvReport/Overview.htm

65. Pérez-Escamilla R, Cobas JA, Balcazar H, Benin MH. Specifying the antecedents of breast-feeding duration in Peru through a structural equation model. Public Health Nutr. 2007;2(04):461-7.

66. Sayers, Thorton, Corcoran, Burke, 1995, as cited in Dennis CL. Breastfeeding initiation and duration: A 1990-2000 literature review. Journal of Obstetric, Gynecologic, and Neonatal Nursing. 2002;31(1):12-32.

67. Taylor JS, Cabral HJ. Are women with an unintended pregnancy less likely to breastfeed?. J Fam Pract. 2002 May;51(5):431-6.

68. Wolfe, Marika (2008). Risk factors for postpartum depressive symptoms among Oregon women: an analysis of the pregnancy risk assessment monitoring system data, 204. OHSU Graduate School Masters Thesis. Portland, Oregon: Department of Public Health and Preventive Medicine, Oregon Health and Science University.