

MATERNAL AND CHILD NUTRITION SUPPORT  
IN THE FOOD ENVIRONMENT

by

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A thesis submitted in partial fulfillment  
of the requirements for the degree

of

Master of Science

in

Health and Human Development

MONTANA STATE UNIVERSITY  
Bozeman, Montana

November 2015

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ii

DEDICATION

For my family.

## ACKNOWLEDGEMENTS

To my primary advisor Dr. Carmen Byker Shanks and to my graduate committee members Dr. Selena Ahmed and Dr. Elizabeth Rink: it has been a truly pleasurable experience of learning, laughter, and adventure under your supreme mentorship.

Thank you, thank you, thank you.

## TABLE OF CONTENTS

1. INTRODUCTION .....	1
Food Environment Defined .....	1
Methods and Measures of the Food Environment.....	2
Goals and Gaps in Food Environment Measures .....	3
WIC’s Role in the Food Environment.....	3
Evaluation of Tools and Measures in the Food Environment that Address WIC, Breastfeeding, or Formula .....	5
Scope and Aims of Research.....	6
References Cited.....	7
 2. FACTORS ASSOCIATED WITH INCREASED LIKELIHOOD OF BREASTFEEDING AMONG PARTICIPANTS OF THE USDA’S FOOD AND NUTRITION SERVICE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN, INFANTS, AND CHILDREN (WIC): A SYSTEMATIC REVIEW OF LITERATURE.....	10
Contribution of Authors and Co-authors.....	10
Manuscript Information Page.....	11
Abstract .....	12
Objective .....	12
Design .....	12
Setting .....	12
Subjects.....	12
Results.....	12
Conclusion .....	12
Introduction .....	13
Methods .....	15
Results .....	16
Discussion .....	17
Sociodemographic Characteristics.....	17
Environmental and Media Support.....	18
Government Policy .....	19
Intention to Breastfeed.....	21
Knowledge and Attitudes toward Breastfeeding .....	22
Health Care Provider and Social Support.....	23
Time Exposure to WIC.....	24
Limitations .....	25
Concluding Statements .....	26

## TABLES OF CONTENTS - CONTINUED

References Cited.....	55
<b>3. VALIDATION AND ADAPTATION OF THE NUTRITION ENVIRONMENT MEASURE IN STORES TO ASSESS INFANT FEEDING RESOURCE SUPPORT IN THE FOOD ENVIRONMENT .....</b>	<b>60</b>
Contribution of Authors and Co-authors.....	60
Manuscript Information Page.....	61
Abstract .....	62
Introduction.....	62
Methods.....	62
Results.....	62
Conclusion .....	63
Introduction .....	63
Methods .....	64
Development of Infant Feeding Resource Survey (IFRS).....	64
Infant Feeding Resource Survey Pilot Testing .....	66
Data Analysis .....	67
Results .....	68
Discussion .....	69
Limitations .....	71
Conclusion .....	72
Appendix 1: Infant Feeding Resource Survey (IFRS) Tool.....	77
Measure #1: Formula .....	78
Measure #2: Equipment .....	79
Measure #3: Nutritional Supplements .....	80
Measure #4: Marketing .....	81
Appendix 2: Infant Feeding Resource Survey (IFRS) Instructions .....	82
Survey Description.....	82
Store Documentation Instructions.....	82
Information About Measure #1, Formula .....	83
Survey Instructions for Measure #1, Formula .....	84
Measure #2, Infant Feeding Equipment Instructions.....	86
Measure #3, Nutritional Supplements Instructions.....	87
Measure #4, Marketing Instructions .....	88
Appendix 3: Infant Feeding Resource Survey (IFRS) Scoring.....	89
References Cited.....	90

TABLES OF CONTENTS - CONTINUED

4.CONCLUSION.....	92
References Cited .....	96
REFERENCES CITED.....	97

## LIST OF TABLES

Table	Page
2.1 Sociodemographic Characteristics as a Predictor of Increased Likelihood of Breastfeeding within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population .....	29
2.2. Environmental and Media Support as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population.....	37
2.3. Government Policy as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population .....	39
2.4. Intention to Breastfeed, Breastfeeding in Hospital, or Previous Breastfeeding Experience as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population.....	40
2.5. Attitudes toward and Knowledge of Breastfeeding Benefits as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population .....	44
2.6. Health Care Provider (HCP) or Social Support as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population .....	46
2.7. Time Exposed to WIC Services as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population.....	51
3.1 Descriptive Statistics of Infant Feeding Resource Survey (IFRS) Across 21 Stores in Montana.....	73

LIST OF TABLES-CONTINUED

Table	Page
3.2. Analysis of Variance and Range of Infant Feeding Resource Survey (IFRS) Scores for WIC-Accepted Term Powder Prices (n=17) by 2013 Rural Urban Continuum Code .....	74
3.3. Analysis of Variance of Infant Feeding Resource Survey (IFRS) Section Scores by 2013 Rural Urban Continuum Code (n=21).....	75

LIST OF FIGURES

Figure	Page
1.1. PRISMA Flow Diagram of Systematic Review Inclusive of all Relevant Articles Associated with an Increased Likelihood of Breastfeeding for the United States Department of Agriculture’s (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Participants. ....	28

## ABSTRACT

Infant feeding resources are often found within food environments yet have not been a main focus of food environment investigations. Food options in the retail environment are important, complex factor in dietary choices that can either be promotional or preventative of healthy behaviors. At the same time, breastfeeding is considered a top public health priority due to its unparalleled, favorable health outcomes that impact infants, mothers, and entire communities. For this reason the American Academy of Pediatrics recommends that breastfeeding continue for at least one year after birth. There are multiple practical and social barriers to breastfeeding for women that support the need for appropriate formula varieties in the food environment to support infant nutrition. The United States Department of Agriculture's (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) promotes breastfeeding as an optimal source of nutrition for infants, and offers breastfeeding incentives for enrolled mother-infant pairs resulting in higher assistance allotment for foods, or formula supplements for non-breastfed infants. This research includes a systematic review of literature conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement guidelines in order to identify factors associated with increased likelihood of breastfeeding among WIC participants. This research also introduces a measure adapted from the Nutrition Environment Measure in Stores (NEMS-S) formulated to capture infant feeding support in the food environment. The Infant Feeding Resource Survey (IFRS) captures WIC-supported brand formulas and alternate brand varieties in addition to resource support necessary for breast or formula feeding in store settings. Review findings indicate sociodemographic characteristics, environmental and media support, government policy, intent to breastfeed, attitudes toward breastfeeding, social support, and time exposed to WIC program are correlated with increasing breastfeeding rates within this population. Application of the IFRS indicated a reduced variety of infant feeding resource options in more rural locations in Montana. Data provides valuable information in extension of the state of the science of food environment focused research.

## CHAPTER ONE

## INTRODUCTION

Dietary intake and health status are closely intertwined.<sup>1</sup> Adequate consumption of nutrient dense, calorically low and higher fibred foods such as fruits and vegetables are linked with lowered instances of obesity and diet-related chronic diseases.<sup>1</sup> Likewise, optimal nutrition from birth (mother's milk) also contributes to a reduction of acute and chronic illness and is also recommended as a promotional nutrition topic for improved health status.<sup>1,2</sup> As obesity rates and diet-related chronic disease rates remain a pressing societal issue in the United States,<sup>1</sup> new insights into dietary choices are necessary. Fairly new research implicates the food environment as a variable in the relationship between dietary intake and nutrient related health adversities.<sup>3</sup>

Food Environment Defined

Public health nutrition science, in broad definition, describes the food environment as a measure of community and consumer nutrition environments within a specified geographic location.<sup>4</sup> Understanding the food environment involves enumeration of food establishment type and location in order to accurately portray food access within a defined location and documentation of food offerings available to consumers at each establishment within the area of interest.<sup>4,5</sup>

Application of socioecological models in health behavior theory<sup>6</sup> to studies of the food environment suggests a continuous interaction of individual and social variables with

community establishments, such as clinics and retail environments, organizational sectors (e.g. schools and workplaces), and policies.<sup>6,7</sup> Therefore, the relationship between a consumer and the food environment is complex and multifaceted and likely a multitude of variables influence behavior. A review of literature with the focus of identifying relationships between a consumer's dietary choices and the food environment has found little correlation between the two.<sup>3</sup> Though, school-based interventions utilizing principles of behavioral economics including strategic fruit placement for easier access<sup>8</sup> and attractively naming vegetable options increased sales in both cases.<sup>9</sup> And so, food environment investigations warrant consideration of both human behaviors in dietary intake in addition to access.

### Methods and Measures of the Food Environment

Valid and reliable measurement tools provide opportunities to understand the role of the food environment in the promotion and/or prevention of diet-related chronic disease.<sup>6</sup> Investigations of food environments utilize primarily quantitative methodologies and are proliferating in recent literature.<sup>5,10</sup> Variables in measures such as availability, price, purchasing convenience, quality, and desirability<sup>10</sup> of food products are integral to food environment descriptions.<sup>5</sup> One standardized measure, the Nutrition Environment Survey in Stores (NEMS-S), captures specific information of popular foods and healthier alternatives in the context of grocery stores in the United States food system.<sup>4</sup> Multiple adaptations of this measure allow NEMS to be implemented in restaurants,<sup>11</sup> convenience stores<sup>4</sup> and vending machines,<sup>12</sup> in addition to grocery stores. Examples of this tool in the

field yield important results. First, one study evidenced reduced quality of fruits and vegetables at more rural grocery locations,<sup>13</sup> and another documented reduced healthier options available across all measured food categories in urban corner stores.<sup>14</sup> A review of literature conducted by Heforth and Ahmed (2015) highlighted existing food environment measures in addition to NEMS-S, included other variables such as: consumer perceptions, culturally variable food options, costs of nutrient-dense diets, and shifts from comparisons of healthy versus non-healthy options to availability of broader food groups, in short.<sup>10</sup>

#### Goals and Gaps in Food Environment Measure

Accurate documentation of interrelating variables in the food environment is elemental in informing policy makers seeking to improve the current public health status of the nation.<sup>5</sup> As the body of literature grows, indicating progression of nutrition science by acknowledging environmental factors as they relate to health statuses, certain voids remain. Developed tools, to date, have primarily focused on retail environments and the promotion, ease of access, or lack of certain food groups.<sup>5,10</sup> Lacking are tailored methods and instruments to vulnerable populations, for example persons of lowered socioeconomic statuses or children.<sup>5</sup>

#### WIC's Role in the Food Environment

The United States Department of Agriculture's (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a government assistance program providing nutrition assistance and education to

program-eligible, at-risk, low-income pregnant women and mothers with children up to the age of 5.<sup>15</sup> Women who participate in the program receive food packages incentives, nutrition and breastfeeding education, and referrals to external health-care providers with the ultimate goal of improving birth outcomes, childhood development, and maternal health.<sup>16</sup> WIC's emphasis on breastfeeding promotion is central to health promotion efforts due to the role of breastfeeding in long-term positive health outcomes respective to time allotted breastfeeding for a mother-infant dyad.<sup>2</sup> Supplemental formulas are offered through WIC's food package, acknowledging personal choice in regard to a mother's preferred infant-feeding method, however; those who choose breastfeeding as a primary source of nutrition for an infant have extended food package offerings.<sup>15</sup>

In In 2009, the USDA implemented an interim rule adjustment in WIC program policies, recommended by the Institute of Medicine, which included food package offerings more aligned with Dietary Guidelines for Americans<sup>17</sup> and further incentivized breastfeeding for enrolled mothers.<sup>18</sup> A recent review of literature highlighted improvements in dietary choice extending to positive changes in community food environments as a result of WIC food package changes, highlighting the role of policy in such improvements.<sup>19</sup> Although perceptions among WIC vendor store locations differed, documented were increased sales of food package additions including whole grains,<sup>20</sup> marginal price reductions,<sup>21</sup> and influences on store stocking decisions leading to greater consumer access to healthier food options post-revisions.<sup>22-25</sup> The role of WIC in providing important nutrition access to low-income women throughout American communities and policy in restructuring accessible foods in order to promote healthier

options is evident. Further understanding of factors involved in positive breastfeeding decisions within this population is a necessary focus.

### Evaluation of Tools and Measures in the Food Environment that Address WIC, Breastfeeding, or Formula

Measures of the food environment are relatively new and an important component in public health investigations seeking to understand the relationship between a consumer, the retail environment, and dietary choices.<sup>4</sup> It is known that low-income or minority neighborhoods experience lowered access to healthier food options, contributory to health disparities.<sup>26-28</sup> Racial and ethnic disparities among low-income populations are also highlighted in breastfeeding science, with non-Hispanic black or African American mothers being the least likely to ever breastfeed or continue to 6 or 12 months.<sup>29</sup> Little is known, however, on how access to infant feeding resource support in the food environment, inclusive of specificity to breast or bottle, and store support of WIC is affecting to breastfeeding outcomes.

One study has associated geographic proximity to a WIC establishment as a predictor of increased probability of improved birth outcomes, and breastfeeding initiation (for those with at least a high school education).<sup>30</sup> Another study analyzed mileage from food outlets and dietary intake for pregnant women, results indicating women living with a four mile radius of a supermarket attained improved dietary quality.<sup>31</sup> Not present in the literature to date are associations of resource and nutrition support in the food environment as a viable factor in informed formula-feeding choices or breastfeeding decisions.

### Scope and Aims of Research

The overall goal of this research to identify factors associated with breastfeeding success and evaluate access to maternal and child health resources specific to infant nutrition within communities. Following, are the two specific aims to support the overall objective of this project:

Specific Aim #1: Carry out a systematic literature review on WIC participation and breastfeeding likelihood. The current literature will investigate the important public health landmark, WIC, and address associations with breastfeeding likelihood among low-income, program enrolled women. This information highlights successes of the wide-reaching community nutrition establishment and provides evidence for further health promotion within this population.

Specific Aim #2: Development and validation of a food environment instrument specific to infant feeding resources. An original tool was designed, implemented, and validated to capture infant feeding resource support in stores, modeled after NEMS-S.<sup>4</sup> Community-specific information is valuable to assessing support for breastfeeding and it is the aim of this research to provide evidence of the food environment as a potential facilitator to support infant feeding in an effort to add valuable knowledge to the extension of the nutrition environment state of the science. This research contributes to the field of nutrition with two notable products including a manuscript on the systematic review component of this study as well as a second manuscript presenting an original food environment tool on infant feeding resources focused on views that the food environment is an important variable in maternal and child health.

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CHAPTER TWO

FACTORS ASSOCIATED WITH INCREASED LIKELIHOOD OF BREASTFEEDING  
AMONG PARTICIPANTS OF THE USDA'S FOOD AND NUTRITION SERVICE  
SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN,  
INFANTS, AND CHILDREN (WIC): A SYSTEMATIC REVIEW OF  
LITERATURE

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Manuscript Information Page

Bailey E Houghtaling, Dr. Carmen Byker Shanks, Mica Jenkins  
Public Health Nutrition

Status of Manuscript:

Prepared for submission to a peer-reviewed journal

Officially submitted to a peer-review journal

Accepted by a peer-reviewed journal

Published in a peer-reviewed journal

Cambridge University Press

Submitted October 2015

**ABSTRACT**

**Objective:** To determine recent factors associated with increased likelihood of breastfeeding for the United States Department of Agriculture's (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants.

**Design:** The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement guided the systematic review of literature. Database searches were conducted in September and October of 2014 and included studies were limited to the previous ten years to capture current practices.

**Setting:** The nature of the review required all studies to be based in the United States.

**Subjects:** A criterion of inclusion within the systematic review process for relevant data was for study samples to be entirely representative of women and children enrolled in the WIC program.

**Conclusions:** Results indicate the complexity of breastfeeding behaviors among WIC participants and provide insight for future research, policies, and practices in support of raising breastfeeding rates of WIC participants.

**Key Words:** Breastfeeding; WIC; Public Health Nutrition

## INTRODUCTION

The United States Department of Agriculture's (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) continues to be integral to American public health.<sup>1</sup> Since its pilot introduction in 1972 and permanent establishment in 1975,<sup>2,3</sup> WIC has supplemented low-income women, infants, and children with nutrition and education to address population-specific health concerns. Present day goals reflect those beginnings, "to safeguard the health of low-income women, infants, and children up to age five who are at nutritional risk, by providing nutritious foods to supplement diets, nutrition education, and referrals to health care and other social services."<sup>2</sup> Today, the reach of WIC is significant, extending to nearly one half of all infants born in the United States.<sup>2</sup> Acting as an entrance to public health services for many underserved Americans, WIC is a prime avenue for dissemination of nutrition education information by healthcare professionals and a basis for community nutrition interventions, including breastfeeding promotion.<sup>1,2</sup> Despite best efforts, however, mothers participating in WIC continue to display lower rates of breastfeeding on a national scale in comparison to non-participants.<sup>2-9</sup>

Breastfeeding is considered a top public health priority due to its unparalleled, favorable health outcomes that impact infants, mothers, and entire communities.<sup>1,10,11</sup> For this reason the American Academy of Pediatrics recommends that breastfeeding continue for at least one year and exclusively for six months.<sup>10</sup> Breastfeeding contributes to lower rates of acute and chronic illnesses and infections during an infant's first year, and benefits as a preliminary disease prevention effort, with associated lowered risks of obesity and

diabetes.<sup>10, 11</sup> Health outcomes for a breastfeeding woman include decreased prevalence in postpartum depression, breast and ovarian cancers, as well as reduced instances of type II diabetes, rheumatoid arthritis, and cardiovascular adversities, all respective to duration of breastfeeding.<sup>10</sup> A longitudinal cohort study established positive correlation between breastfeeding practices from birth and intelligent quotients (IQ).<sup>12</sup> Breastfeeding has also been correlated with real-world benefits, with higher educational achievements and salary earnings at 30 years of age by those breastfed one year or longer.<sup>12</sup>

Comprehensive breastfeeding data conclude that wide-scale promotion has both economic<sup>10,13</sup> and environmental<sup>11</sup> value with the potential to reduce health care costs (United States savings of 13 billion dollars annually),<sup>13</sup> increase economic input,<sup>12</sup> and decrease the use of natural and fiscal resources required to produce and use breast milk alternatives.<sup>11</sup>

A recent review of literature highlighted main barriers to breastfeeding within the WIC population: lack of social and provider support; return to work, inclusive of worksite barriers; lactation issues; WIC program and policy issues; and social or cultural hindrances to breastfeeding.<sup>14</sup> Another systematic review studied the impact of 2009 WIC food package revisions on participant's dietary intake, access to healthy food and beverages, and breastfeeding.<sup>15</sup>

This systematic review of literature examines factors associated with an increased likelihood of breastfeeding among WIC participants, with the goal of providing guidelines for future interventions and policy analysis. Results capture the successes of various approaches and behaviors shown to increase breastfeeding practices within the low-

income population enrolled in WIC in the United States. The authors chose to narrow the literature search to this specific population due to evidence demonstrating demographic differences between those who participate and those who abstain from the WIC program, despite eligibility<sup>3</sup> and to summarize evidence for future improvements within the WIC program, including increased breastfeeding rates for enrolled participants.

## **METHODS**

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)<sup>16</sup> statement guided the methodological component of the research parameters. See figure 1. A total of three databases (PubMed, CINAHL, and Science Direct) were included in the search for publications. Database searches were conducted in September and October of 2014 and were limited to the previous ten years to capture current practices, including all relevant articles published since January of 2004. Combinations of following key words were utilized: *low-income; WIC; women, infants, and children; breastfeeding; breast milk; and maternal and child health*. Articles based in the United States, written in English, observing a low-income population, and focusing on breastfeeding practices were included for a review of abstracts. Publications were excluded from review for the following reasons: study focused on a low-income population not exclusively consisting of WIC participants; and primary objectives of the research were on health outcomes or nutrient analysis, related to infant consumption of breast milk. Articles comparing WIC-populations and non-WIC populations, were excluded from the results due to the focus of this review on persons benefiting from WIC.

The Cochrane Collaboration's tool for assessing risk of bias<sup>17</sup> was applied during the literature selection process in the following ways: a total of three authors were involved in verification of inclusion versus exclusion criteria for all screened articles; and articles were considered appropriate for analysis if all data of interest (listed below and in tables 1-7) were specified within the study. Application of the Cochrane tool ensured a comprehensive analysis of resulting studies and ability to compare results across studies. Data of interest extracted from each publication consisted of: first author and year; research design; participant characteristics; study location by state; description of study; data collection techniques; and specific results which indicated an increase in likelihood of breastfeeding. The authors further identified overarching themes associated with increasing the likelihood of breastfeeding within the WIC population from resulting articles.

## **RESULTS**

See Figure 1 for PRISMA Flow Diagram. Of all articles found in this systematic search of literature (n= 56,290), a total of 2,618 remained after duplicates were removed. A review of titles and abstracts resulted in the exclusion of articles (n= 2,516), leaving 102 for full text review of inclusion eligibility. Thereafter, excluded articles (n= 70) resulted in a total of 32 articles that fit the inclusion criteria. At the point of screening articles for full text eligibility, articles were excluded for the following reasons: no evidence in support of increasing the likelihood of breastfeeding was determined (n=55); participant recruitment was vague and implied a sample not exclusively consisting of WIC participants (n=11);

and study primarily assessed the early introduction of solid foods and did not focus on breastfeeding (n=4). Articles were then organized into area of research by theme, including: sociodemographic characteristics (n= 17);<sup>18-34</sup> environmental and media support (n= 4);<sup>23,35-37</sup> government policy (n= 2);<sup>26,38</sup> intention to breastfeed, breastfeeding in hospital, or previous breastfeeding experience (n= 9);<sup>20,26,27,29-31,33,39,40</sup> attitudes toward and knowledge of breastfeeding benefits (n= 6);<sup>30,31,34,35,41,42</sup> health care provider or social support (n= 15);<sup>21-23,27,28,30,32,35,38,39,43-47</sup> and time exposure to WIC services (n= 5).<sup>25,33,47-49</sup> In many cases, articles were categorized into multiple research foci.<sup>18,20-23,25-28,30-35,38,39,47</sup> Articles reviewed are classified accordingly within tables 1 through 7.

## DISCUSSION

### Sociodemographic Characteristics

On a national scale, demographic characteristics such as income, education, and race/ethnicity are well documented as relative to likelihood of breastfeeding.<sup>11</sup> Statistics show that persons classified in lower socioeconomic groups, with less education, or of minority race/ethnicity are less likely to initiate and sustain breastfeeding.<sup>11</sup>

Within the WIC population, sociodemographic characteristics indicating an increased likelihood of breastfeeding are absence of depression,<sup>19</sup> decreased age(18-19 years),<sup>25</sup> decreased Body Mass Index,<sup>29,33</sup> decreased time spent in the United States,<sup>22,26,27</sup> delayed return to work,<sup>27</sup> increased age,<sup>20,22-24,28,29,34</sup> increased income,<sup>25,30</sup> larger-weight infants,<sup>21</sup> geographic location,<sup>34</sup> cohabitation with child's father,<sup>27</sup> lower birth-weight infants,<sup>28</sup> marriage,<sup>19,31</sup> multiparous,<sup>20</sup> more years of education,<sup>18,24-26,28,34</sup> not receiving

food stamps,<sup>19</sup> non-smoking,<sup>25</sup> planned pregnancies,<sup>22</sup> prenatal care,<sup>25</sup> primiparous,<sup>18,23</sup> Spanish-speaking,<sup>26,27,32,34</sup> taking multi-vitamins,<sup>25</sup> unemployed or working part-time,<sup>31</sup> and urban residency.<sup>28,34</sup> In several research studies, White or Hispanic women were documented as being more likely to breastfeed than non-Hispanic Black or American Indian/Alaska Natives.<sup>18,21,23-28,31,34</sup> See Table 1.

### **Environmental and Media Support**

Public health nutrition measures focus on environmental factors and their potential to contribute to obesity and chronic diseases, linking behavior and environmental cues.<sup>50</sup> A total of four articles addressed supportive environments<sup>23,35,36</sup> and media promotion<sup>37</sup> in the role of increasing the likelihood to breastfeed. See table 2.

One study focused on urban black women enrolled in WIC and documented bottle feeding as the normative infant feeding method within the specified population.<sup>35</sup> After detailed documentation of the WIC physical and social clinic environment, posters focused around the promotion of breastfeeding were considered to be influential overall,<sup>34</sup> and persuasive to one WIC participant who chose breastfeeding. Additionally, positive social interactions between WIC staff and participants were noted to facilitate breastfeeding discussion and increase participant initiation.<sup>35</sup> Another study found that changing the social and physical WIC clinic environment was successful to breastfeeding efforts.<sup>23</sup> Intervention tactics included extensive staff training to align communication styles to WIC principles and increased visual promotion efforts of breastfeeding.<sup>23</sup> Furthermore, visual and audio breastfeeding advertisements through a media campaign in

rural Texas resulted in increased inquiries about breastfeeding practices to health care providers.<sup>37</sup> Lastly, one study associated ease of access to breast pumps with longer breastfeeding duration of WIC participants involved in a breast pump loan program.<sup>36</sup>

Evidence of how the WIC clinic environment influences breastfeeding behavior is limited in published research. WIC's nutrition service standards highlight the importance of breastfeeding education in a participant-specific manner and address the need for the clinic environments to be conducive to breastfeeding success, which include limiting formula advertisements and being respectful of breastfeeding mothers within the waiting area or providing private accommodations.<sup>51</sup> Understanding the relationship between a WIC clinic environment and client health behavior, specifically factors that may increase the likelihood of breastfeeding among participants, requires more research. WIC's breastfeeding promotion tactics may benefit from optimal, defined social and physical environmental standards for positive health behavior changes.

### **Government Policy**

In 2009, the USDA implemented an interim rule adjustment in WIC program policies, recommended by the Institute of Medicine,<sup>52</sup> which included food package offerings more aligned with Dietary Guidelines for Americans<sup>53</sup> and incentivized breastfeeding for enrolled mothers in order to promote initiation and sustained breastfeeding according to the American Academy of Pediatrics recommendations.<sup>51</sup> Three articles measured the impact of the new food packages for breastfeeding mothers<sup>15,26,38,54</sup> and two are represented in this review.<sup>26,38</sup> See table 3. Breastfeeding

packages include full, partial, or no breastfeeding, with full breastfeeding inclusive of a greater multitude of food offerings for the mother and less formula issuance overall for mothers interested in full or partial breastfeeding. A full breastfeeding mother enrolled in WIC is eligible to receive food package offerings up to one year after delivery, an incentive not offered to women choosing partial or no breastfeeding. Furthermore, a full breastfeeding package issuant receives ten dollar vouchers for fresh fruits and vegetables, while all other package participants receive eight dollars.<sup>52</sup>

While issuance rates of full breastfeeding packages increased in a study of ten state's WIC administrative records with a large sample size, partial breastfeeding packages also increased and initiation rates of breastfeeding remained largely unchanged, implying no substantive evidence of increased likelihood of breastfeeding.<sup>54</sup> However, remaining studies found positive effects of the 2009 food package changes on breastfeeding rates.<sup>26,38</sup> Perhaps the wider-scope of measures in regard to package revision changes on breastfeeding included within these two studies offered insight into the increased breastfeeding rates among California WIC participants. For example, one study primarily composed of Latina women linked the importance of hospital breastfeeding policies, specifically issuance of formula upon discharge, and the negative associations with breastfeeding rates, despite WIC program incentives for breastfeeding.<sup>26</sup> Another study documented increased staff training and participant education six months pre-implementation at various WIC agencies in order to promote full breastfeeding package option corresponding to the 2009 policy change.<sup>38</sup> These efforts alone resulted in

increased initiation and duration of breastfeeding measured at two and six months, with further increase post-implementation of food package revisions.<sup>38</sup>

Therefore, while policy changes can provide guidelines for improvement in program areas such as WIC's 2009 food package changes specific to breastfeeding, methods of implementation, as well as regional and population characteristics likely are an important determinant in margins of change. Further research identifying the weight of these factors alongside policy implementation to support breastfeeding is justified.

### **Intention to Breastfeed**

A total of nine articles within this review cited evidence of intention as a strong indicator in likelihood of breastfeeding.<sup>20,26,27,29-31,33,39,40</sup> See table 4. One study excluded from this particular theme concluded that infant feeding methods determined during pregnancy were strongly aligned with method used,<sup>42</sup> indicating prenatal intention to breastfeed is likely predictive of breastfeeding. Three studies specifically identified intention to breastfeed as being predictive of exclusive breastfeeding<sup>26,27,33</sup> with one identifying increased odds of longer duration to three and six month measures.<sup>26</sup> The authors decided to group breastfeeding in hospital and previous breastfeeding experience under the major theme of intention to breastfeed, due to this correlation. It is assumed that a woman breastfeeding in hospital intended to do so and that previous breastfeeding experience influences intent, the latter of which was a conclusion of two studies within this dataset.<sup>30,39</sup> One study identified participation in a prenatal breastfeeding educational class as influential on exclusive breastfeeding in hospital.<sup>40</sup> Exclusive breastfeeding at

initiation or in the hospital led to higher rates of duration of breastfeeding by WIC participants to at least six,<sup>20,26,27,29</sup> twelve,<sup>27</sup> and twenty-four months.<sup>27</sup>

Considering 10.1% of all WIC participants are involved in the supplemental program prenatally<sup>55</sup> any efforts to promote breastfeeding to these women would be beneficial, as well as increasing resources to elevate the percentage of prenatal women participating in an environmentally supportive WIC program.

### **Knowledge and Attitudes toward Breastfeeding**

Six articles addressed the importance of knowledge of breastfeeding and its benefits, noting the positive effect of this awareness on likelihood to breastfeed.<sup>30,31,34,35,41,42</sup> Informed decision making based on increased knowledge of health benefits and breastfeeding to an infant<sup>30,31,35,41</sup> and knowledge of bonding with child through breastfeeding<sup>35</sup> were important factors influencing the decision to breastfeed for WIC mothers. Additionally, personal feelings related to stronger beliefs of breastfeeding benefits,<sup>30,42</sup> and positive attitudes to breastfeeding a child and breastfeeding in public were linked with likelihood to breastfeed.<sup>34</sup> Efforts to educate WIC mothers and increase positive views of breastfeeding have been successful, as demonstrated by these studies. Further research should examine variations of educational methods by ethnically and racially diverse areas and degrees of resonance with WIC mothers. The findings from such a study could provide guidance at the national level for the development and provision of culturally sensitive educational materials. WIC's *Nutrition Services Standards* provide some insight into policy for the education of staff members,

highlighting multicultural awareness training.<sup>51</sup> Perhaps further tailoring of these trainings through site-specific, direct feedback of clientele through focus groups would provide tools to connect with WIC mothers in an effort to further promote breastfeeding.

### **Health Care Provider and Social Support**

Provision of support for breastfeeding success is highly important.<sup>11</sup> Within this review's sample, support from health care professionals,<sup>22,23,28,35,38,44</sup> peers through peer counseling,<sup>18,21,30,32,45,47</sup> and family member focused support for fathers<sup>39,46</sup> increased the likelihood of breastfeeding. See table 6.

Health care professional support varied from: conveying feelings of empathy and trust to client,<sup>23,35</sup> providing positive and consistent interactions with clients;<sup>44</sup> access to and utilization of WIC staff or lactation consultants regarding breastfeeding barriers;<sup>22</sup> receiving any breastfeeding information from a health care professional;<sup>28</sup> and increased staff training on 2009 WIC interim rule changes to the food packages for promotion of breastfeeding.<sup>38</sup>

One study documented the importance of group support through peer counseling as impacting breastfeeding more than educational efforts.<sup>30</sup> Overall, any involvement in a peer counseling group had positive outcomes for breastfeeding,<sup>21,45,47</sup> with implications of prenatal involvement or in-hospital peer counselor support as even more beneficial to the likelihood of breastfeeding.<sup>18</sup> Success of a telephone based counseling support network on breastfeeding likelihood was also documented, primarily to Spanish-speaking participants.<sup>32</sup> Ideally, a mother would be included in peer counseling support prenatally

through her local WIC clinic with familiar support post-delivery to be expected. A recent publication identified the necessity to offer peer counseling support to every WIC participant, highlighting the limited funding available for such programs. Allocated WIC resources for formula purchases are twenty-five times higher than breastfeeding promotion efforts and peer support programs supported by WIC are lacking throughout much of the country.<sup>56</sup>

Inclusion of partner support in breastfeeding has received some acknowledgment of success related to peer dad programs offering support systems to fathers of WIC benefitted dyads. Two studies included within this review found increased breastfeeding rates among clinics offering this type of support.<sup>39,46</sup> Both studies focus on peer dad interventions in Texas with a primarily Hispanic population. Translation of similar interventions focusing on family members surrounding a WIC dyad, fathers or other extended family members, into other socio-cultural contexts would be an interesting comparison and merits further research.

### **Time Exposure to WIC**

Information pertaining to the relationship between breastfeeding and time exposed to the WIC program is conflicting. Five articles identified as a result of this review's specifications associated increased likelihood of breastfeeding with enrollment of participants in WIC during the first<sup>25,33</sup> and second trimester<sup>48,49,57</sup> when compared to later prenatal enrollment. See table 7. However, a study including a nationally representative sample of WIC participants determined that any participation in WIC during the first and

second trimester is associated with decreased likelihood of breastfeeding.<sup>9</sup> Possibly confounding variables, such as resources allocated and breastfeeding promotion techniques at individual WIC clinics, as evidenced by this review, are more influential of infant feeding decisions than time exposure. Perhaps allocated resources above and beyond the minimum breastfeeding promotion standards have increased benefit to breastfeeding when combined with variables such as time exposure to government services. The relationships between time exposure, confounding variables, and how they relate to initiation and duration of breastfeeding among WIC participants warrant further investigation.

### **Limitations**

It is important to highlight methodological limitations for this review focused on factors associated with an increased likelihood of WIC participants to breastfeed. Search terms and specific databases used in order to collect data may not have resulted in a comprehensive gathering of articles fitting inclusion criteria. This would limit the scope of the results and discussion of this review. Including only peer-reviewed articles may have overlooked relevant work such as theses, dissertations, or USDA documents that are WIC-focused. Lastly, the limited number of articles included within this review's specifications necessitates further insights into each described thematic outcome through future investigations.

## **Concluding Statements**

The complexity of breastfeeding behaviors among WIC participants is evident. Although many efforts to overcome documented barriers to breastfeeding for WIC participants seem practical and beneficial to breastfeeding rates, knowledge of community-specific factors inhibiting breastfeeding are useful in the field, as highlighted by the Surgeon General's Call to Action to Support Breastfeeding in 2011.<sup>11</sup> Further, information sought by individual WIC clinics in regard to clientele demographics and beliefs, attitudes, and perceptions of breastfeeding could provide insight into regional differences of breastfeeding rates, ultimately leading to an increase of rates at the local level. Research to determine the effect of an increasingly supportive WIC environment on breastfeeding rates could provide more specific policy guidelines of facility layouts for health promotion. Environments have been impactful on health promotion efforts in other nutrition fields such as food environment knowledge related to community and consumer environments<sup>50</sup> and school lunchroom layouts by influencing positive dietary intake.<sup>59-61</sup> Similar knowledge focused on the WIC environment's role in breastfeeding promotion is needed. Additionally, inclusion of successful peer counseling in each WIC environment would enhance the benefits and resources supplied to women for breastfeeding success.

Current strides in hospital practices including Baby Friendly Hospital initiatives in support of breastfeeding supply a framework for extended health care provider support to new mothers.<sup>62</sup> Modification of these initiatives to align with WIC's breastfeeding goals has the potential to assist in the creation of optimal WIC environment standards and create provider networks offering continual support across practices.

In closing, many low-income women throughout the United States suffer from substance abuse or dependence, domestic violence, and depression,<sup>63</sup> which are lacking as listed barriers to breastfeeding in the literature. Further research to determine the role of these issues in low-income rural and urban settings in relation to maternal and child health has the potential to offer meaningful insights into deeper barriers to breastfeeding and should be a focus in moving breastfeeding science forward. Ultimately, efforts which address multiple hindrances to breastfeeding and the role of social issues within a population or community of need are warranted alongside policies that set the standard of breastfeeding initiation and duration to at least twelve months in clinical, organizational, and government guidelines.

## FIGURES

Figure 1. PRISMA Flow Diagram of Systematic Review Inclusive of all Relevant Articles Associated with an Increased Likelihood of Breastfeeding for The United States Department of Agriculture's (USDA) Food and Nutrition Service Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Participants.

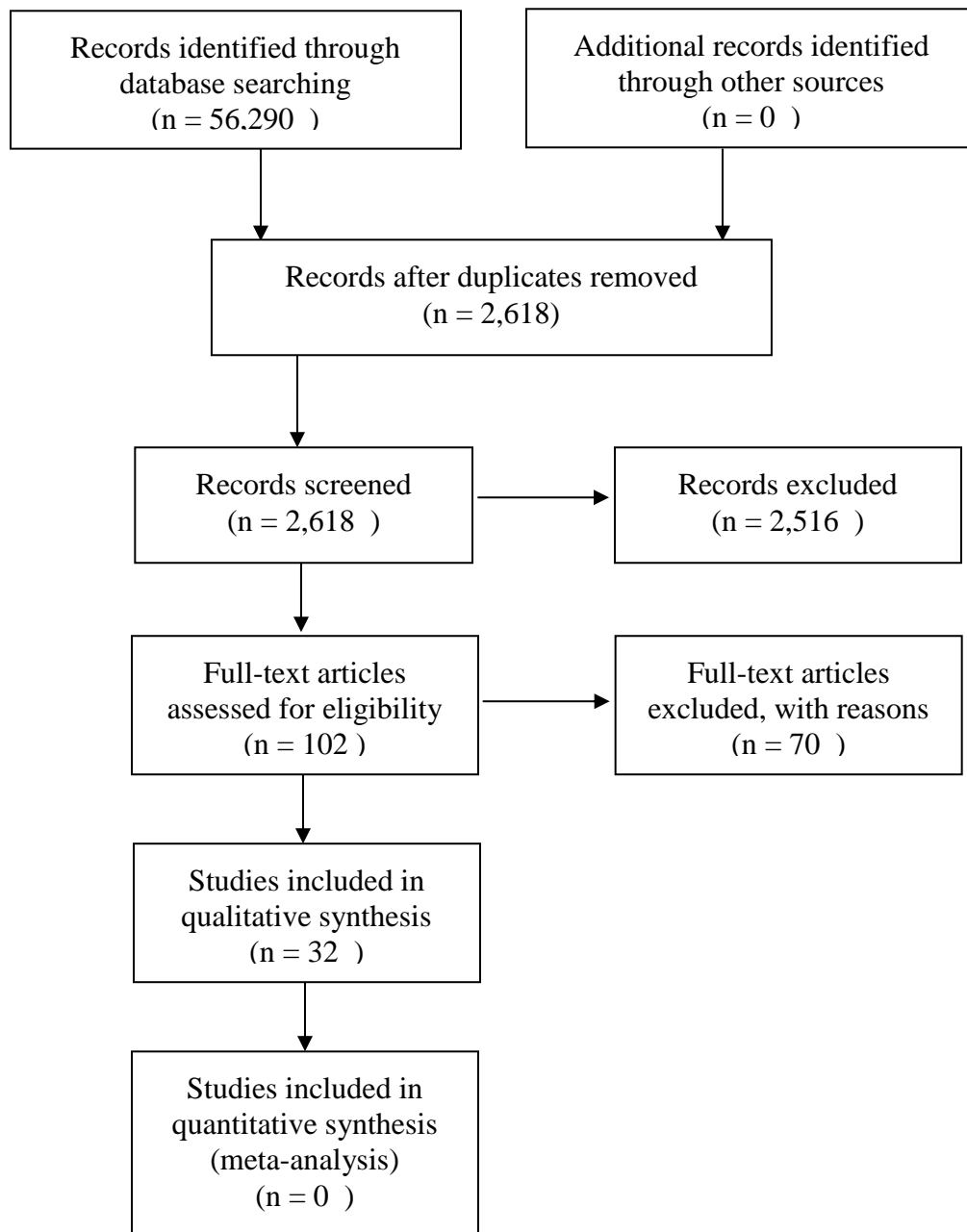


Table 1: Sociodemographic Characteristics as a Predictor of Increased Likelihood of Breastfeeding within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population						
First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Campbell, 2014*	Cross-sectional	WIC participants: no prior breastfeeding experience	TX	Determined peer counselor (PC) contact with breastfeeding initiation rates among primiparas and women with no prior breastfeeding experience	Infant Feeding Practices Survey	More than a high school education; Hispanic women; first time pregnant women when compared to women who did not breastfeed in prior pregnancies
Darfour-Oduro, 2014	Cross-sectional	WIC participants: mother-infant dyads; biological mothers	IL	Understanding of mothers' social environments and well-being to determine how mothers take care of themselves and infants in postnatal period, including breastfeeding initiation and duration to 3 months	Survey	Married mothers 3.47 times likely to initiate breastfeeding and 4.08 times likely to continue through 3 months. Not receiving food stamps; not diagnosed with postpartum depression or not depressed (not statistically significant)

Table 1 Continued

Dodgson, 2007*	Retrospective	WIC participants: postpartum; initiated breastfeeding	HI	Description of breastfeeding patterns of women who had initiated breastfeeding	WIC participant data	Multiparous; older age (not significant)
Gross, 2009*	Cross-sectional	WIC participants	MD	Determined rates of breastfeeding initiation by PC program participation	Electronic data	Hispanic participants had highest breastfeeding rates in all categories; larger infants in comparison to low-birth weight infants
Haughton, 2010*	Retrospective	WIC participants: breastfed at least 1 child who was younger than 5	CT	Identification of factors associated with breastfeeding duration	Survey; self-completed or administered	Additional year of maternal age, less time spent in United States associated with breastfeeding at 6 months; planned pregnancies 2 times as likely to breastfeed for at least 6 months.

Table 1 Continued

Hildebrand, 2014*	Two-part quasi-experimental	WIC Participants: parents and caregivers of children (birth-3years). WIC clinics	OK	Changes in physical and social environment in 4 WIC clinics determined perception of WIC experience and breastfeeding initiation	Computerized survey; secondary breastfeeding data	White women more likely to breastfeed compared with American/Alaskan Indian; women with 1 in comparison to women with 2 or more children; age 28 or older
Hurley, 2008	Cross-sectional	WIC participants	MD	Examined how breastfeeding behaviors, perceptions, and experiences vary by race/ethnicity in the USA	Telephone survey	Hispanic mothers more likely (91%) than African American (65%) or White (61%) to initiate; maternal age; decreased infant age; more than high school education

Table 1 Continued

Jacobson, 2014*	Cross-sectional	WIC participants	KS	Sought insight into maternal characteristics associated with breastfeeding among urban and rural women	Pregnancy Nutrition Surveillance System dataset	Urban women: Hispanic; 18-19 years old; more than a high school education; earning more than \$10,000 per year; prenatal care early in pregnancy; non-smoking; use of multi-vitamins. Not variable within rural population (age, income, prenatal care, WIC enrollment timing not statistically significant predictors)
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Table 1 Continued

Langellier, 2012*	Cross-sectional	WIC participants: biological mother of child in WIC	CA	Measured impact of in-hospital breastfeeding, receiving of formula discharge pack, and maternal return to work on breastfeed duration	Survey data from 2008; telephone interview	Non-Hispanic White mothers had 2.9 times odds of Hispanic mothers to breastfeed exclusively at 6 months; foreign-born mothers more likely to breastfeed at 6 and 12 months; Spanish speaking mothers more likely to breastfeed at 6, 12, and 24 months; mothers living with child's parent 21% increased odds of breastfeeding at 6 months and 31% increased odds at 12 months; mothers returning to work after 7 months postpartum more likely to breastfeed at 6, 12, and 24 months
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Table 1 Continued

Langellier, 2014*	Cross-sectional; pre/post design	WIC participants: English or Spanish speaking	CA	Effect of 2009 WIC changes on breastfeeding outcomes	Survey questionnaire; interview	Latinas in comparison to blacks more likely to initiate breastfeeding, but less likely to exclusively breastfeed at 6months; white mothers more likely than Latinas to exclusively breastfeed at 3 and 6 months; children's age, mother's education, foreign nativity, and Spanish speaking
Ma, 2012*	Cross-sectional	WIC participants: first time mothers	LA	Application of positive deviance concept to explore characteristics of positive deviants for breastfeed	LaPRAMS from 2000-2004	White: increased breastfeeding initiation by maternal age and education, more likely to initiate breastfeeding when compared to black mothers. Black: married, 13 years or more of education, urban residence, and low birth weight infants. Positive deviants were more likely to have a job prior to delivery

Table 1 Continued

McKechnie, 2009	Retrospective	WIC participants	WI	Examined exclusive versus partial breastfeeding relating to breastfeeding duration and determined if demographic characteristics are associated with either	Maternal records from existing database	Exclusive breastfeeding associated with older mothers and mother's with lower Body Mass Index (BMI)
Mickens, 2009*	Cross-sectional	WIC participants: any stage of pregnancy	CA	Identification of impact factors for low-income women's infant feeding decisions	Structured survey questionnaire	Income greater than \$18,000
Murimi, 2010*	Cross-sectional	WIC participants: rural residency	LA	Determined factors that have largest impact on breastfeeding and effect of formula provision by WIC on breastfeeding	Adapted questionnaire validated by Szcodronski and Dobson, 2002	White; unemployed or part-time work; married

Table 1 Continued

Reeder, 2014*	Stratified, randomized	WIC participants: indicated intention or indecisiveness to breastfeed	OR	Tested effectiveness of a telephone PC program for increased breastfeeding initiation, duration and exclusivity	Data retrieved from OR WIC Information System Tracker (TWIST)	Nonexclusive breastfeeding duration greater at 6 months for Spanish speakers only; likelihood of exclusive breastfeeding cessation less among Spanish speakers
Tenfelde, 2011*	Cross-sectional	WIC participants: initiated breastfeeding and responded to a question on breastfeeding exclusivity	IL	Examined predictors of breastfeeding exclusivity in hospital in an urban area	Clinical and administrative data	Women not classified as overweight or obese 50% more likely
Vaaler, 2010*	Cross-sectional	WIC participants: mothers of young children	TX	Influences of demographic characteristics, breastfeeding in public, attitudes to infant feeding and use of formula on breastfeeding	Questionnaire: Infant Feeding Practices Survey	Higher education; older age; Spanish-speaking Hispanic; metropolitan residence; not living near the Texas-Mexico border

\*Data also displayed in other table(s)

Table 2: Environmental and Media Support as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population						
First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Cricco-Lizza, 2005*	Ethnographic	WIC participants and relatives or friends of	NYC	Explored context of infant feeding decisions in an urban WIC clinic	Participant observation; interviews; key informants	Clinic environment with culturally appropriate posters with relevant messages potentially influential of infant feeding decisions; encouraged women to breastfeed or think about breastfeeding more
Hildebrand, 2014*	Two-part quasi-experimental	WIC Participants: parents and caregivers of children (birth-3years). WIC clinics	OK	Changes in physical and social environment in 4 WIC clinics determined perception of WIC experience and breastfeeding initiation	Computerized survey; secondary breastfeeding data	Women 1.5 times more likely to initiate breastfeeding in influence model when compared to traditional services

Table 2 Continued

Meehan, 2008	Cross-sectional; pre/post design	WIC participants: English or Spanish speaking	CA	Electric pump loan program determined facility of breastfeeding for mothers returning to work	Survey questionnaire; interview	Mothers receiving pump as soon as requested did not request formula supplementation until 8.8 months on average and 5.5 times more likely to not request formula at 6 months
Sayegh, 2007	Pre/post intervention	WIC participants: rural, expectant or new mothers	TX	Piolet media breastfeeding outreach campaign (posters, billboard, radio, TV, newspaper, magazine ads, community presentations, gift basket distribution)	Interviews	Post-campaign, providers reported more breastfeeding specific questions being asked; intention to breastfeed <input type="checkbox"/>

\*Data also displayed in other table(s)

Table 3: Government Policy as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population						
First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Langellier, 2014*	Cross-sectional; pre/post design	WIC participants: English or Spanish speaking	CA	Effect of 2009 WIC changes on breastfeeding outcomes	Survey questionnaire; interview	Participants receiving new food package had 2.2 times odds of breastfeeding initiation, 1.7 times odds of exclusive breastfeeding at 3 months and 3.1 times odds of exclusive breastfeeding through 6 months
Whaley, 2012*	Pre/post data analysis	WIC participants	CA	Impact of 2009 WIC food package changes with increased staff training and education on breastfeeding package issuance rates	WIC data on breastfeeding and infant feeding packages issued	Full breastfeeding package issuance ↑ by 86%; increase of exclusive breastfeeding at 2 and 6 months

\*Data also displayed in other table(s)

Table 4: Intention to Breastfeed, Breastfeeding in Hospital, or Previous Breastfeeding Experience as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population						
First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Dodgson, 2007*	Retrospective	WIC participants: postpartum; initiated breastfeeding	HI	Description of breastfeeding patterns of women who had initiated breastfeeding	WIC participant data	Mothers exclusively breastfed at initiation weaned significantly later and more likely to breastfeed for 6 months
Langellier, 2012*	Cross-sectional	WIC participants: biological mother of child in WIC	CA	Measured impact of in-hospital breastfeeding, receiving of formula discharge pack, and maternal return to work on breastfeed duration	Survey data from 2008; telephone interview	Exclusive breastfeeding in hospital 9.9 times more likely to breastfeed for 6 months, 8 times odds of breastfeeding at 12 months, and 5.7 times odds of breastfeeding at 24 months; mothers reporting prenatal intention to breastfeed had 3.6 times the odds of breastfeeding at 6 months with 7.4 times odds of exclusive breastfeeding

Table 4 Continued

Langellier, 2014*	Cross-sectional; pre/post design	WIC participants: English or Spanish speaking	CA	Effect of 2009 WIC changes on breastfeeding outcomes	Survey questionnaire; interview	Intention to breastfeed: 12 times odds of initiation, 3 or more times odds of any breastfeeding at 3 and 6 months, and 4 or more times odds of exclusive breastfeeding at 3 and 6 months. Exclusive breastfeeding in hospital: about 10 times odds of any breastfeeding at 3 months and at least 6 times odds at 6 months
Lovera, 2010*	Cohort; Intervention	WIC- participants: mothers and spouses; initiated breastfeeding	TX	Pilot <i>Peer Dad Program</i> based on Theory of Planned Behavior aimed toward fathers to promote support of breastfeeding through peer counseling (PC)	Structured interviews	Mothers who previously breastfed 2 times more likely to breastfeed for 6 months or longer

Table 4 Continued

McKechnie, 2009	Retrospective review	WIC participants	WI	Examined exclusive versus partial breastfeeding relating to breastfeeding duration and determined if demographic characteristics are associated with either	Maternal records from existing database	Those who initiated exclusive breastfeeding and continued past 6 weeks breastfed significantly longer
Mickens, 2009*	Cross-sectional	WIC participants: any stage of pregnancy	CA	Identification of impact factors for low-income women's infant feeding decisions	Structured survey questionnaire	Previous breastfeeding experience related to increased intent to breastfeed
Murimi, 2010*	Cross-sectional	WIC participants: rural residency	LA	Determined factors that have largest impact on breastfeeding and effect of formula provision by WIC on breastfeeding	Adapted questionnaire validated by Szcodronski and Dobson, 2002	Mothers breastfed as infants more likely to breastfeed their infants

Table 4 Continued

Tender, 2009	Retrospective	WIC participants	DC	Identified reasons breastfeeding mothers begin in-hospital formula supplementation and risk factors associated with supplementation	Orally administered survey	Participation in prenatal breastfeeding class sole factor significantly associated with exclusive breastfeeding in hospital
Tenfelde, 2011*	Cross-sectional	WIC participants: initiated breastfeeding and responded to a question on breastfeeding exclusivity	IL	Examined predictors of breastfeeding exclusivity in hospital in an urban area	Clinical and administrative data	Women intending to breastfeed (determined by prenatal visit) about 4 times more likely to breastfeed exclusively

\*Data also displayed in other table(s)

Table 5: Attitudes toward and Knowledge of Breastfeeding Benefits as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population						
First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Cricco-Lizza, 2004	Ethnographic	WIC participants and relatives or friends of	NYC	Explored context of infant feeding decisions in an urban WIC clinic	Participant observation; interviews; key informants	Women who chose breastfeeding reported health benefits, advantages of breastfeeding, and close bond with baby is what interested them in process
Fornasaro-Donahue, 2014	Mixed methods descriptive	WIC participants: pregnant or non-breastfeeding women with infant aged 1-4 months	RI	Assessed cost of formula as a motivator and deciding factor in breastfeeding decision	Surveys; Interviews	Primary reason to choose breastfeeding was health benefits to infant; cost of formula not influential of breastfeeding decision, but considered additional motivation for women who chose breastfeeding
Mickens, 2009*	Cross-sectional	WIC participants: any stage of pregnancy	CA	Identification of impact factors for low-income women's infant feeding decisions	Structured survey questionnaire	Knowledge of breastfeeding and fewer negative beliefs of breastfeeding

Table 5 Continued

Mistry, 2007	Quantitative	WIC participants	CA	Breastfeeding PC utilized the Theory of Planned Behavior to assess intentions, attitudes, and norms toward breastfeeding	Structured survey questionnaire	Stronger beliefs supporting breastfeeding
Murimi, 2010*	Cross-sectional	WIC participants: rural residency	LA	Determined factors that have largest impact on breastfeeding and effect of formula provision by WIC on breastfeeding	Adapted questionnaire validated by Szcodronski and Dobson, 2002	39% of breastfeeding women reported breastfeeding benefits for baby most important reason for breastfeeding; 96% of participants reported breastfeeding benefits given at WIC were clear and helped in decision to breastfeed
Vaaler, 2010*	Cross-sectional	WIC participants: mothers of young children	TX	Influences of demographic characteristics, breastfeeding in public, attitudes to infant feeding and use of formula on breastfeeding	Questionnaire: Infant Feeding Practices Survey	Positive attitudes to breastfeeding benefits and breastfeeding in public more likely to breastfeed exclusively for 1 year

\*Data also displayed in other table(s)

First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Campbell, 2014*	Cross-sectional	WIC participants: no prior breastfeeding experience	TX	Determined peer counselor (PC) contact with breastfeeding initiation rates among primiparas and women with no prior breastfeeding experience	Infant Feeding Practices Survey	PC contact during pregnancy or after delivery more likely to initiate breastfeeding; Receiving PC contacts during pregnancy and hospitalization highest percentage of breastfeeding initiation
Cricco-Lizza, 2005*	Ethnographic	WIC participants and relatives or friends of	NYC	Explored context of infant feeding decisions in an urban WIC clinic	Participant observation; interviews; key informants	Attentiveness, kindness, and empathy of WIC staff in culturally-appropriate interactions seemed to encourage women to be more open to the promotion of breastfeeding
Cross-Barnet, 2012	Qualitative	WIC participants: with infants; met at least once with Peer Counselor (PC)	MD	Explored infant feeding education and support experiences of mothers	Semi-structured interviews	One mother in sample reported positive, consistent support and information from HCP was only mother who breastfed exclusively for at least 10 months

Table 6 Continued

Gross, 2009*	Cross-sectional	WIC participants	MD	Determined rates of breastfeeding initiation by PC program participation	Electronic data	Odds of breastfeeding initiation 21% greater for PC-exposed infants
Haughton, 2010*	Retrospective	WIC participants: breastfed at least 1 child who was younger than 5	CT	Identification of factors associated with breastfeeding duration	Survey; self-completed or administered	Women who consulted with lactation consultants or WIC staff with breastfeeding issues
Hildebrand, 2014*	Two-part quasi-experimental	WIC Participants: parents and caregivers of children (birth-3years). WIC clinics	OK	Changes in physical and social environment in 4 WIC clinics determined perception of WIC experience and breastfeeding initiation	Computerized survey; secondary breastfeeding data	Women 1.5 times more likely to initiate breastfeeding in influence model when compared to traditional services
Langellier, 2012*	Cross-sectional	WIC participants: biological mother of child in WIC	CA	Measured impact of in-hospital breastfeeding, receiving of formula discharge pack, and maternal return to work on breastfeed duration	Survey data from 2008; telephone interview	mothers not receiving discharge formula pack more likely to breastfeed exclusively for 6 months

Table 6 Continued

Lovera, 2010*	Cohort; Intervention	WIC- participants: mothers and spouses; initiated breastfeeding	TX	Pilot <i>Peer Dad Program</i> based on Theory of Planned Behavior aimed toward fathers to promote support of breastfeeding through peer counseling (PC)	Structured interviews	<i>Peer Dad Program</i> participation resulted in 63.4% of women breastfeeding for 6months or longer compared to 54.6% of non-program participants (not statistically significant)
Ma, 2012*	Cross-sectional	WIC participants: first time mothers	LA	Application of positive deviance concept to explore characteristics of positive deviants for breastfeed	LaPRAMS from 2000-2004	Positive deviants more likely to have received information about breastfeeding from staff
Mickens, 2009*	Cross-sectional	WIC participants: any stage of pregnancy	CA	Identification of impact factors for low-income women's infant feeding decisions	Structured survey questionnaire	Regardless of breastfeeding knowledge or beliefs, women who attended support group 2 or more times more likely to intend to breastfeed
Olson, 2010	Quasi-experimental	WIC participants	MI	Examined effectiveness of a PC program	Administrative and survey-based sources	Estimated PC increased breastfeeding initiation by 27% and increased mean duration of breastfeeding by 3.6 weeks

Table 6 Continued

Reeder, 2014*	Stratified, randomized	WIC participants: indicated intention or indecisiveness to breastfeed	OR	Tested effectiveness of a telephone PC program for increased breastfeeding initiation, duration and exclusivity	Data retrieved from OR WIC Information System Tracker (TWIST)	Treatment group breastfeeding nonexclusively for at least 3months was 22% greater than control
Stremler, 2004	Intervention	WIC participants: fathers of enrolled infants and children.	TX	Father peer support program development from documented success from PC and research identifying father's attitude as important influence on breastfeeding	Exit interviews	Initiation of breastfeeding increased at clinics employing peer dads

Table 6 Continued

Yun, 2010*	Cross-sectional	WIC participant data: all 118 WIC agencies	MO	Effectiveness of PC programs on breastfeeding initiation and identification of factors to facilitate breastfeeding initiation	2006 Missouri Pregnancy Nutrition Surveillance System (PNSS) data and birth certificate data	Breastfeeding initiation rate in PC agencies 2.3% higher than non-PC agencies. Increased <input type="checkbox"/> breastfeeding initiation rates: agencies with more years of PC experience; PC who had other positions within organization; PC coordinator as Breastfeeding PC Task Force member
Whaley, 2012*	Pre/post data analysis	WIC participants	CA	Impact of 2009 WIC food package changes with increased staff training and education on breastfeeding package issuance rates	WIC data on for breastfeeding and infant feeding packages issued	Staff training and participant education (WIC changes and breastfeeding decisions) increased full breastfeeding package rates and exclusive breastfeeding to 2 and 6 months before policy change

\*Data also displayed in other table(s)

Table 7: Time Exposed to WIC Services as a Predictor of Increasing the Likelihood to Breastfeed within the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Population

First author, Year	Research Design	Participant Characteristics	State(s)	Study Description	Data Collection	Results Indicating Increased Likelihood to Breastfeed
Jacobson, 2014*	Cross-sectional	WIC participants	KS	Sought insight into maternal characteristics associated with breastfeeding among urban and rural women	Pregnancy Nutrition Surveillance System dataset	Urban women enrolling in WIC during first trimester had increased odds of initiating breastfeeding. Not statistically significant for rural women

Table 7 Continued

Joyce, 2008	Cross-sectional	WIC participants: enrolled during pregnancy and continued enrollment postpartum	FL, GA, IN, MI, MO, NJ, NC, OH, VA	Tested exposure to WIC and associated outcomes with smoking, weight gain during pregnancy, birth outcomes, and likelihood of breastfeeding	Pregnancy Nutrition Surveillance System dataset	Whites: enrolled in WIC during first trimester (2.2%) and second trimester (1%) more likely to breastfeed when compared to whites enrolled during third trimester. Blacks: enrolled in WIC prenatally (3.1%), during first trimester (3.9%), and during second trimester (3.7%) more likely to breastfeed when compared to blacks enrolled during third trimester. Hispanics: enrolled in WIC prenatally (4.6%), during first trimester (5.7%), and during second trimester (4.7%) more likely to breastfeed when compared to Hispanics enrolled during third trimester.
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Table 7 Continued

Metallinos-Katsaras, 2014	Longitudinal	WIC participants: prenatal and postpartum; singleton live births	MA	Association between length of exposure to WIC and breastfeeding initiation and duration	WIC breastfeeding data	Women entered into WIC in first trimester more likely to breastfeed for 3 months (15%), 6 months (25%) and 12 months (33%) than women enrolled in third trimester; Associations differed upon whether mother had previous live birth
Tenfelde, 2011*	Cross-sectional	WIC participants: initiated breastfeeding and responded to a question on breastfeeding exclusivity	IL	Examined predictors of breastfeeding exclusivity in hospital in an urban area	Clinical and administrative data	Women entering care during first trimester 2 times as likely to exclusively breastfeed

Table 7 Continued

Yun, 2010*	Cross-sectional	WIC participant data: all 118 WIC agencies	MO	Effectiveness of PC programs on breastfeeding initiation and identification of factors to facilitate breastfeeding initiation	2006 Missouri Pregnancy Nutrition Surveillance System (PNSS) data and birth certificate data	Both PC and non-PC agencies: women enrolled in WIC prior to last 3 months antepartum were more likely to initiate breastfeeding; Longer duration correlated with time of WIC enrollment
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CHAPTER THREE

VALIDATION AND ADAPTATION OF THE  
NUTRITION ENVIRONMENT MEASURE IN  
STORES (NEMS-S) TO ASSESS INFANT FEEDING  
RESOURCE SUPPORT IN THE FOOD ENVIRONMENT

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Manuscript Information Page

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Preventing Chronic Disease

Status of Manuscript:

Prepared for submission to a peer-reviewed journal

Officially submitted to a peer-review journal

Accepted by a peer-reviewed journal

Published in a peer-reviewed journal

National Center for Chronic Disease Prevention and Health Promotion

**ABSTRACT**

**Introduction** Breast milk is the gold standard in infant feeding due to its role in the prevention of illnesses and obesity. Barriers to breastfeeding are common and necessitate the need for adequate availability of infant formulas. Tools for measuring the availability and affordability of breast or formula feeding resources in the food environment are lacking. This study addresses this need through the development and validation of the Infant Feeding Resource Survey (IFRS) modeled after the Nutrition Environment Survey in Stores (NEMS-S).

**Methods** Surveys were implemented in stores (n=21) along a rural-urban continuum in Montana. Inter-rater reliability was tested in a portion of locations (n=9). Descriptive statistics were calculated for all measures. Analysis of Variance was used to understand differences ( $P < 0.05$ ) between 2013 Rural-Urban Continuum Code (RUCC) and survey scores. SPSS version 22.0 was used for all statistical analysis.

**Results** Inter-rater reliability scores were high. We found significant differences for IFRS survey scores by RUCC code for formula section score,  $p=.05$  (rounded value); equipment section score,  $p=.02$ ; and total survey score,  $p=.03$ . No significant differences existed between RUCC code and WIC-accepted term powder formula prices; however, variations among prices do warrant further investigation.

**Conclusion** This IFRS is the first tool focused on infant feeding support in the food environment. Findings validate the reliability of the IFRS and highlight a significant disparity for more rural store locations in availability of infant feeding resources in Montana. Further investigations to understand how these findings compare to other retail areas nation-wide are needed.

## **INTRODUCTION**

In food environment research, application of socioecological frameworks can assist in describing the complex, continuous interaction between individual consumers, social networks, community and organizational sectors, and policies on health outcomes.<sup>1</sup> For example, studies in a variety of geographic locations have shown the potential influence of the food environment including decreased quality of produce in rural Montana stores<sup>2</sup> and less healthy options available in urban corner stores,<sup>3</sup> that likely impact consumer purchasing decisions.<sup>4</sup> Diet-related chronic disease is a national issue,<sup>5</sup> though rural populations are at a disadvantage and warrant further investigations aiming to promote health within the food environment context.<sup>6</sup>

Availability of infant feeding resources in the retail sector is an understudied area, though often found in a grocery store setting are resources to support infant feeding via bottle or breast. Women may find support to breastfeed through health care networks, government assistance programs, and community structures (i.e. grocery stores), and the extent to how supportive these establishments are may promote or hinder breastfeeding success.<sup>7</sup> Due to breastfeeding's role in the prevention of acute and chronic diseases

including significant reduced rates of obesity, exclusive breastfeeding to six months and duration to one year is recommended;<sup>8</sup> however, infant formulas are also crucial for adequate infant nutrition if barriers to breastfeeding are too high.<sup>9</sup>

The Nutrition Environment Measure in Stores (NEMS-S) is a validated food environment tool that assesses the in-store availability of popular consumer food choices and healthier alternatives, in addition to availability, price, and quality of fresh fruits and vegetables.<sup>10</sup> This study discusses the development, validation, and testing of the Infant Feeding Resource Survey (IFRS), modeled after NEMS-S, in order to evaluate the primarily rural state of Montana<sup>11</sup> for infant feeding resource support in comparison to more urban state counties.

## **METHODS**

The IFRS was designed for application in store settings and modeled after NEMS-S<sup>10</sup> for use as an independent measure or to be included as a module to supplement other food environment measures. In total, the IFRS was pilot tested in 21 stores in counties in Montana that can be classified along a rural-urban continuum. Research was carried out during the time period of October 2014 to November 2015. Inter-rater reliability was tested for 9 store locations.

### **Development of Infant Feeding Resource Survey (IFRS)**

The IFRS were designed and amended based upon face validity and researcher pilot testing. Original survey sections were based on grocery-store setting observations

and sought to measure: (1) access to formulas containing docosahexaenoic acid (DHA) and arachidonic acid (ARA), based on evidence suggesting infant consumption of long-chain polyunsaturated fatty acids as beneficial to health;<sup>12</sup> (2) nutritional supplements representing vitamin support for a women in child-bearing lifecycle;<sup>13</sup> (3) herbal galactagogues to aid in breastfeeding physiology such as promoting the flow of mother's milk;<sup>14</sup> and (4) equipment available in support of either breast or formula feeding. In addition, measures of marketing advertisements were included in each respective measure above in order to capture any potential consumer push toward breast or formula feeding.

Face validity and pilot testing was utilized to ensure that the IFRS measured what it proposed.<sup>15</sup> The first draft of the IFRS was circulated among content experts, along with the purpose of the tool and instructions. Experts were asked to review the tools ability to measure infant feeding resources in the food environment. At the same time, study authors were pilot-testing the IFRS for usability in the field.

Based upon researcher observations through pilot testing and feedback with experts in the field to strengthen face validity, several changes to the original survey were made: (1) survey measures were changed to include 'WIC-accepted' and 'Non WIC-accepted' brand in order to accurately capture infant feeding resource availability for WIC and non-WIC participants in the same store location; (2) formula measures were tailored to be in alignment with United States Food and Drug Administration (FDA) specifications for infant formulas.<sup>16</sup> (3) infant feeding equipment measure was decreased to only include items most realistically expected from a grocery store setting in relation to support for breast or bottle feeding; (4) measures comparing quality of lower-priced equipment to

higher-priced equipment were removed, due the researcher conclusion that observational methods were not adequate for obtaining this information; (5) nutritional supplements were reduced to only pre and post-natal vitamins; (6) herbal galactagogues was removed from measure based on lack of FDA support for herbal galactagogues;<sup>17</sup>.and (7) the marketing or advertisement measure intending to capture existing media in-store supporting breast or bottle feeding ultimately was isolated to a specific category, rather than included within each survey measure in an effort to streamline the process of collecting store data and allow for overall generalizations of store aisles dedicated to infant feeding resources.

The final IFRS tool includes four sections, titled Formula, Equipment, Supplement, and Marketing (Appendix 1) with detailed instructions (Appendix 2). IFRS scoring by store has the potential to range from a total of 0-36 (Appendix 3). A total of 22 points are available for Formula scoring section, 10 points for Equipment measure, and 2 total points each for Supplement and Marketing scores. Higher numbers indicate increased availability of infant feeding options in total and by section.

### **Infant Feeding Resource Survey Pilot-Testing**

Pilot-testing of the IFRS occurred at stores in northwestern (n=9), northeastern (n=9) and southwest (n=3) areas within the state of Montana. Store sites were randomly selected on the basis of the following parameters for each geographic area of the state: (1) northwestern Montana stores were chosen based on previous research utilizing NEMS-S,<sup>2</sup> (2) northeastern Montana stores were selected based on proximity to ongoing maternal

and child health focused research by this study's lead author, and (3) southwestern store locations were chosen based on urban designation as determined by 2013 Rural-Urban Continuum Code (RUCC).<sup>18</sup> Rurality codes are categorized county measures nation-wide indicating rural or urban status by assigning a number between 1 and 10.<sup>18</sup> Higher numbers indicate increased rurality and lower numbers represent metro areas, by population counts. The split between rural-urban continuum codes by metro and non-metro areas is represented as the designation between 3 and 4, respectively.<sup>18</sup> A store was determined suitable for data collection if it was a community establishment offering more than one product type to consumers. Therefore, information was collected from grocery stores (n=16), department stores (n=3), a pharmacy (n=1), and a general store (n=1). Due to the evolution of the survey and data collection basing on a cross-sectional design, phone calls were made to collect or confirm information where needed.

### **Data Analysis**

Data were coded and entered into a scoring sheet, which was adapted from NEMSS,<sup>10</sup> to determine availability score of infant feeding resources per store site. Each of the collected store surveys (n=21) were analyzed using SPSS statistical software version 22.0. Interrater reliability was assessed by percentage agreement within each store after coding number of agreements between 9 surveys. Descriptive statistics were calculated, including frequency of store type, WIC acceptance, and RUCC codes and range, mean, and standard deviation of survey section scores (Formula, Equipment, Supplement, Marketing), formula prices, and supplement prices. Kruskal-Wallis test was utilized in order to conclude if any

significant differences ( $P < 0.05$ ) existed between RUCC codes and powdered formula prices or survey availability scores by section.

## RESULTS

Results from interrater reliability testing indicate high agreement in stores ( $n=9$ ). Results indicate complete agreement (100%) in both formula and marketing survey measures, and discrepancies in both equipment (93.2%) and nutrition supplement (92.6%) survey measures.

Stores ( $n=21$ ) were categorized as department (14.29%), grocery (76.19%), pharmacy, (4.76%) and other (4.76%). A total of 80.95% of stores accepted WIC and 19.05% of stores did not. All stores analyzed within this dataset were assigned a RUCC of 5 ( $n=3$ ), 6 ( $n=6$ ), or 7 ( $n=12$ ).

Total IFRS survey scores from the stores in this study ranged from 0-24 (potential range of 0-36). The range of scores for each section of the IFRS varies as follows: documented were: Formula, 0-13 (out of 22 points); Equipment, 0-9 (out of 10 points); supplement, 0-1 (out of 2 points); and marketing, 0-1 (out of 2 points). Means and standard deviations of each survey score in total and by section are displayed, in addition to further highlighting time to complete surveys and most common resources found within all stores including WIC versus non-WIC accepted powdered term formulas, ointments for nipple soreness, bottles, and vitamins (Table 1). No post-natal vitamins were found in-store at any of the survey locations, although prenatal vitamins were frequently documented (Table 1).

Although no statistically significant difference was associated with RUCC code and WIC-accepted term powdered formula, prices varied largely within RUCC code designations and between counties (Table 2). Formula ( $p = 0.046$ ), equipment ( $p=0.017$ ), and total IFRS score ( $p=0.027$ ) were significantly different by RUCC codes (Table 3) and indicate increased infant feeding resources available in stores located in more urban locations. Stores were limited in breast pumps available for purchase ( $n=2$ ), and WIC-accepted term powdered formulas were more available ( $n=17$ ) by count. Almost all stores offered bottles for purchase though more scarce in the food environment were nursing pads, nipple shields, and breast milk storage bags in comparison.

## **DISCUSSION**

The development and validation of the IFRS food environment tool resulted in meaningful information to evaluate the accessibility and affordability of infant feeding resources in store settings. Pilot testing of the survey confirmed by a panel of experts, and the high agreement between survey raters indicated inter-rater reliability. Potential factors that limited interrater reliability in some instances included an overwhelming variety of options in both equipment and nutrition supplement aisles in stores. This research highlights disparities in rural resources in comparison to more urban counties. Data show that consumers in more rural environments have less access to a variety of formulas, equipment, and total resources. More insight into vast price differences within the same formula brand by RUCC code designation is needed.

Breast milk is continually recognized as the optimal source of nutrition exclusively for infants up to 6 months of age with continued breastfeeding recommended for at least one year from birth as a preliminary disease prevention method.<sup>8</sup> With respect, variations of formulas that support infant growth and development<sup>19</sup> are also necessary for mothers facing overwhelming barriers to breastfeeding, for example lactation problems or societal pressures.<sup>7</sup> This survey provides evidence that a mother in a retail environment will have access to different resources by county in Montana. Findings raise the question of how this disparity in access to infant feeding resources based on rurality impacts health outcomes. Further research is needed to address how differences in access to infant feeding resources in the retail environment affect infant feeding decisions or potentially affect perspectives on infant feeding for the average consumer.

Public health nutrition research is increasingly focused on factoring ‘obesogenic environments’<sup>20</sup> as inhibiting factors to health and conducive to the promotion of chronic disease through disparities in food access.<sup>15</sup> Concepts from socioecological models<sup>1</sup> further highlight the relationship between a consumer and the food environment and additional information is needed to support the expansion of these ideas to maternal and child environmental health factors, including breastfeeding. Thus far, research has expanded the scope of food environment studies to include maternal and child health questions by documenting decreased mileage to grocery stores as a factor in increased dietary quality of pregnant women.<sup>22</sup> This research is suggestive of access to maternal and child health resources as another factor in promotion of health maternal-infant pairs. Further, given the variability in evidence of the impact of food environments in different

geographic areas on dietary choices,<sup>23</sup> additional research on infant feeding resources should take into account geographic location.

### **Limitations**

These are several limits to this current research on the introduction of a food environment tool designed to capture availability, price, and promotion of infant feeding resources in stores. First, this tool is proposed as a first step in measuring the availability of infant feeding resources in the food environment and the authors recognize further measures to evaluate store characteristics are needed. For example, documentation of lowest prices offers a logical way to compare offerings spanning various locations though may not be an accurate depiction of the most nutritious option.<sup>24</sup> Second, documentation of purely quantitative data offers no insight in store owners perspectives on stocking decisions or issues, WIC vouchers for formula, or women's perspectives on availability of resources within a community. Future research involving the IFRS should complement this tool with qualitative information through a mixed-methods approach in order to elucidate a more comprehensive understanding of potential relationships. Third, due to the evolution of the survey and data collection, phone calls were used to update survey information. Due to communication barriers it was concluded by researchers that it might be rather difficult for a women looking to compare prices or inquire about a certain product via telephone. Research is needed to investigate the ease of navigating the many options offered for infant feeding whether by telephone or in person and the potential associated impact on infant feeding decisions. Fourth, Montana is primarily a rural state

and so comparison of rural and urban counties is likely not representative of other areas. Lastly, grocery store locations might be inclined to offer less infant feeding resources than larger department stores. However, with recent expansion of multi-sectored stores facilitating one stop shopping<sup>25</sup> more information is needed to understand why stocking decisions of a smaller store might not mimic larger competitors, even if more limited in scope.

## **Conclusion**

The IFRS provides important information to evaluate the accessibility to maternal and child nutrition support in the food environment. Findings from pilot testing the IFRS in Montana revealed interesting results that point to health disparities in rural communities with regards to access to infant feeding resources. Future investigations are warranted in additional field sites in order to understand how these findings compare to other retail areas around the nation. In addition, future research utilizing the IFRS should include a larger sample size, document a wider range of store types, and carry out additional comparisons between rural and urban locations. Increased survey implementation in both rural and urban health disparate areas has the potential to document if IFRS scores mirror other food environment findings that have suggested lowered access to healthier options and increased access to unhealthy options.<sup>17</sup> Additionally, findings on the correlation of IFRS scores in comparison NEMS-S scores would be of interest to better understand food environments and the relationship of infant feeding resources to the overall availability, affordability, and quality of foods for consumers.

Findings from this survey have the potential to provide a platform for discussion in regard to optimal resources supporting maternal and child health in the food environment. The degree to which varieties of formulas, infant feeding equipment specific to breast or bottle, supplements, and potential marketing techniques should be accessible in the food environment needs exploration. Insight into these variables has the potential to extend support provided at the clinical and policy sectors to the retail environment for the promotion of optimal maternal and child health nutrition through adequate access to a variety of resources and information.

Table 1. Descriptive Statistics of Infant Feeding Resource Survey (IFRS) Across 21 Stores in Montana	
Survey Measure	Mean (SD) <sup>a</sup>
Total Formula Score	6.2 (4.0)
Total Equipment Score	2.1 (2.2)
Total Supplement Score	0.67 (0.48)
Total Marketing Score	0.05 (0.22)
Total Store Score	8.9 (6.0)
WIC-Accepted Term Powder <sup>b</sup> Ounce	12.4 (.14)
WIC-Accepted Term Powder <sup>b</sup> Price	16.6 (4.3)
Non-WIC-Accepted Term Powder <sup>c</sup> Ounce	12.6 (0.15)
Non-WIC-Accepted Term Powder <sup>c</sup> Price	17.3 (0.76)
Ointment Price	10.1 (0.62)
Bottle Price	2.2 (3.4)
Prenatal Vitamin Price	8.2 (4.2)
Post-natal Vitamin Price	0.0 (0.0)
Minutes to Complete Survey	17.5 (10.2)

<sup>a</sup>SD, Standard Deviation

<sup>b</sup>Powdered formula with 20kcal/oz., lactose, and cow's milk protein (1) designated as WIC-accepted brand (determined by store-signage).

<sup>c</sup>Powdered formula with 20kcal/oz., lactose, and cow's milk protein (1) not designated as WIC-accepted and offered in more surplus in comparison to other non-WIC accepted formula brands (determined by shelf space).

(1) O'Conner, N. Infant formula. *Am Fam Physician*. 2009;29(7):565-570.

RUCC <sup>b</sup>	N <sup>c</sup>	Mean (SD) <sup>d</sup>	Price (\$) Range <sup>e,f</sup>
5	3	16.3 (0.41)	15.8 – 16.5
6	6	18.1 (2.2)	16.5 – 21.9
7	8	17.6 (1.6)	16.5 – 19.9

<sup>a</sup>Powdered formula with 20kcal/oz., lactose, and cow's milk protein (1) designated as WIC-accepted brand by store-signage.

<sup>b</sup>RUCCs range from 1 through 10: ranges 1 through 3 are classified as metro (urban; counties in metro areas; population  $\geq 250,000$ ), and 4 through 10 as nonmetro (rural; counties not in metro areas; population  $< 250,000$ ).

<sup>c</sup>IFRS surveys collected included 21 total stores. 4 stores were excluded from this analysis because they did not offer WIC Term Powder.

<sup>d</sup>SD, Standard Deviation

<sup>e</sup>Range displayed as minimum to maximum prices

<sup>f</sup> P = .08 Kruskal–Wallis test for overall differences in IFRS section score by RUCC  
(1) O'Conner, N. Infant formula. *Am Fam Physician*. 2009;29(7):565-570.

IFRS Scoring Section	RUCC <sup>a</sup>	Mean (SD) <sup>b</sup>
Formula <sup>c</sup>	5	11.3 (1.5)
	6	6.2 (2.8)
	7	5.0 (4.1)
Equipment <sup>d</sup>	5	5.3 (3.2)
	6	1.8 (0.75)
	7	1.2 (1.8)
Supplements <sup>e</sup>	5	1 (0.0)
	6	0.5 (0.55)
	7	0.67 (0.49)
Marketing <sup>f</sup>	5	0.33 (0.58)
	6	0 (0)
	7	0 (0)
Total Score <sup>g</sup>	5	18 (5.2)
	6	8.5 (3.6)
	7	6.8 (5.3)

<sup>a</sup>RUCCs range from 1 through 10: ranges 1 through 3 are classified as metro (urban; counties in metro areas; population  $\geq 250,000$ ), and 4 through 10 as nonmetro (rural; counties not in metro areas; population  $< 250,000$ ). 3 stores were classified as RUCC 5, 6 stores were classified as RUCC 6, and 12 stores were classified as RUCC 7.

<sup>b</sup>SD, Standard Deviation

<sup>c</sup>Of 22 possible points;  $P = .05$  (rounded value) Kruskal–Wallis test for overall differences in IFRS section score by RUCC

<sup>d</sup>Of 10 possible points;  $P = .02$  (rounded value) Kruskal–Wallis test for overall differences in IFRS section score by RUCC

<sup>e</sup>Of 2 possible points;  $P = .34$  (rounded value) Kruskal–Wallis test for overall differences in IFRS section score by RUCC

<sup>f</sup>Of 2 possible points;  $P = .05$  Kruskal–Wallis test for overall differences in IFRS section score by RUCC

<sup>g</sup>Of 36 possible points;  $P = .03$  (rounded value) Kruskal–Wallis test for overall differences in IFRS section score by RUC

Appendix 1: Infant Feeding Resource Survey (IFRS) Tool

<input type="checkbox"/> Baby-specific store <input type="checkbox"/> Convenience Store <input type="checkbox"/> Department Store <input type="checkbox"/> Grocery store <input type="checkbox"/> Health Food Store <input type="checkbox"/> Pharmacy <input type="checkbox"/> Other: _____  (Check one)	Cash Registers (#): _____ Date: _____ Start time: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM End Time: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM
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RATER ID: \_\_\_\_\_ STORE CODE: \_\_\_\_\_

Store Name

Store Address

Store Phone #

Does the store accept WIC?  yes  no

NOTES:

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**MEASURE #1: FORMULA**

Are formulas available?  yes  no

WIC ACCEPTED BRAND NAME: \_\_\_\_\_

Term Formula	Powder	Liquid Concentrate	Ready-To-Feed	Iron-Fortified	Low-Iron
	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	yes  no	yes  no
Total Number of Variations: Powder _____ Liquid Concentrate _____ Ready-To-Feed _____					

NON-WIC ACCEPTED COMPARISON BRAND NAME: \_\_\_\_\_

Term Formula	Powder	Liquid Concentrate	Ready-To-Feed	Iron-Fortified	Low-Iron
	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	yes  no	yes  no
Total Number of Variations: Powder _____ Liquid Concentrate _____ Ready-To-Feed _____					

NOTES:

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**MEASURE #2: EQUIPMENT**

Is infant feeding equipment available?

yes  no

Equipment	Available	Quantity #	Price \$.\$\$
Breast Pump: Electronic	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Breast Pump: Manual	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Instant Formula-Prep Machine	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Nursing Pads	<input type="checkbox"/> yes <input type="checkbox"/> no		
Breast Milk Storage Bags	<input type="checkbox"/> yes <input type="checkbox"/> no		
Nipple Shields	<input type="checkbox"/> yes <input type="checkbox"/> no		
Ointment Specific for Nipple Soreness	<input type="checkbox"/> yes <input type="checkbox"/> no		
Bottles	<input type="checkbox"/> yes <input type="checkbox"/> no		
Other:			
Other:			

NOTES:

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**MEASURE #3: NUTRITIONAL SUPPLEMENTS**

Nutritional Supplement	Available	Quantity #	Price \$.\$\$
Prenatal Vitamin	<input type="checkbox"/> yes <input type="checkbox"/> no		
Postnatal Vitamin	<input type="checkbox"/> yes <input type="checkbox"/> no		

NOTES:

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**MEASURE #4: MARKETING**

- Store or brand advertisements specific to breastfeeding promotion:  yes  no

Describe: \_\_\_\_\_

- Store or brand advertisements specific to formula promotion:  yes  no

Describe: \_\_\_\_\_

NOTES:

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## Appendix 2: Infant Feeding Resource Survey (IFRS) Instructions

### **SURVEY DESCRIPTION**

The Infant Feeding Resource Support (IFRS) Environment Measure Survey is an adaptation to the Nutrition Environment Measure in Stores (NEM-S)<sup>8</sup> and aims to document affordable access to formula varieties, infant feeding equipment and resources, nutritional supplements to aid in breastfeeding, and infant-feeding focused marketing strategies in stores. Formula measures are based on FDA approved guidelines for infant formulas<sup>13</sup> and literature synthesizing formula options.<sup>16</sup> Other measures are based on researcher observations of available resources in-stores.

### **STORE DOCUMENTATION INSTRUCTIONS**

The first page of the IFRS environment measure survey seeks to document store specifics.

1. Check the box associated with the type of store that most accurately describes location being assessed (convenience, baby-specific, grocery, health food, pharmacy, or other). If other, document store type.
2. Count the number of cash registers total in store location, inclusive of customer service desk, pharmacy counter, and self-checkout lanes, if applicable.

3. Mark the date (MM/DD/YY) of survey implementation and the time it is begun.  
Be sure to mark appropriate AM or PM box. At the end of survey documentation, mark the time at which all survey measures are completed, including the appropriate AM or PM box.
4. The rater ID documents the person implementing the survey, in order to provide an avenue for follow up with any discrepancies. The store code provides enumeration of store location. Method of documentation is according to primary investigator's discretion.
5. Write the store name, address, city, and zip code.
6. Find out if the store accepts WIC. If yes, mark 'yes'. If no, mark, 'no'.
7. Document any notes that may be of interest specific to store location.

### **INFORMATION ABOUT MEASURE #1, FORMULA**

Page 2 of the IFRS environment measure survey compares availability, variety, and price of both WIC accepted formulas and alternate options. Based on FDA guidelines, the three types of formulas available on the market (powder, liquid concentrate, and ready-to-feed) differ by liquid needed to prepare.<sup>13</sup> Each variation is categorized as either "Iron-Fortified" or "Low-Iron." Measures in this survey will be based on this information.

**SURVEY INSTRUCTIONS FOR MEASURE #1: FORMULA**

Term Formula	Powder	Liquid Concentrate	Ready-To-Feed	Iron-Fortified	Low-Iron
	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	<input type="checkbox"/> yes <input type="checkbox"/> no oz. _____ \$.\$\$ _____	yes  no	yes  no
Total Number of Variations: Powder _____ Liquid Concentrate _____ Ready-To-Feed _____					

1. Locate aisle(s) dedicated to infant formulas.
2. If infant formulas are available in store, mark 'yes'. If there are no formulas available mark 'no' and proceed to Measure #2.
3. Scan over all offerings to determine WIC accepted brand by searching for a label designating a certain brand of formula to be accepted by WIC. This is usually indicated by a sign below or above the formula and near the price.
4. If a WIC accepted brand is available in-store write the name of the brand beside WIC ACCEPTED BRAND NAME. This brand will be the only formula brand utilized in the first table.

5. Determine the term formula of the designated WIC ACCEPTED brand and document the name in the 'Term Formula' column. Term formulas are defined as standard formulas providing nutrition that benefits most infants, are modeled after breast milk, and include 20kcal/oz., lactose, and cow's milk protein.<sup>16</sup>
6. The 'Powder,' 'Liquid Concentrate,' and 'Ready-To-Feed' columns allow you to document the size and price of the term formula by differing powder, liquid, and ready-to-feed concentrates. Choose smallest size offered for each and document availability (mark 'yes' or 'no'), size in ounces, and price per container in each column.
7. Determine if term formula of WIC accepted brand is 'Iron-Fortified' and mark by circling 'yes' or 'no'.
8. Determine if term formula of WIC accepted brand designated as 'Low-Iron' is available and mark by circling 'yes' or 'no'.
9. In 'Total Number of Variations row, determine number of available variations (not including term formula offered, of each available WIC approved brand concentrate. Variations of formulas documented in survey include preterm and enriched formulas, and specialized term formulas (soy, lactose-free, hypoallergenic, non-allergenic, and anti-reflux).<sup>16</sup> Again, choose smallest size offered for each.

10. In NON-WIC ACCEPTED COMPARISON BRAND NAME table, complete the same method described in steps 1 through 8 for a comparison brand that is not accepted by WIC. Choose the brand that is not WIC accepted and has the most shelf space.

11. Make notes as needed.

## MEASURE #2, INFANT FEEDING EQUIPMENT INSTRUCTIONS

Next, page 3 offers insight into resources offered to support either formula and/or breast feeding.

Equipment	Available	Quantity #	Price \$.\$\$
Breast Pump: Electronic	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Breast Pump: Manual	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Instant Formula-Prep Machine	<input type="checkbox"/> yes <input type="checkbox"/> no	1	
Nursing Pads	<input type="checkbox"/> yes <input type="checkbox"/> no		
Breast Milk Storage Bags	<input type="checkbox"/> yes <input type="checkbox"/> no		
Nipple Shields	<input type="checkbox"/> yes <input type="checkbox"/> no		
Ointment Specific for Nipple Soreness	<input type="checkbox"/> yes <input type="checkbox"/> no		
Bottles	<input type="checkbox"/> yes <input type="checkbox"/> no		
Other:			

Other:		
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1. Locate aisle(s) dedicated to infant feeding equipment.
2. If infant feeding equipment is available in store, mark 'yes'. If there is no infant feeding equipment available mark 'no' and proceed to Measure #3.
3. For each specified resource listed in the 'Equipment' column mark: either 'yes' or 'no' in the corresponding 'Available' column, quantity available in each package in the 'Quantity' column, and lowest priced options in the 'Price' column.
4. If there are other equipment resources available that directly support formula and/or breast feeding, document similarly in the 'other' rows.
5. Make notes as needed.

### **MEASURE #3, NUTRITIONAL SUPPLEMENTS INSTRUCTIONS**

Page 4 documents access to prenatal and postnatal vitamins.

1. Locate aisle(s) dedicated to nutritional supplements.
2. Look for prenatal and postnatal vitamins in the nutritional supplement aisle. Mark 'yes' or 'no' in the corresponding 'Available' column depending on availability. Document the number of supplements per container, respectively.

3. Make notes as needed.

#### **MEASURE #4, MARKETING INSTRUCTIONS**

This measure, also located on page 4, documents any advertisements that promote formula or breast feeding viewed in the store at the time of completing this survey. An advertisement is defined as, “something (such as a short film or a written notice) that is shown or presented to the public to help sell a product or to make an announcement.”<sup>23</sup>

1. Mark ‘yes’ or ‘no’ for each question in measure 4. If ‘yes’ document capacity of marketing technique.
2. Make notes as needed.

Appendix 3: Infant Feeding Resource Survey (IFRS) Scoring

Individual Store Availability					
Store #:					
		Available: Yes	Available: No	More than one available? Yes=1, No=0	
<b>1) Formula</b>					
	WIC Accepted Iron-Fortified	1	0		
	WIC Accepted Low-Iron	1	0		
	WIC Accepted Term-Powder	1	0		
	WIC Accepted Term-Liquid Concentrate	1	0		
	WIC Accepted Term-Ready-To-Feed	1	0		
	WIC Accepted Powder Variations	1	0	1/0	
	WIC Accepted Liquid Concentrate Variations	1	0	1/0	
	WIC Accepted Ready-To-Feed Variations	1	0	1/0	
SECTION SCORE		Total+	Total	Total+	= Score
	Non-WIC Accepted Iron-Fortified	1	0		
	Non-WIC Accepted Low-Iron	1	0		
	Non-WIC Accepted Term-Powder	1	0		
	Non-WIC Accepted Term-Liquid Concentrate	1	0		
	Non-WIC Accepted Term-Ready-To-Feed	1	0		
	Non-WIC Accepted Powder Variations	1	0	1/0	
	Non-WIC Accepted Liquid Concentrate Variations	1	0	1/0	
	Non-WIC Accepted Ready-To-Feed Variations	1	0	1/0	
SECTION SCORE		Total+	Total	Total+	= Score
<b>2) Equipment</b>					
	Breast Pump: Electronic	1	0		
	Breast Pump: Manual	1	0		
	Instant Formula-Prep Machine	1	0		
	Nursing Pads	1	0		
	Breast Milk Storage Bags	1	0		
	Nipple Shields	1	0		
	Ointment Specific for Nipple Soreness	1	0		
	Bottles	1	0		
	Other (1)	1	0		
	Other (2)	1	0		
SECTION SCORE		Total+	Total	Total+	= Score
<b>3) Nutritional Supplements</b>					
	Prenatal Vitamin	1	0		
	Postnatal Vitamin	1	0		
SECTION SCORE		Total+	Total	Total+	= Score
<b>4) Marketing</b>					
	Breastfeeding Promotion	1	0		
	Formula Promotion	1	0		
SECTION SCORE		Total+	Total+	Total+	= Score
= Score					

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## CHAPTER 4

## CONCLUSION

Adequate nutrition for women, infants, and children is important for health, wellbeing, and the prevention of disease.<sup>1</sup> The uniqueness of mother's milk in providing unparalleled benefits to an infant is widely acknowledged as the gold standard in infant feeding<sup>2,3</sup> despite infant formula manufacturer's efforts in mimicking breast milk.<sup>4</sup> The many barriers to successful breastfeeding including social and lactation concerns<sup>2</sup> solidify the need for quality formula options as appropriate alternatives.<sup>4</sup>

Nation-wide promotion to facilitate breastfeeding initiation and duration are longstanding public health efforts, with immense long-term documented health benefits associated and role of mother's milk in the prevention of obesity.<sup>2,5</sup> Access to quality resources supporting a woman's decision to breastfeed, may provide an additional barrier to those commonly stated in the literature, including poor social support, returning to work, embarrassment, and practical issues affecting lactation.<sup>2</sup> What is more, a lack of adequate formula variations in the food environment could also be classified as a barrier for non-breastfed infants requiring specific resources due to cow's milk allergies or intolerances.<sup>4</sup> Resources in the food environment such as pre or post-natal vitamins, a variety of infant formulas supporting a range of intolerances, and breastfeeding or formula feeding supplies (e.g. breast pumps, milk storage bags, bottles, and ointments) may assist mothers and infants in life-cycle nutrient needs.

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides immense support nationwide at the community setting for low-income mothers, infants, and children in navigating the food environment to decrease nutritional risk by providing supplemental foods, nutrition and breastfeeding education, and health care referrals.<sup>1</sup>

This research addressed infant feeding resources in the context of the food environment in two ways. First a review of literature assessed successes in breastfeeding promotion to WIC participants including themes such as sociodemographic characteristics, environmental and media support, government policy, intent to breastfeed, attitudes toward breastfeeding, social support, and time exposed to WIC program. Second this research developed and tested a valid and reliable measurement tool designed to address questions of access to infant feeding resources in the food environment. A general lack of information available about infant feeding methods and support in the food environment is noted. The IFRS found notable differences in WIC-accepted powder term formulas in more rural locations compared to more urban counties in Montana. There were significant differences in availability of infant feeding resources, with less variety of options found as store locations became more rural.

Several limitations exist in this thesis research. Although a systematic review of the literature was conducted, the small number of articles collected for the review of literature limits the scope of policy implications and necessitates the need for further investigations on how WIC is able to continue contributing to likelihood of breastfeeding among participants. The IFRS, to the knowledge of the authors, is the first tool of its kind

and has the potential to uncover important contextual information of the role of the environment in maternal and child health nutrition support and overall health status. However, the lack of knowledge on this topic does not warrant solid conclusions based on the quantitative data collected from Montana stores, which is limited in scope and by geographic location.

Future research should further identify WIC's role in the consumer food environment. Perhaps identification of infant feeding resource support outside of the WIC environment and store retail areas, such as hospitals and clinics is a worthy investigation. Research focused on maternal and child health indicators in the food environment and breastfeeding rates in addition to identifying beliefs, attitudes, and perceptions of community-specific resource support, representative of a mixed methods approach to research, requires consideration moving forward. The IFRS should be tested in more urban settings and in diverse communities to provide valuable information and a roadmap for solutions regarding breastfeeding disparities. Qualitative methods including interviews or focus groups should be considered from the perspective of both mother's in the food environment and store managers or owners who decide on inventory. Experiments determining if a correlation exists between placement and promotion of maternal and child health resources and marketing materials with chosen infant feeding methods is warranted. For example, perhaps an overwhelming presence of formula on store shelves in comparison to a small amount of breastfeeding supportive equipment further normalizes bottle-feeding in United States society.

In light of current trends that evidence the ongoing prevalence of obesity in the United States,<sup>6</sup> studies of the food environment that include populations such as mothers, infants, and children are more important than ever. In terms of socioecological models of health behavior theory,<sup>7</sup> it seems appropriate that community level assessments of food retail offerings be investigated further in the context of public health nutrition research. As such, a consumer with easier access to higher processed food items and reduced access to healthier options of quality or desirable fresh food options is inclined to poor dietary intake, especially in disadvantaged areas,<sup>8</sup> leading to an increased likelihood of developing diet-related chronic diseases.<sup>9</sup> Though it has been shown, that access to high quality foods is not the only variable in the probability of consumption,<sup>10,11</sup> it is an important limitation indicating further the need for site-specific data and consideration of external factors in future research. Valuable evidence in the public health setting gathered in order to provide information to families, communities, and policy makers in support of promoting improved quality of life through food and nutrition is an encouraging focus, now and in the future.

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