

Association Between WIC Enrollment and Exclusive Breastfeeding at 3 Months Postpartum Among Low-Income Mothers

John Francescon, OMS III; Zelalem T. Haile, PhD, MPH; David Kling, OMS III; and Ilana Chertok, PhD, MSN, RN, IBCLC

From the Ohio University Heritage College of Osteopathic Medicine in Athens (Student Doctor Francescon) and in Dublin (Dr Haile and Student Doctor Kling) and the School of Nursing at Ohio University in Athens (Dr Chertok).

Financial Disclosures: None reported.

Support: None reported.

Address correspondence to Zelalem T. Haile, PhD, MPH, Department of Social Medicine, Ohio University Heritage College of Osteopathic Medicine, 6775 Bobcat Way, Dublin, OH 43016-1406.

E-mail: haile@ohio.edu

Submitted July 31, 2015; final revision received April 13, 2016; accepted May 11, 2016.

Context: Existing literature suggests participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in the prenatal and postnatal periods is associated with lower rates of breastfeeding among WIC-eligible mothers. However, minimal research has been published on the association between WIC enrollment and exclusive breastfeeding.

Objective: To examine the association between WIC exposure and exclusive breastfeeding at 3 months postpartum.

Methods: We conducted a secondary data analysis using information on 784 low-income women who participated in the longitudinal population-based Infant Feeding Practices Study II between May 2005 and June 2007. The main outcome of interest was exclusive breastfeeding at 3 months postpartum. Logistic regression analysis was used to estimate OR and 95% CI for exclusive breastfeeding relative to WIC enrollment status, controlling for the confounding effects of other maternal characteristics. We further conducted a subgroup analysis among those participating in WIC prenatally to examine the association between receipt of information about infant feeding from WIC and exclusive breastfeeding at 3 months postpartum.

Results: The crude prevalence of exclusive breastfeeding at 3 months postpartum was 18.1% of women enrolled in WIC and 41.1% of WIC-eligible nonparticipants ($P < .0001$). After adjusting for sociodemographic, behavioral, and anthropometric factors, the odds of exclusive breastfeeding at 3 months were lower for women enrolled in WIC (OR, 0.57; 95% CI, 0.37-0.88) when compared with women not enrolled in WIC. In the subgroup analysis, receipt of information from WIC about feeding infants during the prenatal period was not significantly associated with exclusive breastfeeding at 3 months (OR, 0.86; 95% CI, 0.39-1.89).

Conclusion: Women who were enrolled in WIC and who received information about feeding infants were less likely to exclusively breastfeed than women not in WIC. Continued improvement and adjustment to the existing WIC breastfeeding program could potentially improve these rates. Additional studies that examine the quality of WIC services provided, especially those pertaining to breastfeeding programs, are warranted.

J Am Osteopath Assoc. 2016;116(12):770-779
doi:10.7556/jaoa.2016.152

Keywords: breastfeeding, mother, pregnancy, WIC

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a \$6.2-billion national program in the United States.¹ This program was created to ensure that participants have access to a nutritious diet, information on healthy eating practices, and health care referrals.¹ Currently, 8.3 million people, including 2 million mothers, 2 million infants, and 4.3 million children, benefit from WIC each month.¹ To be eligible, the applicant's income must fulfill the following 4 risk areas: categorical, income, residential, and nutritional.²

A primary goal of WIC is to improve infant nutrition by promoting breastfeeding.² Exclusive breastfeeding up to 6 months is recommended by many health organizations, including the American Academy of Pediatrics and the World Health Organization.³⁻⁵ The benefits of breastfeeding are well documented and include reduced rates of lower respiratory tract infections,⁶ otitis media,⁷ asthma,⁸ childhood leukemia,⁹ and infant mortality,¹⁰ as well as improved cognitive development.⁵ In addition, breastfeeding is associated with lower rates of type 2 diabetes mellitus, postpartum depression, breast cancer, and ovarian cancer in mothers.¹¹ A 2010 study estimated that if 90% of mothers exclusively breastfed for 6 months, \$13 billion per year could be saved and 911 infant deaths could be prevented.¹² Despite the numerous benefits and the emphasis that WIC places on breastfeeding, a negative association between WIC participation and breastfeeding rates exists.¹³⁻¹⁶ Among WIC participants, studies indicate that those exposed to WIC earlier and for a longer duration may be more likely to breastfeed.^{17,18} However, these studies did not measure exclusive breastfeeding and compared only prenatal and postnatal WIC participants.

We sought to build on these studies by examining the association between participation in WIC and exclusive breastfeeding up to 3 months postpartum after adjusting for potential confounders. Additionally, we examined the association between exposure to WIC information about infant breastfeeding and exclusive breastfeeding at 3 months.

Methods

Data were analyzed from the Infant Feeding Practices Study II (IFPS II),¹⁹ a longitudinal survey of pregnant women that was conducted by the Centers for Disease Control and Prevention and US Food and Drug Administration from 2005 to 2007. Samples were collected from a nationally distributed consumer-opinion mail panel of 500,000 households that consisted of 1 prenatal survey, 1 neonatal survey, and 9 postnatal surveys that were administered at 1, 2, 3, 4, 5, 6, 7, 9, 10.5, and 12 months postpartum. A detailed description of the IFPS II study design and methods is available.¹⁹ This study was deemed exempt by the institutional review board at Ohio University because it was a secondary analysis of a publicly available dataset.

The main outcome of interest was exclusive breastfeeding at 3 months postpartum. Participants were asked how many weeks they exclusively breastfed. Women who reported less than 13.04 weeks of exclusive breastfeeding were categorized as “no,” and women who reported more than 13.04 weeks of exclusive breastfeeding were categorized as “yes” in “exclusively breastfeeding at 3 months.”

On the prenatal questionnaire and month-1, month-2, and month-3 postnatal questionnaires, participants were asked, “Mother enrolled in WIC in past month?” Women who responded “no” in all 4 questionnaires were coded as “no” in the “WIC enrollment” category. Women who responded “yes” in any of the 4 questionnaires were coded as “yes” in the WIC enrollment category.

The analysis included several variables within IFPS II that were likely to be associated with breastfeeding. Covariates included mothers' age, marital status, race or ethnicity, education, income, body mass index (BMI), smoking status, gestational age, neonatal intensive care unit stay, employment status, parity, delivery type, prenatal intention to breastfeed, infant sex, and geographic region. Percentage of federal poverty level was calculated in IFPS II using household income and size. Maternal BMI was calcu-

Table 1.
Overall Baseline Characteristics of Women
by Enrollment in Special Supplemental Nutrition
Program for Women, Infants, and Children (N=784)^a

Characteristic	Enrollment		P Value ^b
	No (n=280)	Yes (n=504)	
Age, y			<.001
18-24	48 (17.1)	193 (38.3)	
25-34	195 (69.6)	266 (52.8)	
>34	37 (13.2)	45 (8.9)	
Marital Status			<.001
Never married	32 (11.4)	138 (27.4)	
Currently married	237 (84.6)	335 (66.5)	
Other	11 (3.9)	31 (6.2)	
Race or Ethnicity			.052
Non-Hispanic white	251 (89.6)	416 (82.5)	
Non-Hispanic black	9 (3.2)	35 (6.9)	
Hispanic	13 (4.6)	34 (6.7)	
Other	7 (2.5)	19 (3.8)	
Education			<.001
High school or less	54 (19.3)	186 (36.9)	
Some college	123 (43.9)	263 (52.2)	
College graduate	103 (36.8)	55 (10.9)	
Income, % of Poverty Level			<.001
<100	53 (18.9)	228 (45.2)	
100-185	227 (81.1)	276 (54.8)	
Body Mass Index^c			.166
Underweight	13 (4.6)	24 (4.8)	
Normal	123 (43.9)	194 (38.5)	
Overweight	76 (27.1)	125 (24.8)	
Obese	68 (24.3)	161 (31.9)	
Current Smoker			<.001
No	249 (88.9)	396 (78.6)	
Yes	31 (11.1)	108 (21.4)	
Gestational Age, wk			.047
<38	31 (11.1)	82 (16.3)	
≥38	249 (88.9)	422 (83.7)	

(continued)

lated using the formula BMI=703×weight, lb/(height, in)² and was categorized based on the Institute of Medicine classifications.²¹

Statistical Analysis

Frequencies and proportions were used to describe each categorical variable. The bivariate association between WIC enrollment, covariates, and exclusive breastfeeding at 3 months postpartum was examined using the χ^2 test. Multivariable logistic regression analyses were used to calculate the OR (95% CI) and determine the independent association between WIC enrollment and exclusive breastfeeding at 3 months postpartum after adjusting for potential confounders. Variables that showed a significant association ($P<.02$) in bivariate analyses were included in multivariable analyses. Pairwise interactions between WIC enrollment and each covariate were tested to address the possibility of differences in exclusive breastfeeding by category of each covariate. None of the interaction terms included were significant, and the model without the interaction terms was fitted. Regression diagnostic for potential multicollinearity revealed that variance inflation factor and tolerance values were within acceptable limits. All analyses were performed using SAS software (version 9.3; SAS Institute, Inc).

Results

Of the 4900 participants in IFPS II, 2204 reported an income less than 185% of the federal poverty income guidelines and were eligible for WIC.²⁰ Of those participants, 1271 answered all questions related to exclusive breastfeeding up to 3 months postpartum. Participants with missing values on covariates adjusted in the multivariable model (n=487) were excluded from the analysis. The final sample consisted of 784 participants. Additionally, a subgroup analysis among women who reported WIC exposure during the prenatal period (n=413) was conducted to examine the association between receipt of information about infant feeding from WIC personnel during the prenatal

period and exclusive breastfeeding at 3 months postpartum. *Table 1* presents baseline characteristics of all 784 participants by WIC enrollment. Of 784 participants, 461 (58.8%) were aged 25 to 34 years, 572 (73.0%) were married, 667 (85.1%) were non-Hispanic white, and 544 (69.4%) either had some college experience or had graduated from college. In addition, 317 (40.4%) of all participants had a normal BMI, 645 (82.3%) reported that they did not smoke at 3 months postpartum, and 464 (59.2%) had prenatal intentions to breastfeed exclusively in the first few weeks. Enrollment in WIC substantially differed by age, marital status, education, income, smoking status, parity, and prenatal intention to breastfeed exclusively in the first few weeks.

The odds of exclusive breastfeeding at 3 months were lower among WIC participants than non-WIC participants after adjusting for potential confounders (*Table 2*). Compared with women who were not exposed to WIC, women enrolled in the program had a 43% reduction in the odds of exclusive breastfeeding at month 3.

Among respondents who had available information from WIC about feeding infants and exclusive breastfeeding at 3 months postpartum, no statistically significant differences in the odds of exclusive breastfeeding existed between those who had available information and those who did not have available information (unadjusted OR, 0.86; 95% CI, 0.46-1.61) (multivariate adjusted OR, 0.86; 95% CI, 0.39-1.89). Although women who were exposed to information regarding infant feeding had a 14% reduction in the odds of exclusive breastfeeding at 3 months postpartum, these associations were not statistically significant. A statistically significant difference existed between the characteristics of the study sample and those who were eligible for WIC but had incomplete data. However, participants who responded to the question regarding WIC exposure during the prenatal period did not differ from the rest of the participants enrolled in or eligible for WIC by key demographic aspects except by education level and BMI (*Table 3*).

Table 1 (continued).
Overall Baseline Characteristics of Women by Enrollment in Special Supplemental Nutrition Program for Women, Infants, and Children (N=784)^a

Characteristic	Enrollment		P Value ^b
	No (n=280)	Yes (n=504)	
NICU, ≤3 d			.460
No	276 (98.6)	493 (97.8)	
Yes	4 (1.4)	11 (2.2)	
Mother Worked in Past Month			.517
No	193 (68.9)	336 (66.7)	
Yes	87 (31.1)	168 (33.3)	
Other Children by Mother			.049
0	42 (15.0)	112 (22.2)	
1	100 (35.7)	169 (33.5)	
≥2	138 (49.3)	223 (44.2)	
Delivery Type			.178
Vaginal	224 (80.0)	382 (75.8)	
Cesarean	56 (20.0)	122 (24.2)	
Prenatal Intention to Exclusively Breastfeed			<.001
No	90 (32.1)	230 (45.6)	
Yes	190 (67.9)	274 (54.4)	
Infant Sex			.213
Male	148 (52.9)	243 (48.2)	
Female	132 (47.1)	261 (51.8)	
Exclusively Breastfeeding at 3 mo			<.001
No	165 (58.9)	413 (81.9)	
Yes	115 (41.1)	91 (18.1)	
Region			.446
Northeast	38 (13.6)	64 (12.7)	
Midwest	83 (29.6)	156 (31.0)	
South	87 (31.1)	177 (35.1)	
West	72 (25.7)	107 (21.2)	

^a Data are given as No. (%) unless otherwise indicated.

Some percentages do not total 100 because of rounding.

^b P values calculated using the χ^2 test.

^c Body mass index was calculated and category assigned based on the Institute of Medicine classifications.

Abbreviation: NICU, neonatal intensive care unit.

Table 2.
Demographic Characteristics and Association
Between Enrollment in Special Supplemental
Nutrition Program for Women, Infants, and
Children and Exclusive Breastfeeding (N=784)

Characteristic	Unadjusted OR (95% CI)	Multivariable Adjusted OR (95% CI)
Age, y		
18-24	1	1
25-34	2.12 (1.48-3.30) ^a	0.99 (0.58-1.71)
>34	1.84 (1.00-3.37) ^b	0.98 (0.42-2.28)
Marital Status		
Never married	1	1
Currently married	5.15 (2.85-9.32) ^a	2.19 (1.08-4.46) ^b
Other	3.77 (1.52-9.36) ^c	3.24 (1.06-9.93) ^b
Race or Ethnicity		
Non-Hispanic white	1	1
Non-Hispanic black	0.21 (0.06-0.68) ^c	0.35 (0.09-1.39)
Hispanic	0.77 (0.37-1.57)	1.20 (0.49-2.95)
Other	1.04 (0.43-2.53)	0.63 (0.22-1.81)
Education		
High school or less	1	1
Some college	1.55 (1.01-2.37) ^b	1.02 (0.61-1.70)
College graduate	4.59 (2.87-7.35) ^a	1.97 (1.09-3.57) ^b
Income, % of Poverty Level		
<100	1	1
100-185	1.52 (1.07-2.16) ^b	1.07 (0.68-1.67)
Body Mass Index^d		
Underweight	0.45 (0.18-1.12)	0.38 (0.12-1.16)
Normal	1	1
Overweight	0.85 (0.58-1.26)	0.68 (0.42-1.12)
Obese	0.48 (0.32-0.73) ^a	0.45 (0.27-0.75) ^c

(continued)

Discussion

Enrollment in WIC was found to be negatively associated with exclusive breastfeeding at 3 months postpartum independent of age, marital status, race or ethnicity, education, income, BMI, smoking status, gestational age, neonatal intensive care unit stay, employment status, parity, delivery type, prenatal intention to breastfeed, and infant sex. Geographic region was not adjusted in the multivariable model because there was no difference in WIC enrollment by region. However, no statistically significant difference existed in exclusive breastfeeding at 3 months between WIC participants who received information about infant feeding from WIC and those who did not.

The negative association between WIC participation and breastfeeding has been found in previous studies.¹³⁻¹⁵ These findings suggest the need for improved access to WIC benefits, such as breast pumps and counseling. Also needed is coordination between WIC offices and local hospitals to promote breastfeeding because these services have been shown to positively influence infant feeding practices.²²⁻²⁴ Several studies have also found a positive correlation between breastfeeding and WIC peer-counseling programs²⁵⁻²⁷; 69% of local WIC agencies offer peer-counseling programs.²² By increasing access and availability to these services, WIC may be able to substantially improve feeding practices among participants.

Recent improvements have been made to WIC after data were released from IFPS II.^{28,29} One such provision discontinues regular distribution of infant formula to breastfeeding mothers during the first month postpartum to help establish long-term successful breastfeeding.²⁸ In addition, WIC mothers who choose to exclusively breastfeed now have access to a greater variety of foods, such as cheese and fish, and receive larger food packages than partially breastfeeding and nonbreastfeeding mothers.²⁹ Those who breastfeed are able to remain in the program 6 months longer than their nonbreastfeeding counterparts.²⁹ These improvements were not reflected in the current study. Future research using data collected after these changes were implemented could reveal higher breastfeeding rates in WIC participants.

The lack of a statistically significant association between access to information related to infant feeding and exclusive breastfeeding at 3 months postpartum is consistent with a study that compared WIC breastfeeding promotion classes and exclusive breastfeeding³⁰ and an older study that compared WIC participants who received prenatal nutrition classes and breastfeeding education classes with women who received prenatal nutrition classes alone.³¹ Perhaps these prenatal education programs are ineffective because many centers develop their own educational materials and more than half of them do not regularly update these materials.²² Further research could explore the distribution and content of educational breastfeeding materials to evaluate the quality and efficacy of WIC. This process could substantially contribute to the development and implementation of standardized and consistently updated breastfeeding educational materials.

Increased knowledge and access to breastfeeding information is an important but insufficient strategy for promoting exclusive breastfeeding. Additional strategies are being explored or developed by WIC and other non-profits agencies,³² such as workplace support, maternity leave policy, peer support, partner acceptance, religious community support, improved access to quality breast pumps, social marketing to determine what is important about breastfeeding for a WIC mother, and WIC financial incentives for low-income women.

The current study found statistically significant associations between exclusive breastfeeding and marital status, education, BMI, smoking status, parity, and prenatal intention to breastfeed. The positive association between parity and exclusive breastfeeding is likely because multiparous women have experience breastfeeding and feel more comfortable breastfeeding their children. This explanation is supported by a study that found previous breastfeeding experience to positively affect prenatal intention to breastfeed.³³ Additionally, women who are married or have partners are more likely to breastfeed, especially if their significant others are supportive of their decision to do so.^{34,35} The literature also supports positive associations

Table 2 (continued).
Demographic Characteristics and Association Between Enrollment in Special Supplemental Nutrition Program for Women, Infants, and Children and Exclusive Breastfeeding (N=784)

Characteristic	Unadjusted OR (95% CI)	Multivariable Adjusted OR (95% CI)
Current Smoker		
No	1	1
Yes	0.11 (0.05-.25) ^a	0.20 (0.08-0.50) ^a
Other Children by Mother		
0	1	1
1	2.83 (1.60-5.03) ^a	3.54 (1.82-6.92) ^a
≥2	3.39 (1.95-5.90) ^a	3.65 (1.82-7.32) ^a
Delivery Type		
Vaginal	1	1
Cesarean	0.50 (0.32-0.77) ^c	0.70 (0.40-1.20)
Prenatal Intention to Exclusively Breastfeed		
No	1	1
Yes	20.37 (10.57-39.28) ^a	18.85 (9.50-37.42) ^a
Participation in Program		
No	1	1
Yes	0.35 (0.25-0.49) ^a	0.57 (0.37-0.88) ^b

^a $P < .001$.

^b $P < .05$.

^c $P < .01$.

^d Body mass index calculated and category assigned based on the Institute of Medicine classifications.

between college education,^{15,34} prenatal intention to breastfeed,^{34,35} The negative association between smoking and exclusive breastfeeding has been previously found; studies suggest that women who smoke daily are up to 4 times more likely to discontinue breastfeeding earlier than nonsmokers.³⁵ Finally, the influence of maternal obesity observed in the current study has also been identified as a factor negatively associated with exclusive breastfeeding. The likely mechanism is that a combination of delayed lactation, hormonal imbalances, and negative perceptions of personal abilities leads to lower breastfeeding rates among mothers who are obese.³⁶

Table 3.
Comparison of Women in the Special Supplemental Nutrition Program
for Women, Infants, and Children in the Final Analytic Sample With Woman
Excluded Because of Missing Data by Key Demographic Characteristics^a

Characteristic	Missing Data on Covariates			Missing Data on Receipt of Breastfeeding Information		
	No (n=784)	Yes ^b	P Value	No (n=413)	Yes ^b	P Value
Age, y			<.001			.218
18-24	241 (30.7)	659 (46.6)		155 (37.5)	745 (41.7)	
25-34	461 (58.8)	631 (44.6)		221 (53.5)	871 (48.8)	
>34	82 (10.5)	124 (8.8)		37 (9.0)	169 (9.5)	
Marital Status			<.001			.100
Never married	170 (21.7)	368 (33.4)		112 (27.1)	426 (28.9)	
Currently married	572 (73.0)	615 (55.8)		275 (66.6)	912 (61.9)	
Other	42 (5.4)	119 (10.8)		26 (6.3)	135 (9.2)	
Race or Ethnicity			<.001			.294
Non-Hispanic white	667 (85.1)	995 (73.7)		336 (81.4)	1326 (77.0)	
Non-Hispanic black	44 (5.6)	138 (10.2)		31 (7.5)	151 (8.8)	
Hispanic	47 (6.0)	139 (10.3)		29 (7.0)	157 (9.1)	
Other	26 (3.3)	78 (5.8)		17 (4.1)	87 (5.1)	
Education			<.001			.002
High school or less	240 (30.6)	490 (45.1)		149 (36.1)	581 (39.9)	
Some college	386 (49.2)	486 (44.8)		221 (53.5)	651 (44.7)	
College graduate	158 (20.2)	110 (10.1)		43 (10.4)	225 (15.4)	
Income, % of Poverty Level			<.001			.023
<100	281 (35.8)	645 (45.4)		194 (47.0)	732 (40.9)	
100-185	503 (64.2)	775 (54.6)		219 (53.0)	1059 (59.1)	
Current Smoker			.007			.157
No	645 (82.3)	114 (73.1)		325 (78.7)	434 (82.4)	
Yes	139 (17.7)	42 (26.9)		88 (21.3)	93 (17.6)	

(continued)

Findings of the present study, which yielded similar results to previous publications,¹³⁻¹⁶ add to the validity of existing literature on the topic. Data from IFPS II represent a large sample size of varying sociodemographic backgrounds across the United States over time. We were able to reduce bias in the current study by excluding all individuals who did not provide information on income level or who reported an income higher than that required

for WIC eligibility. We added strength to our study by adjusting for potential confounding variables known to influence feeding practices.

Limitations

The current study has several limitations. First, the cross-sectional study design prevents the inference of causal relationships, and the temporal relationship between

Table 3 (continued).
Comparison of Women in the Special Supplemental Nutrition Program
for Women, Infants, and Children in the Final Analytic Sample With Woman
Excluded Because of Missing Data by Key Demographic Characteristics^a

Characteristic	Missing Data on Covariates			Missing Data on Receipt of Breastfeeding Information		
	No (n=784)	Yes ^b	P Value	No (n=413)	Yes ^b	P Value
Mother Worked in Past Month			.923			.670
No	529 (67.5)	114 (67.9)		282 (68.3)	361 (67.0)	
Yes	255 (32.5)	54 (32.1)		131 (31.7)	178 (33.0)	
Other Children by Mother			<.001			.003
0	154 (19.6)	403 (30.5)		86 (20.8)	471 (27.8)	
1	269 (34.4)	453 (34.3)		139 (33.7)	583 (34.5)	
>2	361 (46.0)	465 (35.2)		188 (45.5)	638 (37.7)	
Delivery Type			.004			.675
Vaginal	606 (77.3)	339 (70.2)		305 (73.8)	640 (74.9)	
Cesarean	178 (22.7)	144 (29.8)		108 (26.2)	214 (25.1)	
Prenatal Intention to Exclusively Breastfeed			<.001			.714
No	320 (40.8)	674 (51.6)		193 (46.7)	801 (47.7)	
Yes	464 (59.2)	633 (48.4)		220 (53.3)	877 (52.3)	
Infant Sex			.964			.222
Female	393 (50.1)	243 (50)		217 (52.5)	419 (48.9)	
Male	391 (49.9)	243 (50)		196 (47.5)	438 (51.1)	
Exclusively Breastfeeding at 3 mo			<.001			.239
No	590 (75.3)	426 (87.5)		338 (81.8)	678 (79.0)	
Yes	194 (24.7)	61 (12.5)		75 (18.2)	180 (21.0)	
WIC Participation			.998			<.001
No	280 (35.7)	506 (35.7)		0	786 (44.0)	
Yes	504 (64.2)	911 (64.3)		413 (100)	1002 (56.0)	

^a Data are given as No. (%) unless otherwise indicated. Some percentages do not total 100 because of rounding.

^b The number of respondents in the "yes" columns vary because of missing data.

WIC enrollment and exclusive breastfeeding could not be delineated. Additionally, WIC eligibility was solely based on income level because we did not have data on whether participants met WIC nutrition risk or residential eligibility requirements.²⁰

The results were susceptible to volunteer bias, selection bias, and recall bias because IFPS II data are based on women who agreed to participate in the survey.

Although the current literature maintains that breastfeeding rates are lower among WIC participants than WIC-eligible nonparticipants,³⁷ one study found notable sociodemographic differences between the 2 groups that are known to influence exclusive breastfeeding,³⁸ thereby indicating that exclusive breastfeeding duration has multifactorial associations. Another study found that more than a third of WIC-eligible nonparticipants denied a need

for the program, suggesting an economic advantage over WIC participants.³⁹ Women who had missing or incomplete data differed from women who had complete data on key demographic aspects except infant sex, WIC participation, and mother's employment status in the past month (Table 3). As such, results of the current study may not be generalizable to everyone enrolled in or eligible for the program. Participants in WIC differed from eligible nonparticipants in age, marital status, education, income, smoking status, and prenatal intention to breastfeed. As these factors are known to influence feeding practices, characteristic differences between WIC participants and WIC-eligible nonparticipants could lead to an overestimation of the effects of WIC participation on exclusive breastfeeding.

Conclusion

The current study shows that WIC participation by itself is negatively associated with exclusive breastfeeding at 3 months postpartum. Follow-up studies should examine the quality of WIC services provided, especially breastfeeding-related educational programs, as quality improvement adjustments and assessment have the potential to improve breastfeeding outcomes in WIC participants. Local agencies, hospitals, and WIC providers should work together to increase availability and access to counseling programs, and WIC providers should revamp educational programs to improve breastfeeding outcomes. Primary care physicians, especially those caring for low-income mothers, must make every effort to educate patients and encourage breastfeeding to safeguard the health of both mother and child. Additionally, for mothers who have difficulty breastfeeding because of anatomical dysfunction in infants, osteopathic physicians should consider evidence-based osteopathic manipulative treatment, such as osteopathic cranial manipulative medicine, which is known to improve breastfeeding skills.⁴⁰

Acknowledgments

We are grateful to the Centers for Disease Control and Prevention for providing us access to data from the Infant Feeding Practices Study II.

Author Contributions

All authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; all authors drafted the article or revised it critically for important intellectual content; all authors gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

- Oliveira V. *The Food Assistance Landscape: FY 2014 Annual Report*. United States Department of Agriculture website. http://www.ers.usda.gov/webdocs/publications/eib137/52405_eib137.pdf. Published March 2015. Accessed October 31, 2016.
- About WIC-WIC's mission. United States Department of Agriculture Food and Nutrition Service website. <http://www.fns.usda.gov/wic/about-wic-wics-mission>. Updated February 6, 2015. Accessed October 31, 2016.
- Kramer MS, Kakuma R. The optimal duration of exclusive breastfeeding: a systematic review. *Adv Exp Med Biol*. 2004;554:63-77.
- The Optimal Duration of Exclusive Breastfeeding: Report of an Expert Consultation*. Geneva, Switzerland: World Health Organization Department of Nutrition for Health and Development and Department of Child and Adolescent Health and Development; 2001. http://www.who.int/nutrition/publications/optimal_duration_of_exc_bfeeding_report_eng.pdf. Accessed October 31, 2016.
- Section on Breastfeeding. Breastfeeding and the use of human milk [published online February 27, 2012]. *Pediatrics*. 2012;129(3):e827-e841. doi:10.1542/peds.2011-3552
- Banerji A, Greenberg D, White LF, et al. Risk factors and viruses associated with hospitalization due to lower respiratory tract infections in Canadian Inuit children: a case-control study. *Pediatr Infect Dis J*. 2009;28(8):697-701. doi:10.1097/INF.0b013e31819f1f89
- Uhari M, Mäntysaari K, Niemelä M. A meta-analytic review of the risk factors for acute otitis media. *Clin Infect Dis*. 1996;22(6):1079-1083. doi:10.1093/clinids/22.6.1079
- Scholtens S, Wijga AH, Brunekreef B, et al. Breast feeding, parental allergy and asthma in children followed for 8 years: the PIAMA birth cohort study. *Thorax*. 2009;64(7):604-609. doi:10.1136/thx.2007.094938
- Flores-Lujano J, Perez-Saldivar ML, Fuentes-Pananá EM, et al. Breastfeeding and early infection in the aetiology of childhood leukaemia in Down syndrome. *Br J Cancer*. 2009;101(5):860-864. doi:10.1038/sj.bjc.6605244
- Gertosio C, Meazza C, Pagani S, Bozzola M. Breastfeeding and its gamut of benefits [published online May 29, 2015]. *Minerva Pediatr*. 2016;68(3):201-212.
- Ip S, Chung M, Raman G, et al. Breastfeeding and maternal and infant health outcomes in developed countries. *Evid Rep Technol Assess (Full Rep)*. 2007;(153):1-186.
- Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis [published online

- April 5, 2010]. *Pediatrics*. 2010;125(5):e1048-e1056. doi:10.1542/peds.2009-1616
13. Grummer-Strawn LM, Scanlon KS, Fein SB. Infant feeding and feeding transitions during the first year of life. *Pediatrics*. 2008;122(suppl 2):S36-S42. doi:10.1542/peds.2008-1315d
 14. Ziol-Guest KM, Hernandez DC. First- and second-trimester WIC participation is associated with lower rates of breastfeeding and early introduction of cow's milk during infancy. *J Am Diet Assoc*. 2010;110(5):702-709. doi:10.1016/j.jada.2010.02.013
 15. Ryan AS, Zhou W, Gaston MH. Regional and sociodemographic variation of breastfeeding in the United States, 2002. *Clin Pediatr (Phila)*. 2004;43(9):815-824. doi:10.1177/000992280404300905
 16. Ryan AS, Zhou W. Lower breastfeeding rates persist among the Special Supplemental Nutrition Program for Women, Infants, and Children participants, 1978-2003. *Pediatrics*. 2006;117(4):1136-1146. doi:10.1542/peds.2005-1555
 17. Joyce T, Racine A, Yunzal-Butler C. Reassessing the WIC effect: evidence from the Pregnancy Nutrition Surveillance System. *J Policy Anal Manage*. 2008;27(2):277-303. doi:10.1002/pam.20325
 18. Metallinos-Katsaras E, Brown L, Colchamiro R. Maternal WIC participation improves breastfeeding rates: a statewide analysis of WIC participants. *Matern Child Health J*. 2015;19(1):136-143. doi:10.1007/s10995-014-1504-1
 19. Infant feeding practices study II and its year six follow-up. Centers for Disease Control and Prevention website. <http://www.cdc.gov/breastfeeding/data/ifps/index.htm>. Accessed October 31, 2016.
 20. WIC eligibility requirements. United States Department of Agriculture Food and Nutrition Service website. <http://www.fns.usda.gov/wic/wic-eligibility-requirements>. Accessed October 31, 2016.
 21. Institute of Medicine. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: National Academy of Sciences; 2009. <http://iom.nationalacademies.org/l~/media/Files/Report%20Files/2009/Weight-Gain-During-Pregnancy-Reexamining-the-Guidelines/Report%20Brief%20-%20Weight%20Gain%20During%20Pregnancy.pdf>. Accessed October 31, 2016.
 22. Forrestal S, Briefel R, Mabli J. *WIC Breastfeeding Policy Inventory*. Princeton, NJ: Mathematica Policy Research; 2015.
 23. Landau TV. Breastfeeding case study: New York City—the WIC Program's vital role in breastfeeding success. *Breastfeed Med*. 2011;6:277-279. doi:10.1089/bfm.2011.0067
 24. Hedberg IC. Barriers to breastfeeding in the WIC population. *MCN Am J Matern Child Nurs*. 2013;38(4):244-249. doi:10.1097/NMC.0b013e3182836ca2
 25. Gross SM, Resnik AK, Cross-Barnet C, Nanda JP, Augustyn M, Paige DM. The differential impact of WIC peer counseling programs on breastfeeding initiation across the state of Maryland [published online August 3, 2009]. *J Hum Lact*. 2009;25(4):435-443. doi:10.1177/0890334409342070
 26. Reeder JA, Joyce T, Sibley K, Arnold D, Altindag O. Telephone peer counseling of breastfeeding among WIC participants: a randomized controlled trial [published online August 4, 2014]. *Pediatrics*. 2014;134(3):e700-e709. doi:10.1542/peds.2013-4146
 27. Bronner Y, Barber T, Miele L. Breastfeeding peer counseling: rationale for the National WIC Survey. *J Hum Lact*. 2001;17(2):135-139. doi:10.1177/089033440101700208
 28. Final rule: revisions in the WIC food packages. United States Department of Agriculture Food and Nutrition Service website. <http://www.fns.usda.gov/wic/final-rule-revisions-wic-food-packages>. Updated August 3, 2016. Accessed November 7, 2016.
 29. WIC food packages - maximum monthly allowances. United States Department of Agriculture Food and Nutrition Service website. <http://www.fns.usda.gov/wic/wic-food-packages-maximum-monthly-allowances>. Published December 12, 2013. Updated March 1, 2016. Accessed August 23, 2016.
 30. Petrova A, Ayers C, Stechna S, Gerling JA, Mehta R. Effectiveness of exclusive breastfeeding promotion in low-income mothers: a randomized controlled study. *Breastfeed Med*. 2009;4(2):63-69. doi:10.1089/bfm.2008.0126
 31. Reifsnider E, Eckhardt D. Prenatal breastfeeding education: its effect on breastfeeding among WIC participants. *J Hum Lact*. 1997;13(2):121-125.
 32. Centers for Disease Control and Prevention. *Strategies to Prevent Obesity and Other Chronic Diseases: The CDC Guide to Strategies to Support Breastfeeding Mothers and Babies*. Atlanta, GA: US Dept of Health and Human Services; 2013. <https://www.cdc.gov/breastfeeding/pdf/BF-Guide-508.PDF>. Accessed November 9, 2016.
 33. Kloeblen-Tarver AS, Thompson NJ, Miner KR. Intent to breast-feed: the impact of attitudes, norms, parity, and experience. *Am J Health Behav*. 2002;26(3):182-187.
 34. Meedya S, Fahy K, Kable A. Factors that positively influence breastfeeding duration to 6 months: a literature review [published online March 17, 2010]. *Women Birth*. 2010;23(4):135-145. doi:10.1016/j.wombi.2010.02.002
 35. Dennis CL. Breastfeeding initiation and duration: a 1990-2000 literature review. *J Obstet Gynecol Neonatal Nurs*. 2002;31(1):12-32. doi:10.1111/j.1552-6909.2002.tb00019.x
 36. Bever Babendure J, Reifsnider E, Mendias E, Moramarco MW, Davila YR. Reduced breastfeeding rates among obese mothers: a review of contributing factors, clinical considerations and future directions. *Int Breastfeed J*. 2015;10:21. doi:10.1186/s13006-015-0046-5
 37. Breastfeeding among U.S. children born 2002-2013, CDC National Immunization Survey. Centers for Disease Control and Prevention website. http://www.cdc.gov/breastfeeding/data/NIS_data/index.htm. Updated August 1, 2016. Accessed August 23, 2016.
 38. Jacknowitz A, Novillo D, Tiehen L. Special Supplemental Nutrition Program for Women, Infants, and Children and infant feeding practices. *Pediatrics*. 2007;119(2):281-289. doi:10.1542/peds.2006-1486
 39. Black MM, Cutts DB, Frank DA, et al; Children's Sentinel Nutritional Assessment Program Study Group. Special Supplemental Nutrition Program for Women, Infants, and Children participation and infants' growth and health: a multisite surveillance study. *Pediatrics*. 2004;114(1):169-176. doi:10.1542/peds.114.1.169
 40. Wescott N. The use of cranial osteopathy in the treatment of infants with breast feeding problems or sucking dysfunction. *Aust J Holist Nurs*. 2004;11(1):25-32.

© 2016 American Osteopathic Association