



Breastfeeding Outcomes Associated With the Special Supplemental Nutrition Program for Women, Infants, and Children: A Systematic Review

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ABSTRACT

BACKGROUND: The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) promotes and supports breastfeeding for low-income women and children. A prior review reported negative associations of WIC with breastfeeding outcomes. WIC food package changes in 2009 increased breastfeeding support.

OBJECTIVE: The objectives of this systematic review were to 1) evaluate evidence on WIC participation and breastfeeding outcomes and 2) evaluate breastfeeding outcomes of WIC participants before versus after the 2009 food package.

DATA SOURCES: PubMed, Embase®, CINAHL, ERIC, SCOPUS, PsycINFO, and the Cochrane Central Register of Controlled Trials for papers published January 2009 to April 2022.

ELIGIBILITY CRITERIA: Included studies compared breastfeeding outcomes (initiation, duration, exclusivity, early introduction of solid foods) of WIC participants with WIC-eligible nonparticipants, or among WIC participants before versus after the 2009 package change.

STUDY APPRAISAL METHODS: Two independent reviewers evaluated each study and assessed risk of bias using EHPHP assessment.

RESULTS: From 13 observational studies we found: 1) moderate strength of evidence (SOE) of no difference in initiation associated with WIC participation; 2) insufficient evidence regarding WIC participation and breastfeeding duration or exclusivity; 3) low SOE that the 2009 food package change is associated with greater breastfeeding exclusivity; 4) low SOE that WIC breastfeeding support services are positively associated with initiation and duration.

LIMITATIONS: Only observational studies, with substantial risk of bias and heterogeneity in outcomes and exposures.

CONCLUSIONS AND IMPLICATIONS OF KEY FINDINGS: WIC participation is not associated with a difference in breastfeeding initiation compared to WIC-eligible nonparticipants, but the 2009 food package change may have improved breastfeeding exclusivity among WIC participants and receipt of breastfeeding support services may have improved breastfeeding initiation and duration.

KEYWORDS: breastfeeding; infant feeding; special supplemental nutrition program for Women Infants and Children (WIC)

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WHAT THIS SYSTEMATIC REVIEW ADDS

- WIC participation is associated with no difference in breastfeeding initiation, and evidence is insufficient regarding duration or exclusivity.
- The 2009 WIC package change is positively associated with breastfeeding exclusivity.
- WIC breastfeeding support services are positively associated with initiation and duration.

HOW TO USE THIS SYSTEMATIC REVIEW

- To estimate the impact of WIC on breastfeeding behavior and guide development of breastfeeding policy for WIC programs
- To identify research priorities and strong research designs for the evaluation of breastfeeding outcomes and WIC participants.

A REVIEW OF STUDIES from 2002 to 2010 published By US Department of Agriculture (USDA) in 2012, reported that WIC participants were less likely to breastfeed, and they breastfed for shorter durations than WIC-eligible nonparticipants.¹ A limitation of observational studies on WIC is the potential for selection bias because participation in WIC is a decision based on many observed and unobserved factors. Various analytic techniques can be used to address selection bias and studies using these methods less consistently reported negative associations between WIC participation and breastfeeding.^{2–4}

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to improve the health of low-income women and children by providing nutritious supplemental foods, education, breastfeeding support, and referrals to health and social service programs for pregnant, postpartum, and breastfeeding women and for children up to age five in the United States (US).⁵ One goal of the WIC program is to promote breastfeeding.⁶ Since 2004, WIC has increased funding for breastfeeding support services including breastfeeding peer counselors, and enacted supportive policies such as extended certification periods for breastfeeding women. In 2009, WIC food packages were revised, and they now provide more benefits to breastfeeding mothers and infants.^{7,8}

Accordingly we have conducted a systematic review of studies published since 2009 using the PICOTS framework (populations, interventions, comparators, outcomes, timing, and settings; [Table 1](#)) to address the following questions: Among individuals eligible to participate in WIC, how is WIC participation associated with breastfeeding outcomes (breastfeeding initiation, duration and exclusivity)? Does the association with WIC vary by participant characteristics (eg, maternal or child race and ethnicity, geographic location) or duration of enrollment in the WIC program? Did the 2009 WIC food package change alter breastfeeding outcomes among WIC participants?

METHODS

This review is part of a larger evidence report commissioned by the USDA to examine the most recent evidence on the association of WIC participation with maternal, infant, and childhood outcomes focusing mainly on studies published since January 2009. With input from a technical expert panel and representatives from the Agency for Healthcare Research and Quality (AHRQ), and the USDA Food and Nutrition Service (FNS), we developed a protocol, registered on PROSPERO (CRD42020222452). We followed the AHRQ Methods Guide for Effectiveness

Table 1. List of Inclusion/Exclusion Criteria Using the PICOTS Framework (Populations, Interventions, Comparisons, Outcomes, Timing, and Setting)

	Inclusion	Exclusion
Population	Women who participated in WIC during pregnancy and their infants up to age 28 days Infants/Children who participated in WIC (age greater than 28 days and less than 5 years)	Animal studies
Interventions	Participation in WIC with service provisions from 2009 onwards (year and location), defined at a minimum as enrolling in WIC for one month or more.	No intervention of interest
Comparisons	Women who were eligible for WIC, but did not participate during pregnancy, and their infants at birth up to 28 days; duration of WIC participation. Infants/children who were eligible for WIC, but did not participate at the age studied (age greater than 28 days and less than 5 years); duration of WIC participation	Studies that do not report a comparison group
Outcomes	Breastfeeding (intention, initiation, and duration of any breastfeeding) Infants: maternal intention to breastfeed; Ever breastfed or any breastfeeding; Exclusive breastfeeding (initiation and duration); Duration of any breastfeeding; introduction of formula (timing); timing of solids introduction (< 4 months, < 6 months); cereal in the bottle; timing of cow's milk introduction (< 12 months)	No outcome of interest
Type of Study	Experimental intervention trials (randomized and non-randomized), observational studies, quasi-experimental studies, before-after studies, and interrupted time series	<ul style="list-style-type: none"> • Studies published before 2009 or that only use data collected before 2009 • Publications with no original data (e.g., editorials, letters, comments, reviews) • Full text not presented or unavailable, abstracts only • WIC program materials, brochures, and training manuals • Descriptions of WIC participation levels and participant characteristics without outcome data • Descriptive research on WIC implementation, operations, and program costs

and Comparative Effectiveness Reviews⁹ and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guideline.¹⁰

ELIGIBILITY CRITERIA AND STUDY SELECTION

For the breastfeeding outcomes, eligible studies included women and infants participating in WIC since 2009, with a concurrent comparison group of women and infants eligible but not participating in WIC, or a comparison group of women and infants participating in WIC prior to 2009. There were no restrictions for study design. Qualitative studies published since 2009 were also eligible if they focused on WIC services and breastfeeding outcomes. The *a priori* outcomes of interest, based on maternal reporting included breastfeeding initiation defined as baby ever fed breast milk, breastfeeding duration, defined as baby fed any breast milk at 3 or 6 months, breastfeeding exclusivity, defined as baby only given breast milk, and complementary feeding (introduction of solid foods). WIC follows the American Academy of Pediatrics in guidance to parents/caregivers on infant food packages with infant solid foods starting at 6 months.¹¹ Introduction of solid foods before four months of age has been associated with shorter breastfeeding duration,¹² and therefore, we included studies of the association of WIC participation with the early introduction of solid foods. Team members independently screened abstracts and full-text articles for eligibility with differences resolved through consensus (discussion and inclusion of a third team member).

DATA SOURCES AND SEARCHES

We searched PubMed, Embase, CINAHL, ERIC, SCOPUS, PsycINFO, and the Cochrane Central Register of Controlled Trials from January 2009 to September 2021, and then conducted a second search to identify studies published through April 2022. The search used the following medical subject heading terms (WIC program OR WIC OR “Women, Infants, and Children” OR “WIC program” OR “WIC programs” OR “Special Supplemental Nutrition Program.” (See [Supplement A](#) for full search strategy by database). We hand-searched the references of relevant systematic reviews and searched the grey literature for relevant unpublished studies.

DATA EXTRACTION AND QUALITY ASSESSMENT

Paired investigators sequentially extracted data on study characteristics, WIC program characteristics (eg, national, state, local agencies), participant characteristics including maternal education, parity and race/ethnicity, WIC eligibility and duration of participation, breastfeeding outcome results, and extent of covariate adjustment (Study-specific covariates are included in [Supplement B](#)). One reviewer completed abstraction for included studies, and a second reviewer checked for completeness and accuracy.

RISK OF BIAS AND STRENGTH OF EVIDENCE ASSESSMENT

We used the Effective Public Health Practice Project tool to assess the risk of bias.¹³ We created a summary assessment of the overall quality of each study (strong, moderate, or weak) based on the risk of bias according to the domains included in the tool (ie, study selection bias, appropriate adjustment for confounders (a measure taking into account both the existence of significant differences in characteristics between intervention groups and, if so, percent relevant confounders that were controlled for), data collection methods, withdrawals, and drop-outs; [Table 2](#) and [Supplement C](#)). We graded the strength of evidence from quantitative studies by using the grading scheme recommended by the AHRQ Methods Guide for Conducting Comparative Effectiveness Reviews.⁹ In assigning evidence grades, we considered four recommended domains, including study limitations across all studies (high, medium or low, corresponding to the EPHPP risk of bias/study quality assessment rating of weak, moderate, and strong, respectively). We did not formally assess the domain of reporting bias because of the lack of reliable methods for identifying reporting bias in observational studies. We considered the strength of evidence (SOE) for each outcome from studies of WIC participants compared with WIC-eligible nonparticipants, separately from studies of WIC participants only, which were largely natural experiment designs that assessed the association of the 2009 WIC food package change with breastfeeding outcomes.

For qualitative studies, reviewers assessed study quality using Joanna Briggs Institute Checklist.¹⁴

DATA SYNTHESIS AND ANALYSIS

We conducted descriptive synthesis for each breastfeeding outcome. Evidence Tables show detailed study characteristics and results, and a Summary Table highlights the main findings. We narratively summarized results from qualitative studies that described WIC participant or staff perceptions or experiences that were linked to specific participant characteristics or an outcome. Missing data were not imputed and were recorded as “not reported.” To determine whether meta-analyses were appropriate, we considered whether studies were adequately homogenous with respect to key variables (population characteristics, intervention, comparison, outcome measures, study design, duration, data source). Meta-analyses were deemed not appropriate for all comparisons and outcomes owing to the small number of studies reporting for each comparison and outcome category and heterogeneity in the studies’ measures of the exposure and outcomes. Studies generally did not report enough data to support calculation of standardized mean differences or data conversion.

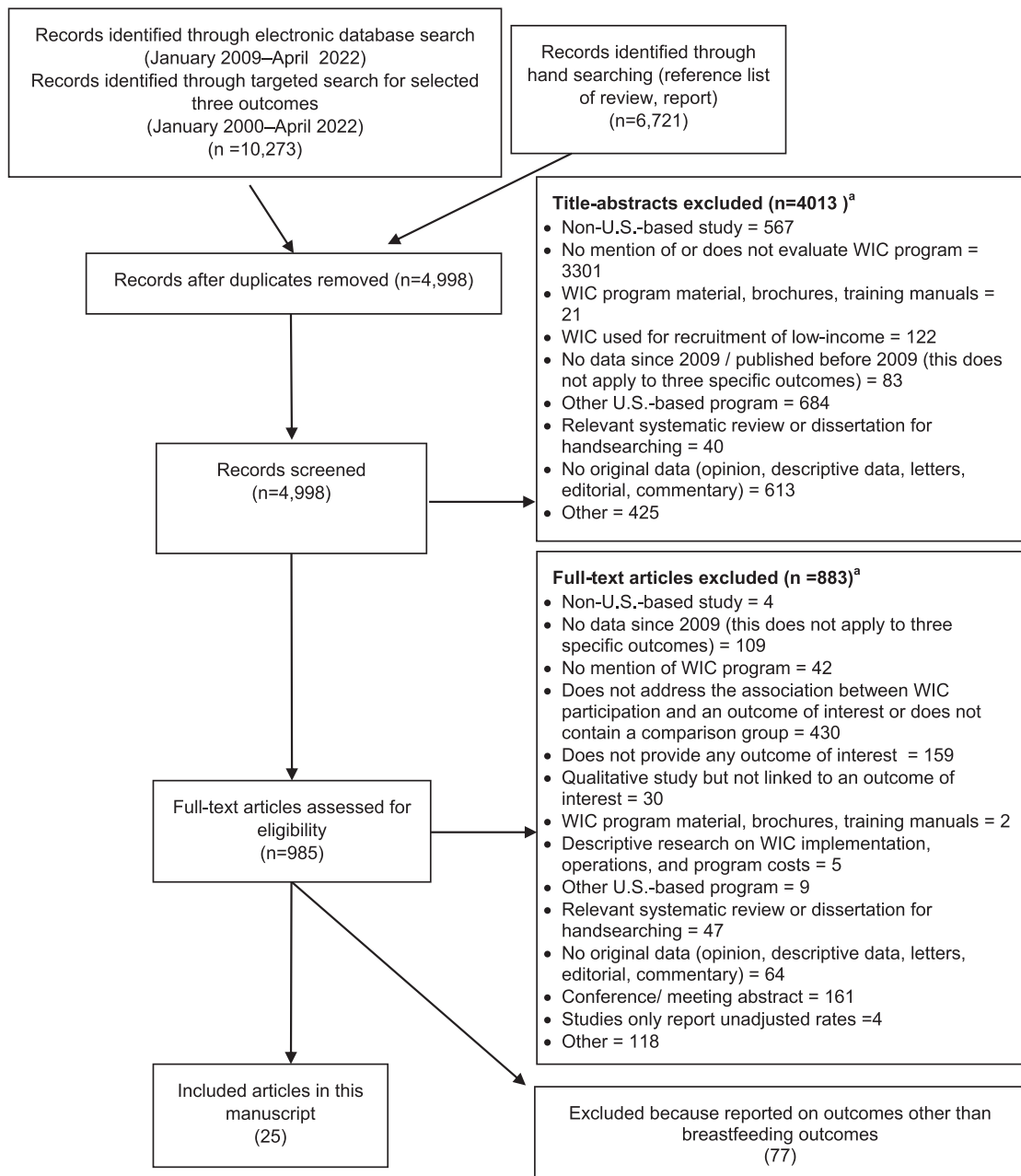
We assigned the final SOE grade by evaluating and qualitatively considering the assessments of the domains and the overall assessment of the results across studies. We classified the SOE into four categories: high, moderate, low, and insufficient. The interpretation of moderate

SOE is that the findings are likely to be stable, but some doubt remains, while low SOE indicates additional evidence is needed before concluding that the findings are stable.¹³ Insufficient SOE indicates that we cannot reach a conclusion due to no evidence, inability to estimate an effect or no confidence in the estimate effect for this outcome. (All SOE grades are defined in Supplement D and the full report [AHRQ]).¹⁵ Results for all studies are presented in the tables, with select studies highlighted in the text to provide context particularly for outcomes with low and moderate SOE rating.

RESULTS

STUDY SELECTION RESULTS

A summary of the evidence search and study selection results is presented in Figure. The literature search and hand searching process identified 4998 citations after removing duplicates. The title-abstract screening process excluded 4013 citations that did not meet one or more of the eligibility criteria. At the article-screening phase, we excluded an additional 883 articles that did not meet one or more of the eligibility criteria. Seventy-seven articles



^aTotal exceeds the number of citations in the exclusion box, because citations could be excluded for more than one reason (i.e., reviewers did not need to agree on reason for exclusion.)

Figure. PRISMA Flow Diagram: Identification of published studies for inclusion.

were excluded because they reported on outcomes other than breastfeeding outcomes. A total of 25 articles were included in the manuscript. Of these, 7 observational studies^{16–22} compared outcomes of WIC participants and eligible nonparticipants, one of these studies¹⁸ also reported on breastfeeding outcomes associated with the 2009 package change among WIC participants as did 4 other studies,^{23–26} 2 studies reported on receipt of breastfeeding support services,^{27,28} and 10 qualitative studies reported on breastfeeding perceptions among WIC participants.^{29–38}

BREASTFEEDING OUTCOMES ASSOCIATED WITH WIC PARTICIPATION

Studies comparing breastfeeding initiation, duration, and exclusivity by WIC participation provide direct evidence of the association between WIC participation and breastfeeding outcomes. Details about those studies are presented in [Tables 2 and 3](#).

BREASTFEEDING INITIATION

Six studies compared breastfeeding initiation between WIC participants and WIC-eligible nonparticipants using national or multistate surveys and birth certificate data.^{16–21} Breastfeeding initiation was most often assessed through maternal responses to queries about whether the infant was ever breastfed or ever received breast milk and one study assessed breastfeeding status at hospital discharge as a surrogate for initiation.¹⁸ These studies also used data over time to examine the potential impact of the 2009 food package change. In 2 of the studies (using 3 data sources),^{18,19} eligible non-WIC participants were more likely to initiate breastfeeding than the WIC participants before the 2009 food package change (2000–2008), but reported no difference in breastfeeding initiation after the 2009 food package change (2009–2014). In a national retrospective cohort study of low-income children born from 2005 to 2014, WIC participation was negatively associated with breastfeeding initiation (probability of breastfeeding coefficient was -0.063 (standard error [SE] 0.008, $P < .001$). However, after applying an instrumental variable to address selection bias in WIC participation, they found no difference in initiation by WIC participation before or after the 2009 food package change (probability of breastfeeding coefficient -0.039 [SE 0.322, $P = \text{ns}$]).¹⁹ Using Pregnancy Risk Assessment Monitoring System (PRAMS) data from 19 states, breastfeeding initiation increased 2.8% more among WIC participants than eligible non-participants comparing 2010 with 2004–2007, but this difference was only -0.08% using data from the National Immunization Survey (NIS) survey.¹⁷ Three studies from South Carolina provided conflicting results.^{16,17,21} In line with the PRAMS data, one South Carolina study used birth certificate data and found a 1.48% higher rate of initiation among WIC participants (SE 0.4%, $P < .05$).¹⁶ However, a second study used the same South Carolina data, applied a difference-in-difference analysis approach, and found no difference in breastfeeding initiation for WIC participants compared with eligible

nonparticipants (0.5 percentage points [SE 0.9]).²¹ The third study from South Carolina over-sampled for low birth weight and preterm delivery and found greater likelihood of breastfeeding initiation for WIC-eligible non-participants (adjusted OR 2.6, 95% confidence interval [CI] 1.1–4.3) compared to WIC participants.¹⁷ We concluded that WIC participation was likely to be associated with no difference in breastfeeding initiation. The SOE was moderate based on medium study limitations, general consistency across studies, and relatively precise findings ([Tables 2 and 3](#)).

BREASTFEEDING DURATION

Two studies compared breastfeeding duration between WIC participants and WIC-eligible nonparticipants.^{17,20} They used different measures of duration. One national cohort study reported that child WIC participation was associated with lower prevalence of any breastfeeding at 6 months of age (after matching 2009–2014 WIC participants vs eligible non-WIC participants, percent any breastfeeding at 6 months (32% vs 45%, $P < .05$).²⁰ The other cross-sectional study, from South Carolina, used survival analysis to examine the probability of discontinuing breastfeeding through 30 weeks (approximately 6.9 months) of age. Among those who initiated breastfeeding and were evaluated through 30 weeks, there was no difference by maternal WIC participation in the hazard ratio for discontinuing breastfeeding after adjustment for socioeconomic and other factors (Adjusted HR for discontinuing breastfeeding income-eligible non-WIC participants 0.66 (95% CI, 0.41, 1.05) compared with WIC participants).¹⁷ Due to high study limitations, inconsistency across studies, and imprecise findings, the evidence was deemed insufficient to draw a conclusion about the association between WIC participation and duration of breastfeeding ([Tables 2 and 3](#)).

BREASTFEEDING EXCLUSIVITY

Only one cohort study compared exclusive breastfeeding at 3 months between WIC participants and WIC-eligible nonparticipants. This national study using the NIS reported no difference in exclusivity at 3 months by WIC participation.¹⁸ Because there was only one study, which had medium limitations, and the outcome was based on a long recall period, the evidence was deemed insufficient with respect to differences in breastfeeding exclusivity by WIC participation ([Tables 2 and 3](#)).

EARLY INTRODUCTION OF SOLID FOODS

One cross-sectional study used National Health and Nutrition Examination Survey data from 2009 to 2014 to compare the prevalence of early introduction of solid foods for WIC participants with income-eligible non-WIC participants.²² In adjusted analyses, WIC participants were not more likely to introduce solids before 4 months of age than non-participants eligible for WIC (OR 0.97 [95% CI, 0.67, 1.41]). Although there was only one study, because it was a national study, and had medium limitations, the SOE was low that WIC participation may not be

Table 2. Summary Study Characteristics and Quality of Included Studies on the Evidence on Whether Breastfeeding Outcomes Were Associated With WIC Participation Compared With Nonparticipation by Those Eligible for WIC, Breastfeeding Outcomes Associated With the 2009 WIC Food Package Change, Breastfeeding Outcomes Associated With Receipt of WIC Breastfeeding Support Services

Author, Year, Funding Source	Outcome	Design	Data Source/ Setting	Population Characteristic	Key Findings	Risk of Bias
Comparison of WIC Participant Versus Eligible Non-WIC Participant						
Sonchak, 2017 ¹⁶ SUNY Oswego	Breastfeeding initiation	Retrospective Cohort study	South Carolina Birth certificates (2004–2013)	Postpartum (n = 271,096)	WIC participation was associated with 1.48% (SE 0.4%) increase in breastfeeding initiation.	Moderate <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak
Ma, 2014 ¹⁷ Funding source not reported	Breastfeeding initiation Breastfeeding duration	Cross-sectional study	South Carolina Birth certificates (2009–2010)	Postpartum (n = 1238)	WIC participation negatively associated with breastfeeding initiation. WIC income-eligible non-WIC participants (OR 2.6; 95% CI 1.1–4.3) compared to WIC participants. Among those who initiated breastfeeding and evaluated through 30 weeks, no difference by maternal WIC participation in the hazard ratio for discontinuing breastfeeding after adjustment for socioeconomic and other factors. Adjusted HR for discontinuing breastfeeding income-eligible non-WIC participants (HR 0.66; 95% CI 0.41–1.05) compared with WIC participants.	Weak <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Weak • Confounders: Strong • Data collection method: Strong • Withdrawals and dropout: Weak
Joyce, 2015 ¹⁸ USDA	Breastfeeding initiation Breastfeeding exclusivity	Cohort study	PRAMS (19 states) NIS national (2005–2014)	Postpartum (n = 127,477) Infants (n = 73,991)	No difference in breastfeeding initiation rates between WIC participants and WIC eligible non-participants. WIC eligible non-WIC difference in proportion ever breastfed was 2.8 (SE 0.01) percentage points greater comparing 2010 to 2004–2007 but no difference comparing 2010 to 2008 0.01 (SE 0.01) percentage points. No difference in exclusive breastfeeding at age 3 months by WIC participation. WIC eligible non-WIC	Moderate <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak

(Continued)

Table 2. (Continued)

Author, Year, Funding Source	Outcome	Design	Data Source/ Setting	Population Characteristic	Key Findings	Risk of Bias
Zhang, 2021 ¹⁹ NIH/ NICHD/ USDA	Breastfeeding initiation	Retrospective cohort	NIS national (2005–2014)	Infants (n = 92,335)	difference in proportion exclusive breastfed at 3 months was –0.0 (SE 0.04) percentage points comparing 2010 to 2008 No difference in breastfeeding initiation rates between WIC participants and WIC eligible nonparticipants. Regression Coefficient WIC participant on Breastfeeding after application of IV (–0.04 (SE 0.32))	Moderate • Selection bias: Strong • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak
Li, 2019 ²⁰ NIH/ NICHD/ USDA	Breastfeeding initiation Breastfeeding duration	Cohort study	NHANES national 2000–2008; 2009–2014	WIC eligible children 0–59 months (n = 4308)	No difference in breastfeeding initiation rates between WIC participants and WIC eligible nonparticipants. After matching 2009–2014 WIC vs non-WIC % ever-breastfed (69% vs 73%, ns) Child WIC participation was associated with lower prevalence of breastfeeding at age 6 months After matching 2009–2014 WIC vs non-WIC % breastfed at 6 months (32% vs 45%, $P < .05$)	Moderate • Selection bias: Moderate • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak
Bersak, 2021 ²¹ SUNY Oswego	Breastfeeding initiation	Cohort study	South Carolina Birth certificates (2004–2013)	Postpartum (n = 254,150)	No difference in breastfeeding initiation rates between WIC participants and WIC eligible non-participants. Differential linear time trends estimates that there was a insignificant increase in breastfeeding initiation 0.5 percentage point (SE 0.9) after 2009 food package change.	Weak • Selection bias: Strong • Study design: Weak • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak

(Continued)

Table 2. (Continued)

Author, Year, Funding Source	Outcome	Design	Data Source/ Setting	Population Characteristic	Key Findings	Risk of Bias
Barrera, 2018 ²² No external funding	Introduction of solid foods before age 4 months	Cross-sectional	NHANES national (2009–2014)	WIC eligible children 6–36 months (n = 936)	Prevalence of solids introduction before age 4 months is declining and no difference by WIC participation. In adjusted analysis there was no difference in odds of being introduced to solids before age 4 months by WIC participation (OR 0.97; 95% CI 0.67, 1.41).	Moderate <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Moderate • Confounders: Moderate • Data collection method: Strong • Withdrawals and dropout: Weak
2009 Food Package Impact Joyce, 2015 ¹⁸ USDA	Breastfeeding initiation	Cohort study	PedNSS: 16 states	WIC Infants (n = 744)	Rates of ever breastfed children are rising nationally but the increase is not associated with 2009 WIC food package change. WIC eligible non-WIC difference in proportion ever breastfed was 2.8 (SE 0.01) percentage points greater comparing 2010 to 2004–2007 but no difference comparing 2010 to 2008 0.01(SE 0.01) percentage points.	Moderate <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak
Wilde, 2012 ²³ USDA	Breastfeeding initiation Breastfeeding duration (receipt of full breastfeeding package at 3 months)	Before/after	17 local WIC agencies 10 states (California, Florida, Georgia, Idaho, Illinois, Minnesota, Rhode Island, Tennessee, Texas, and Utah)	Mother-infant dyads with infants aged 0–5 months (n = 88,251)	No change in breastfeeding initiation comparing 1–2 month before the 2009 food package change versus 5–12 months after change. (65.5% vs 65.1%) 10% greater prevalence of infants receiving the fully breastfeeding package at the age 3 months after the 2009 food package change. Odds of receiving fully breastfeeding package in birth month after 2009 food package change (OR 2.5; 95% CI 2.4–2.7).	Moderate <ul style="list-style-type: none"> • Selection bias: Moderate • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak

(Continued)

Table 2. (Continued)

Author, Year, Funding Source	Outcome	Design	Data Source/ Setting	Population Characteristic	Key Findings	Risk of Bias
Lee, 2017 ²⁴ CDC	Breastfeeding initiation Breastfeeding duration Breastfeeding exclusivity	Prospective cohort	PedNSS New York State 2002–2015	WIC infants (110,000 per year)	Breastfeeding initiation among New York WIC infants increased significantly, from 62.0% in 2002 to 83.4% in 2015 No change in the prevalence of any breastfeeding at age 6 months associated with the 2009 food package change. 41.2% in 2008 and 39.5% in 2015. Increase in crude prevalence of exclusive breastfeeding at ages 3+ months from 2006–2015 (8.9% to 14.3%) and at ages 6+ months from 2006–2010 (2.9% to 5.8%)	Moderate • Selection bias: Strong • Study design: Moderate • Confounders: Moderate • Data collection method: Moderate • Withdrawals and dropout: Weak
Langellier, 2014 ²⁵ First 5 LA	Breastfeeding initiation Breastfeeding duration Breastfeeding exclusivity	Before/after	Repeated cross-sectional surveys Los Angeles County, CA 2005, 2008, 2011	WIC participants (n = 5020)	There were higher odds of initiating breastfeeding in 2011 vs 2008 (OR 2.16; 95% CI, 1.69–2.76). No changes in any breastfeeding at 3 and 6 months from pre- to postimplementation of the new WIC food package. (OR 0.95; 95% CI, 0.81–1.11; and OR 0.89; 95% CI, 0.75–1.05, respectfully) The prevalence of exclusive breastfeeding roughly doubled for 3 months (OR 1.72; 95% CI, 1.43–2.07) and tripled for 6 months (OR 3.08; 95% CI, 2.27–4.18).	Moderate • Selection bias: Strong • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak
Whaley, 2012 ²⁶ First 5 LA	Breastfeeding exclusivity	Before/after	Los Angeles County, CA Monthly samples of infants (5000) from 12/2007–10/2010	WIC participants (n = 5000)	Rate of fully breastfeeding food package issuance increased from before to after the 2009 food package change at enrollment at age 2 months (12.7% vs 19.9%, $P < .01$) and at age 6 months (8.5% vs 13.9%, $P < .01$).	Moderate • Selection bias: Strong • Study design: Moderate • Confounders: Strong • Data collection method: Moderate • Withdrawals and dropout: Weak

(Continued)

Table 2. (Continued)

Author, Year, Funding Source	Outcome	Design	Data Source/ Setting	Population Characteristic	Key Findings	Risk of Bias
Receipt of WIC Breastfeeding Support Services						
McCoy, 2018 ²⁷ Funding source not reported	Breastfeeding initiation Breastfeeding duration	Retrospective cohort	Pregnant participants enrolled in Minnesota WIC program in 2012	WIC participants (n = 2219)	<ul style="list-style-type: none"> • Odds of breastfeeding initiation were higher for those who received a prenatal peer counselor contact. (OR 1.66; 95% CI, 1.19 to 2.32) • Lower Hazards Ratio for discontinuing breastfeeding from birth through 12 months for those who received a prenatal peer counselor contact; HR month one: 0.45; 95% CI, 0.33 to 0.61); HR months 2 through 12: 0.33; 95% CI, 0.18 to 0.60) 	Weak <ul style="list-style-type: none"> • Selection bias: Weak • Study design: Weak • Confounders: Strong • Data collection method: Weak • Withdrawals and dropout: Moderate
Gleason, 2020 ²⁸ Funding source not reported	Breastfeeding duration Breastfeeding exclusivity	Prospective cohort	National WIC Infant and Toddler Feeding Practices Study – 2 (2013–2015)	WIC participants (n = 1235)	<ul style="list-style-type: none"> • Increased OR of any breastfeeding at 6 months and OR of fully breastfeeding at 6 months with receipt of any breastfeeding support service. Addition of each breastfeeding service; Any Breastfeeding at 6 months (OR 1.19; 95% CI, 1.16 to 1.23); Fully Breastfeeding at 6 months (OR 1.36; 95% CI, 1.31 to 1.42) 	Weak <ul style="list-style-type: none"> • Selection Bias: Moderate • Study design: Weak • Confounders: Moderate • Data collection: Strong • Withdrawals and dropout: Weak

CA indicates California; CDC, Centers for Disease Control; CI, confidence interval; HR, Hazards ratio; OR, odds ratio; PedNSS, Pediatric Nutrition Surveillance System; NIH/ NICHD/ USDA NIH/ Eunice Kennedy Shriver National Institute of Child Health & Human Development, USDA; NIS, National Immunization Survey; NHANES, National Health and Nutrition Examination Survey; PRAMS, Pregnancy Risk Assessment Monitoring System; SE, standard error; USDA, United States Department of Agriculture; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children;

Table 3. Summary of Evidence on Whether Breastfeeding Outcomes Were Associated With WIC Participation During Pregnancy and in Childhood Compared With Nonparticipants Eligible for WIC

Outcome	Comparison	Number Studies	Conclusion	Strength of Evidence (Rationale)*
Comparison of WIC Participant Versus Eligible non-WIC Participant				
Breastfeeding initiation	Maternal WIC participation versus income-eligible non-participant	Six ^{16–21}	WIC participation may not be associated with breastfeeding initiation.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Direct • Consistency: Inconsistent • Precision: Precise
Breastfeeding duration	Child WIC participation versus income-eligible nonparticipant	Two ^{17,20}	Inconclusive	Insufficient <ul style="list-style-type: none"> • Study limitations: High • Directness: Direct • Consistency: Inconsistent • Precision: Imprecise
Breastfeeding exclusivity	Child WIC participation versus income-eligible nonparticipant	One ¹⁸	Inconclusive	Insufficient [†] <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Direct • Consistency: Unknown • Precision: Precise
Introduction of solids before age 4 months	Child WIC participation versus income-eligible non-participant	One ²²	WIC participation may not be associated with introduction of solids before age 4 months.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Direct • Consistency: Unknown • Precision: Precise
Impact of 2009 Food Package Change				
Breastfeeding initiation	Maternal-infant exposure to revised versus pre-2009 WIC food package	Four studies ^{18,23–25}	The 2009 food package change may not be associated with breastfeeding initiation, which is indirect evidence of a relationship between WIC participation and this outcome.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Indirect • Consistency: Consistent • Precision: Precise
Breastfeeding duration	Maternal-infant exposure to revised versus pre-2009 WIC food package	Four studies ^{23–26}	The 2009 food package change may not be associated with breastfeeding duration, which is indirect evidence of no relationship between WIC participation and this outcome.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Indirect • Consistency: Consistent • Precision: Precise
Breastfeeding exclusivity	Maternal-infant exposure to revised versus pre-2009 WIC food package	Three studies ^{24–26}	The 2009 food package change may be associated with breastfeeding exclusivity, which is indirect evidence of a relationship between WIC participation and these outcomes.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Indirect • Consistency: Consistent • Precision: Precise

(Continued)

Table 3. (Continued)

Outcome	Comparison	Number Studies	Conclusion	Strength of Evidence (Rationale)*
Introduction of solids before age 4 months	Infant exposure to revised versus pre-2009 WIC food package	One study ²²	The 2009 food package change may be associated with a decline in the introduction of solids before age 4 months, which is indirect evidence of a relationship between WIC participation and these outcomes.	Low <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Indirect • Consistency: Consistent • Precision: Precise
Receipt of WIC Breastfeeding Support Services Breastfeeding duration	Maternal exposure to WIC breastfeeding support services	Two studies ^{27,28}	‡WIC breastfeeding support services (full breastfeeding package, prenatal peer counseling, number of services) were associated with longer duration of any breastfeeding,	Moderate <ul style="list-style-type: none"> • Study limitations: Medium • Directness: Direct • Consistency: Consistent • Precision: Precise

vs. indicates versus; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

*Low strength indicates low confidence that the evidence reflects the true effect, and further research is very likely to change the result, and insufficient evidence indicates that evidence is unavailable or does not permit a conclusion.

†Because respondents are asked to recall the duration of exclusive breastfeeding a year later as part of an immunization survey, we considered this evidence as insufficient.

‡The evidence was insufficient to determine whether maternal or child WIC participation was associated with longer duration of breastfeeding, breastfeeding exclusivity, or introduction of solids before 4 months of age (SOE: Insufficient).

associated with the prevalence of introduction of solid foods before 4 months of age (Tables 2 and 3).

BREASTFEEDING OUTCOMES IN 2009 FOOD PACKAGE CHANGE STUDIES

Five studies compared breastfeeding outcomes for WIC participants before versus after the 2009 food package change.^{18,23–26} We viewed these studies as providing indirect evidence regarding the association of outcomes with WIC participation. Study details are presented in Tables 2 and 3 and Supplement B.

BREASTFEEDING INITIATION

Four studies evaluated changes over time in breastfeeding initiation among WIC participants only.^{18,23–25} In a national study of 17 WIC local agencies examining the immediate impact of the 2009 food package change, no difference in breastfeeding initiation was found comparing 1 to 2 months before the 2009 food package change with 5 to 12 months after change (65.5% vs 65.1%; $P = .58$).²³ However, a 2-fold higher Adjusted Odds Ratio (AOR) for breastfeeding initiation was reported after the 2009 food package change (2.16; 95% CI, 1.69–2.76) in Los Angeles County, California among predominantly Hispanic WIC participants.²⁵ No change or graduated increases in breastfeeding initiation over time were reported in studies using either national WIC data¹⁸ or New York State WIC data²⁴ which suggested no change in breastfeeding initiation related to the 2009 food package change. Based on medium study limitations, inconsistency across studies, and relatively precise findings, it was concluded that the evidence was low that the 2009 food package change may not be associated with breastfeeding initiation.

BREASTFEEDING DURATION

Three studies assessed the 2009 food package change and prevalence of any breastfeeding at 3 months of age.^{23–25} In a national study, the receipt of full or partial breastfeeding packages as an indicator of any breastfeeding at 3 months declined significantly immediately after the 2009 food package change.²³ In a study from Los Angeles County, California,²⁵ no significant change in any breastfeeding at 3 months of age was reported after the 2009 food package change. The temporal trends study from New York State WIC found gradually increased rates of any breastfeeding at 3 months of age from 2002 to 2015, again suggesting no change associated with the 2009 food package.²⁴

These same studies assessed the 2009 food package change and prevalence of any breastfeeding at 6 months of age.^{23–25} However, a pre-post study from Los Angeles County, California found that issuance of the full breastfeeding food package at 6 months of age increased 13.9% with the food package change, which would be consistent with a higher prevalence of any breastfeeding at 6 months.²⁶

Small or no change in prevalence of any breastfeeding at 3 months were reported in 3 of these studies.^{23–25}

Results from these studies mostly indicated no change in prevalence of any breastfeeding at 6 months of age associated with the 2009 food package change. Based on medium study limitations, some inconsistency across studies, and relatively precise findings, the SOE was low that the 2009 food package change may not be associated with a difference in breastfeeding duration (any breastfeeding at 3 or 6 months).

BREASTFEEDING EXCLUSIVITY

Of the studies of WIC participants and the 2009 food package change, three reported on prevalence of breastfeeding exclusivity at 2 to 3 months of age^{24–26} and 2 on exclusivity at 6 months of age.^{25,26} One study from Los Angeles County, California reported that the revised food package was associated with a 1.72 (95% CI, 1.43–2.07) times greater likelihood of exclusive breastfeeding at 3 months, and a 3.08 (95% CI, 2.27–4.18) times greater likelihood of exclusive breastfeeding at 6 months.²⁵ In another study from the same local agency, the rate of fully breastfeeding issuance (no infant formula issuance) increased significantly ($P < .001$) with the 2009 food package change at enrollment (23.8%–44.2%), at 2 months (12.7%–19.9%) and at 6 months (8.5%–13.9%).²⁶ Trend data from that study showed a rise in fully breastfeeding package issuance in conjunction with the 2009 food package change.²⁶ Trends in breastfeeding exclusivity for 1 or more or 3 or more months were evaluated among infants in New York State WIC and, although the prevalence increased significantly, changes were gradual over time, suggesting no difference related to the 2009 food package change.²⁴ Based on consistency across the studies and relatively precise findings but medium study limitations, the SOE was low that the 2009 food package change may be associated with increased breastfeeding exclusivity among WIC participants.

No studies compared the prevalence of early introduction of complementary foods before and after the 2009 food package change among WIC participants.

RECEIPT OF WIC BREASTFEEDING SUPPORT SERVICES

One retrospective cohort study ($n = 2219$) from Minnesota evaluated the association between breastfeeding initiation and specific WIC services to support breastfeeding.²⁷ The study found 1.66 times (95% CI, 1.19–2.32) higher odds of breastfeeding initiation for those who received a prenatal peer counselor contact.²⁷ Two studies evaluated the association between breastfeeding duration and specific WIC services to support breastfeeding.^{27,28} A national study, the WIC Infant and Toddler Feeding Practices Study – 2 ($n = 1,235$), reported higher odds of any breastfeeding at 6 months of age for each breastfeeding support service received (AOR 1.41, 95% CI 1.32–1.52).²⁸ A study from Minnesota reported that prenatal peer counselor contacts were associated with a lower risk of discontinuing breastfeeding from birth through 12 months of age (adjusted HR 0.33, 95% CI 0.18–0.60).²⁷ Among WIC participants, these 2 studies report

that the availability or receipt of support services was associated with longer duration of breastfeeding with evidence up to 12 months of age. Due to medium study limitations, indirect relationship to the key question, consistent findings across studies and time points, and relatively precise findings, the SOE was low that increased breastfeeding support services improved both breastfeeding initiation and duration among WIC participants.

Finally, a national study evaluating the number of breastfeeding supports available to participants reported higher odds of an infant fully breastfed (receiving only breast milk with no introduction of formula or complementary foods) at 2 months (AOR 1.52, 95% CI [1.41–1.65]) and 6 months of age (AOR 2.13, 95% CI [1.98–2.30]) per service available.²⁸ Based on having only one study, which had limitations, the evidence was deemed insufficient to conclude whether breastfeeding support services increased exclusivity of breastfeeding among WIC participants.

QUALITATIVE STUDIES ABOUT BREASTFEEDING PERCEPTIONS AMONG WIC PARTICIPANTS

We identified ten qualitative studies that reported on breastfeeding perceptions among WIC participants.^{29–38} Themes that arose include perceptions of cultural attitudes about breastfeeding in the United States,^{31–33} perceptions of WIC staff attitudes toward participants and their infant feeding decisions^{36,37} and the influence of the 2009 food package revision (Study details found in [Supplement E](#)).

Perceptions and attitudes regarding WIC and breastfeeding are complex. In 3 studies, Hispanic women³⁴ and Marshallese immigrants^{31,32} reported positive cultural attitudes about breastfeeding. However, participants in 2 of the studies^{31,34} perceived that the US culture did not approve of breastfeeding and expressed feeling ashamed of breastfeeding in the United States. The third study identified returning to work as a barrier to exclusive breastfeeding in Marshallese women living in the United States.³² Access to formula that participants may not have had in their country of origin was also mentioned as being provided by WIC, and this was a major driver in the decision to formula feed instead of breastfeeding. In another study, mothers who elected to formula feed felt judged or left out because of a perceived emphasis on breastfeeding in the WIC program.³⁷ In 2 studies, women noted conflicting information about breastfeeding from WIC staff and physicians³⁷ or just lack of information from physicians.³⁶ Specifically, WIC peer counselors and midwives were mentioned as providing more education and encouragement to breastfeed than obstetricians who remained silent when asked about breastfeeding.³⁶ However, in a study of Marshallese women living in Arkansas, participants described both WIC counselors and healthcare providers as supportive of breastfeeding, and the study identified WIC as the dominant institutional facilitator supporting breastfeeding in participating women.³² In 2 studies, African American WIC participants expressed that social support was among the most important factors that influenced

initiation and duration of breastfeeding.^{30,36} The few participants that accessed WIC-related breastfeeding support services had a positive experience,^{32,36} and those unaware of these WIC services expressed a desire to have peer role models who have breastfed long term. In another study, African American WIC peer counselors reported that resistance to breastfeeding arose from historical factors (eg, slavery and Black/African American women's role as wet nurses) and community perceptions of breasts as well as norms of Black/African American womanhood.³³

When asked about the influence of the 2009 food package change on infant feeding decisions, some women viewed the revised food package for exclusive breastfeeding as positively influencing their choice to breastfeed, but a majority noted it had no influence on their decisions.³⁵ When asked, some women stated the decision to breastfeed was based on other things such as the health of the baby. Some women also noted they would breastfeed regardless of whether there were nutritional or economic incentives in the food package.

DIFFERENCES IN BREASTFEEDING OUTCOMES BY DURATION OF PARTICIPATION IN WIC OR PARTICIPANT CHARACTERISTICS

We found no studies evaluating duration of WIC participation and breastfeeding outcomes. The only participant characteristic that was evaluated for an association with breastfeeding outcomes was maternal race or ethnicity.

One study in South Carolina (2004–2013) examined WIC participation and breastfeeding initiation and presented results stratified by maternal race.¹⁶ In that study, WIC participation was associated with a 2.76% (SE, 0.57%) higher rate of breastfeeding initiation among Black/African American women, whereas there was no significant difference in initiation by WIC participation (1.2% [SE, 0.56%]) among white women. When considering all South Carolina births during the time period, and adjusting for maternal and child characteristics, year of birth, and multiple pregnancies in women over time (but not income or Medicaid use), WIC participation was associated with a statistically significant 2.54% (SE, 0.46%) higher rate of breastfeeding initiation for Black/African American women and no difference in breastfeeding initiation (–0.45%, SE, 0.34%) among White women. In contrast, a national study used an instrumental variable approach to address selection bias in analyses stratifying by race and ethnicity group and found no difference in breastfeeding initiation by WIC participation in any group.¹⁹

Several studies evaluated associations between exposure to the revised food package and breastfeeding outcomes among WIC participants by racial and ethnic groups. A prospective cohort study used New York Pediatric Nutrition Surveillance System reports from 2002 to 2015 to assess temporal trends in breastfeeding initiation and duration of more than 1 month.²⁴ Breastfeeding initiation increased significantly, from 62.0% in 2002 to 83.4% in 2015, with an annual percent change of 2.4, or an

average of 1.7 percentage points, per year. Stratifying by maternal race and ethnicity, the study reported the largest increase in breastfeeding initiation for Asian infants, from 45.8% in 2002 to 84.7% in 2015. The study also found that the racial or ethnic disparity in breastfeeding initiation rate (ie, the difference between the highest and the lowest rates among White, Black/African American, Hispanic and Asian infants in a particular year) was reduced from 26.5 percentage points in 2002 (Hispanic vs Asian) to 9.2 in 2015 (Hispanic vs white). In addition, breastfeeding duration trends by race or ethnicity demonstrated significant increases in the prevalence of breastfeeding duration for more than one month, with the largest increase among Asians. The findings across studies of predominantly Hispanic women in Los Angeles County, California suggested positive findings for the association between the 2009 food package change and breastfeeding initiation and exclusivity.^{25,26} Overall, these studies suggested that the revised food package may have differentially benefited breastfeeding outcomes for specific racial groups.

Thus, one study with direct evidence and several studies with indirect evidence suggested that WIC participation may be associated with differential improvement in breastfeeding outcomes by maternal racial and ethnic groups. However, the SOE was insufficient to draw conclusions about racial and ethnic differences due to limitations of the studies and the indirect nature of most of the evidence.

DISCUSSION

The findings from this systematic review indicate that based on moderate strength of evidence from 6 studies,^{16–21} WIC participation is likely to be associated with no difference in breastfeeding initiation and based on low SOE from one national study²² WIC participation may be associated with no difference in introduction of solids before 4 months. There was insufficient evidence to conclude regarding the association of WIC participation with breastfeeding duration or exclusivity based on 3 studies.^{17,18,20} Although WIC breastfeeding initiation rates have increased from 48.3% in 2002 to 71.8% in 2018, these rates are not different from those for WIC-eligible nonparticipants.^{39,40} The 2012 review of the WIC program suggested that prior to 2009, WIC participants were less likely to breastfeed than eligible nonparticipants.¹ As shown here, data since 2009 indicate only negligible differences in breastfeeding initiation by WIC participation.

WIC has made breastfeeding promotion and support a priority. The 2009 food package changes and extension of maternal WIC participation postpartum were designed to enhance support for breastfeeding initiation and duration. With the exception of a study from Los Angeles County, California, evidence suggests that the 2009 food package change has had little effect on WIC breastfeeding initiation rates. With respect to breastfeeding duration and exclusivity, we found some evidence of greater breastfeeding exclusivity after the 2009 food package change

among WIC participants. Findings from one qualitative study indicated that although the enhanced food package for breastfeeding mothers was perceived to be beneficial it would not affect decisions regarding breastfeeding.³⁵ Many of the WIC services to promote and support breastfeeding including breastfeeding peer counselors, provision of breast pumps, and prenatal education, were well established before 2009.⁶ We found low SOE that these services have beneficial effects on breastfeeding initiation and duration.

In qualitative studies that focused on breastfeeding in racial and ethnic groups that have experienced breastfeeding disparities, Black/African American women emphasized the importance of social support for breastfeeding and spoke positively about experiences with WIC peer counseling.^{30,36} We also reported findings from quantitative studies of steady increases in breastfeeding initiation across racial and ethnic groups with some indication of reduced racial or ethnic disparities in breastfeeding initiation between WIC participants and eligible nonparticipants. Despite these findings, the evidence was insufficient to draw firm conclusions as to whether the association of WIC participation with breastfeeding outcomes varied by maternal race or ethnicity.

STRENGTHS AND LIMITATIONS

There are several strengths to the evidence base for these findings. The data come from federally supported national surveys, birth certificates, and WIC state or local agencies. Study sample sizes ranged from < 1000 to > 1,000,000, with most studies having samples sizes of 80,000 to 250,000, suggesting that the sample sizes were adequate to identify differences in breastfeeding outcomes. Although largely based on self-report, the outcomes were queried with standardized questions, with available study documentation.

The evidence has multiple limitations. First, the evidence resulted from observational studies. Most studies used multiple covariate adjustment, and some used stronger methods involving matched samples or instrumental variables. That said, a major limitation of observational studies is risk of bias due to residual confounding. Second, because WIC participation and breastfeeding outcomes were self-reported in most studies, reporting or recall bias must be considered, and differences in the recall period may lead to heterogeneity in the findings. Third, selection bias must be acknowledged because income-eligible women decide whether or not to participate in WIC; there are unmeasurable differences between groups who choose to participate and those who do not. Studies find that early entry and later exit from WIC are associated with greater economic disadvantage (among those WIC eligible) indicating the potential for negative bias in studies.^{41–43} Also, some studies have reported that child retention in WIC may be associated with positive health behaviors (such as breastfeeding, seeking support and nutritional advice), and this may indicate positive selection bias with respect to breastfeeding.^{43,44} There was insufficient evidence to conclude regarding duration of WIC participation and

breastfeeding outcomes, or regarding differences in associations of WIC participation and breastfeeding outcomes depending on participant characteristics.

CONCLUSIONS

WIC participation is not associated with a difference in breastfeeding initiation compared with income-eligible non-WIC participants. The 2009 food package change was not associated with changes in breastfeeding initiation or duration, but the package change may have positively affected breastfeeding exclusivity. Receipt of breastfeeding support services may improve breastfeeding initiation and duration. Health care practitioners who serve women eligible for WIC and are interested in breastfeeding should recommend WIC for breastfeeding support starting in pregnancy.

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MeSH Terms: "WIC program OR WIC OR "Women, Infants, and Children" OR "WIC program" OR "WIC programs" OR "Special Supplemental Nutrition Program".

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.acap.2022.10.008>.

REFERENCES

- Colman S, Nichols-Barr IP, Redline JE, et al. Effects of the special supplemental nutrition program for women, infants, and children (WIC): a review of recent research. 2012. Available at: <https://fns-prod.azureedge.net/sites/default/files/WICMedicaidLitRev.pdf>.
- Jiang M, Foster EM, Gibson-Davis CM. The effect of WIC on breastfeeding: a new look at an established relationship. *Child Youth Serv Rev*. 2010;32:264–273. <https://doi.org/10.1016/j.chilgyouth.2009.09.005>.
- Bunik M, Krebs NF, Beatty B, et al. Breastfeeding and WIC enrollment in the nurse family partnership program. *Breastfeeding Med*. Sep 2009;4:145–149. <https://doi.org/10.1089/bfm.2008.0140>.
- Wojcicki JM, Gugig R, Tran C, et al. Early exclusive breastfeeding and maternal attitudes towards infant feeding in a population of new mothers in San Francisco, California. *Breastfeeding Med*. 2010;5:9–15. <https://doi.org/10.1089/bfm.2009.0003>.
- WIC Data Tables. US Department of Agriculture. Accessed August 17, 2021, Available at: <https://www.fns.usda.gov/pd/wic-program>.
- Public Law 108 - 265 - Child Nutrition and WIC Reauthorization Act of 2004. US Government Publishing Office. Accessed April 16, 2021, Available at: <https://www.govinfo.gov/app/details/PLAW-108publ265>.
- USDA/FNS 7 CFR Part 246 [FNS–2006–0037] RIN 0584–AD77 Special Supplemental Nutrition Program for Women, Infants and Children (WIC): Revisions in the WIC Food Packages. *Fed Regist*. 2007;72. Vol Available at: <http://www.gpo.gov/fdsys/pkg/FR-2007-12-06/pdf/E7-23033.pdf>.
- Bartholomew A, Adedze P, Soto V, et al. Historical perspective of the WIC program and its breastfeeding promotion and support efforts. *J Nutr Educ Behav*. 2017;49(7 Suppl 2):S139–143.e1. <https://doi.org/10.1016/j.jneb.2017.03.018>.
- Methods Guide for Effectiveness and Comparative Effectiveness Reviews*. AHRQ Publication No. 10(14)-EHC063-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2014. Available at: www.effectivehealthcare.ahrq.gov.
- PRISMA Statement. PRISMA. Accessed November 23, 2021. Available at: <http://www.prisma-statement.org/PRISMAStatement/PRISMAStatement.aspx>.
- Breastfeeding and the use of human milk. *Pediatrics*. 2012;129:e827–e841. <https://doi.org/10.1542/peds.2011-3552>.
- 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. <https://doi.org/10.1542/peds.2008-1315d>.
- Quality assessment tool for quantitative studies. Effective Public Healthcare Panacea Project. Accessed November 23, 2021. Available at: <https://www.ehphp.ca/quality-assessment-tool-for-quantitative-studies/>.
- JBIC manual for evidence synthesis. JBI. Accessed March 12, 2021. Available at: <https://wiki.jbi.global/display/MANUAL/2.1+Introduction+and+purpose+of+this+guidance>.
- Caulfield, L.E., Bennett, W.L., Gross, S.M., et al. (2022). Maternal and child outcomes associated with the special supplemental nutrition program for Women, Infants, and Children (WIC). Agency for Healthcare Research and Quality (US). <https://doi.org/10.23970/AHRQEPCCER253>.
- Sonchak L. The impact of WIC on breastfeeding initiation and gestational weight gain: case study of South Carolina Medicaid mothers. *Child Youth Serv Rev*. 2017;79:115–125. <https://doi.org/10.1016/j.chilgyouth.2017.05.024>.
- Ma X, Liu J, Smith M. WIC participation and breastfeeding in South Carolina: updates from PRAMS 2009–2010. *Matern Child Health J*. 2014;18:1271–1279. <https://doi.org/10.1007/s10995-013-1362-2>.
- Joyce T, Reeder J. Changes in breastfeeding among WIC participants following implementation of the new food package. *Matern Child Health J*. 2015;19:868–876. <https://doi.org/10.1007/s10995-014-1588-7>.
- Zhang Q, Chen C, Xue H, et al. Revisiting the relationship between WIC participation and breastfeeding among low-income children in the U.S. after the 2009 WIC food package revision. *Food Policy*. 2021;101. <https://doi.org/10.1016/j.foodpol.2021.102089>.
- Li K, Wen M, Reynolds M, et al. WIC participation and breastfeeding after the 2009 WIC revision: a propensity score approach. *Int J Environ Res Public Health*. 2019;16. <https://doi.org/10.3390/ijerph16152645>.
- Bersak T, Sonchak-Ardan L. Marginal changes, marginal impacts: the limits of changes to WIC and their ability to influence breastfeeding rates. *Child Youth Serv Rev*. 2021;126:N.PAG-PAG. <https://doi.org/10.1016/j.chilgyouth.2021.106043>.
- Barrera CM, Hamner HC, Perrine CG, et al. Timing of introduction of complementary foods to US infants, national health and nutrition examination survey 2009–2014. *J Acad Nutr Diet*. 2018;118:464–470. <https://doi.org/10.1016/j.jand.2017.10.020>.
- Wilde P, Wolf A, Fernandes M, et al. Food-package assignments and breastfeeding initiation before and after a change in the special

- supplemental nutrition program for women, infants, and children. *Am J Clin Nutr*. 2012;96:560–566. <https://doi.org/10.3945/ajcn.112.037622>.
24. Lee F, Edmunds LS, Cong X, et al. Trends in breastfeeding among infants enrolled in the special supplemental nutrition program for women, infants and children - New York, 2002–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66:610–614. <https://doi.org/10.15585/mmwr.mm6623a4>.
 25. Langellier BA, Chaparro MP, Wang MC, et al. The new food package and breastfeeding outcomes among women, infants, and children participants in Los Angeles County. *Am J Public Health*. 2014;104(suppl 1):S112–S118. <https://doi.org/10.2105/ajph.2013.301330>.
 26. Whaley SE, Koleilat M, Whaley M, et al. Impact of policy changes on infant feeding decisions among low-income women participating in the Special Supplemental Nutrition Program for Women, Infants, and Children. *Am J Public Health*. 2012;102:2269–2273. <https://doi.org/10.2105/ajph.2012.300770>.
 27. McCoy MB, Geppert J, Dech L, et al. Associations between peer counseling and breastfeeding initiation and duration: an analysis of Minnesota participants in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). *Matern Child Health J*. 2018;22:71–81. <https://doi.org/10.1007/s10995-017-2356-2>.
 28. Gleason S, Wilkin MK, Sallack L, et al. Breastfeeding duration is associated with WIC site-level breastfeeding support practices. *J Nutr Educ Behav*. 2020;52:680–687. <https://doi.org/10.1016/j.jneb.2020.01.014>.
 29. Almeida R, Alvarez Gutierrez S, Whaley SE, et al. A qualitative study of breastfeeding and formula-feeding mothers' perceptions of and experiences in WIC. *J Nutr Educ Behav*. 2020;52:615–625. <https://doi.org/10.1016/j.jneb.2019.12.006>.
 30. Schindler-Ruwisch J, Roess A, Robert RC, et al. Determinants of breastfeeding initiation and duration among African American DC WIC recipients: perspectives of recent mothers. *Women's Health Issues*. 2019;29:513–521. <https://doi.org/10.1016/j.whi.2019.07.003>.
 31. Scott A, Shreve M, Ayers B, et al. Breast-feeding perceptions, beliefs and experiences of Marshallese migrants: an exploratory study. *Public Health Nutr*. 2016;19:3007–3016. <https://doi.org/10.1017/s1368980016001221>.
 32. Ayers BL, Purvis RS, White A, et al. Best of intentions: influential factors in infant feeding intent among marshallese pregnant women. *Int J Environ Res Public Health*. 2022;19:1740. <https://doi.org/10.3390/ijerph19031740>.
 33. Gross TT, Powell R, Anderson AK, et al. WIC peer counselors' perceptions of breastfeeding in African American women with lower incomes. *J Hum Lactation*. 2015;31:99–110. <https://doi.org/10.1177/0890334414561061>.
 34. Hohl S, Thompson B, Escareño M, et al. Cultural norms in conflict: breastfeeding among Hispanic immigrants in rural Washington state. *Matern Child Health J*. 2016;20:1549–1557. <https://doi.org/10.1007/s10995-016-1954-8>.
 35. Bedwell RM. The impact of federal breastfeeding policy initiatives on women's breastfeeding practices and attitudes in Southern Indiana. *J Pover*. 2017;21:508–527. <https://doi.org/10.1080/10875549.2017.1348423>.
 36. Gross TT, Davis M, Anderson AK, et al. Long-term breastfeeding in African American mothers. *J Hum Lactation*. 2017;33:128–139. <https://doi.org/10.1177/0890334416680180>.
 37. Isaacs S, Shriver L, Haldeman L. Qualitative analysis of maternal barriers and perceptions to participation in a federal supplemental nutrition program in rural appalachian North Carolina. *J Appalachian Health*. 2020;2:37–52. <https://doi.org/10.13023/jah.0204.06>.
 38. Ruiz M, Arroyo H, Dávila Torres R, et al. Qualitative study on WIC program strategies to promote breastfeeding practices in Puerto Rico: what do Nutritionist/Dietician's [sic] Think? *Matern Child Health J*. 2011;15:520–526. <https://doi.org/10.1007/s10995-010-0592-9>.
 39. WIC Participant and Program Characteristics 2018 – Charts. United States Department of Agriculture, Food and Nutrition Service. Special Supplemental Nutrition Program for Women, Infants and Children (WIC). Accessed February 3, 2022. Available at: www.fns.usda.gov/wic/participant-and-program-characteristics-2018-charts.
 40. Kline N, Thorn B, Bellows D, et al. WIC participant and program characteristics 2018. 2018. Available at: <https://www.fns.usda.gov/wic/wic-participant-and-program-characteristics-2018>.
 41. Currie J, Rossin-Slater M. Does the WIC program promote equality of opportunity in early life? In: Tach L, Dunifon R, Miller DL, eds. *Confronting Inequality: How Policies and Practices Shape Children's Opportunities*. American Psychological Association; 2020:49–66. APA Bronfenbrenner series on the ecology of human development.
 42. Jacknowitz A, Tiehen L. Transitions into and out of the WIC Program: a cause for concern? *Review. Soc Serv Rev*. 2009;83:151–183. <https://doi.org/10.1086/600111>.
 43. Whaley SE, Martinez CE, Paolicelli C, et al. Predictors of WIC participation through 2 years of age. *J Nutr Educ Behav*. 2020;52:672–679. <https://doi.org/10.1016/j.jneb.2019.12.015>.
 44. Whaley SE, Whaley M, Au LE, et al. Breastfeeding is associated with higher retention in WIC after age 1. *J Nutr Educ Behav*. 2017;49:810–816.e1. <https://doi.org/10.1016/j.jneb.2017.07.003>.