Maternal health behaviors and infant health outcomes among homeless mothers: U.S. Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) 2000–2007

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A R T I C L E   I N F O

A B S T R A C T

Objective. To determine whether participation in the Women, Infants, and Children Program is associated with improved maternal and infant health outcomes among homeless women in the Pregnancy Risk Assessment Monitoring System.

Method. Analyses were based on Pregnancy Risk Assessment Monitoring System participants from 31 states/cities in the United States, 2000–2007 ($n = 272,859$). Overall, 4% of women completing the Pregnancy Risk Assessment Monitoring System survey were homeless, with 76% participating in the Women, Infants, and Children Program, a federally-funded supplemental nutrition program for low-income women and children less than 5 years old.

Results. Among women in the Pregnancy Risk Assessment Monitoring System survey who reported using the Women, Infants, and Children Program, those experiencing homelessness were older, less educated, less likely to have private health insurance, and more likely to receive government assistance. Homeless women in the Women, Infants, and Children Program compared with those not in the program were significantly more likely to have a higher body mass index, to initiate breastfeeding after delivery, have prenatal care visits, have a longer gestational age, and have a greater infant birth weight.

Conclusion. Characteristics of homeless pregnant women choosing to participate in the Women, Infants, and Children Program are consistent with the requirements for program participation for women in general. Homeless women accessing the Women, Infants, and Children Program had better maternal and infant health outcomes.

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Introduction

The Special Supplemental Nutrition Program for WIC is a federally-funded, state-administered program for low-income women who are pregnant, breastfeeding, or non-breastfeeding for up to 6 months postpartum; infants; and children 1–5 years old (Food and Nutrition Service [FNS], 2010). Other eligibility requirements include the presence of a nutritional or medical risk (e.g., anemia or maternal underweight or overweight status) and residing in the geographical state of application (Food and Nutrition Service [FNS], 2010). WIC provides clients with food vouchers, such as whole grain products, fruits and vegetables, milk, and eggs, and nutrition education about healthy eating patterns such as increasing folic acid during pregnancy (Food and Nutrition Service [FNS], 2010). WIC clients also receive referrals to agencies offering services for medical and dental care, housing, and other food resources (Food and Nutrition Service [FNS], 2010). WIC participation has been associated with decreased infant mortality rates, decreased health care costs, and improved nutrient intakes among children (Avruch and Cackley, 1995; Khanani et al., 2010; Rose et al., 1998).

WIC-eligible homeless women may not utilize the program because of limited access and inadequate cooking and food storage facilities, which may result in less healthy food choices and poor infant health outcomes (Avruch and Cackley, 1995; Bassuk, 1993; Beal and Redlener, 1995; Bloom et al., 2004; Davis et al., 2008; Hamm and Holden, 1999; Khanani et al., 2010; Killion, 1995; Richards and Smith, 2006; Rose et al., 1998; Smith et al., 2010; Stein et al., 2000). Identifying the number of people who are homeless in a given year in the United States (U.S.) is estimated to be as high as 3.5 million people, with approximately one-third children (National Coalition for the Homeless, 2009). Unfortunately, little is known about the state of homelessness among pregnant women in this country. Some studies have shown that homeless pregnant women tend to be younger, less educated, unmarried, African-American, and more likely to use

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Table 1
Homeless and homeless WIC[a] participants in each PRAMS[b] state/city by United States geographic area.

PRAMS[b] area	Years available	Homeless* No.[†]	% [†]	WIC No.[†]	% [†]
East					
Maine	2000–2007	2799	3	2006	72
Maryland	2000–2007	14,328	4	11,589	81
New Jersey	2002–2007	21,285	5	15,427	72
New York	2000–2007	25,667	3	19,129	75
New York City	2004–2007	11,073	4	8845	80
Rhode Island	2002–2007	2488	4	2028	82
Vermont	2000–2007	1214	3	1071	88
West Virginia	2000–2007	2441	2	2088	86
Total		81,295	4	62,183	76
Midwest					
Illinois	2000–2006	69,918	7	53,378	76
Michigan	2001–2006	12,784	2	10,187	80
Minnesota	2002–2007	10,648	3	8685	82
Montana	2002	392	4	350	89
Nebraska	2000–2006	5774	4	4324	75
North Dakota	2002	121	2	101	83
Ohio	2000–2007	21,057	2	16,903	80
Oklahoma	2000–2007	15,108	5	11,875	79
Total		135,802	4	105,803	78
South					
Alabama	2000–2004	5595	2	4563	82
Arkansas	2000–2007	11,041	4	7822	71
Florida	2000–2006	60,965	5	44,258	73
Georgia	2004–2006	10,387	4	6661	64
Louisiana	2000–2005	7522	2	5511	73
Mississippi	2003–2007	2612	2	1713	66
North Carolina	2000–2006	28,474	4	21,950	77
South Carolina	2000–2007	7036	2	5022	71
Total		133,632	4	97,500	73
West					
Alaska	2000–2007	2737	4	2101	77
Colorado	2000–2007	23,877	5	15,228	64
Hawaii	2000–2007	2500	2	1941	78
New Mexico	2000–2006	7367	5	5622	76
Oregon	2003–2007	11,277	6	9243	82
Utah	2000–2007	11,227	3	7999	71
Washington	2000–2007	31,814	6	26,731	84
Total		90,799	5	68,865	76
Total		441,528	4	334,351	76

[a] WIC indicates The Special Supplemental Nutrition Program for Women, Infants, and Children.

[b] PRAMS indicates Pregnancy Risk Assessment Monitoring System.

* Homeless within past 12 months.

[†] Estimates were weighted to be representative of all women who gave birth in each state during the specified years.

government assistance programs; however, these studies have been based on small sample sizes or a small geographic region (Bloom et al., 2004; Little et al., 2005; Webb et al., 2003). In addition, no research has evaluated the association between WIC participation and homelessness during the pregnancy period.

The purpose of this study was to evaluate the extent of homelessness among WIC participants and to assess whether participation was associated with improved maternal and infant health outcomes. Selected demographic and health behavior variables were compared among non-homeless WIC participants, homeless women who participate in WIC, and homeless women who do not participate in WIC. We hypothesize that homeless pregnant women who use WIC compared with non-homeless WIC users are younger, less educated, less likely married, less likely to have insurance, less likely to have pre-pregnancy BMI in the normal range, and less likely to use multivitamins in the pre-conception period. We further hypothesize that participation in WIC among homeless pregnant women would result in better maternal-related health behaviors and better infant health outcomes.

Materials and methods

Study population

Data from 31 states/cities in the United States participating in the PRAMS, 2000–2007. Each of these 31 areas achieved at least a 70% response rate for each individual year the survey was conducted. PRAMS is an ongoing, state-specific surveillance program that obtains data about maternal health practices before, during, and after pregnancy among women who delivered an infant in the past 2–4 months (Centers for Disease Control and Prevention [CDC], 2009). Participating women are mailed a pre-letter to explain the PRAMS program, an introductory letter, and a survey.

Of the 272,859 survey respondents, 6018 had missing information on homeless or WIC status and 138,476 were neither homeless or had not participated in the WIC program. These individuals were not included in the current study, but analyses were based on 128,365 pregnant women completing the PRAMS survey (i.e., 117,184 non-homeless WIC participants, 8557 homeless WIC participants, and 2624 homeless non-WIC participants).

Study variables

Homelessness was based on responses to the question "This question is about things that may have happened during the *12 months before* your new baby was born…I was homeless." The term "homeless" was not defined and left to participants' interpretation. WIC participation was based on the question "During your pregnancy, were you on WIC (the Special Supplemental Nutrition Program for Women, Infants, and Children)?"

BMI [kg/m^2] was derived from self-reported height and weight prior to pregnancy. BMI may be underestimated because women in the age range 15–44 tend to underestimate their weight (Kovalchik, 2009; Merrill and Richardson, 2009). Classifications of BMI are underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9), class I & II obesity (30–39.9), and class III obesity (≥40).

Breastfeeding duration was determined by the PRAMS questions "*Are you still breastfeeding or feeding pumped milk to your new baby?*" If women responded "*yes,*" then duration of breastfeeding was estimated by subtracting the infant's date of birth from the date the PRAMS survey was filled out by the participant. If women responded "*no,*" then duration of breastfeeding was determined from the following PRAMS survey question: "*How many weeks or months did you breastfeed or pump milk to feed your baby?*" Maternal recall about breastfeeding initiation and duration has shown good reliability and validity, especially if recalled within 3 years after their infant's birth (Li et al., 2005).

Homeless status among PRAMS survey participants and WIC participation rates were compared among four geographic areas in the United States: East (Maine, Maryland, New Jersey, New York, New York City, Rhode Island, Vermont, West Virginia), Midwest (Illinois, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, Oklahoma), South (Alabama, Arkansas, Florida,

Notes to Table 2:
Of the 31 PRAMS cities/states, Montana and Vermont did not collect information on ethnicity; Georgia and New York City did not collect information on government aid; Vermont did not collect information on BMI.

[a] WIC indicates The Special Supplemental Nutrition Program for Women, Infants, and Children.

[b] PRAMS indicates Pregnancy Risk Assessment Monitoring System.

* Estimates were weighted to represent all homeless women who gave birth.

[†] Based on the Rao–Scott chi-square.

[‡] Based on weighted data, with the estimated odds ratios and 95% confidence intervals adjusted for the other variables listed in the table.

[δ] Government aid includes welfare, public assistance, general assistance, food stamps, or supplemental security income. This variable does not include WIC. Other includes income assistance from family or friends, unemployment, child support/alimony, and/or social security/disability.

Table 2
Demographic and health characteristics among homeless and non-homeless WIC[a] women completing the PRAMS[b] survey in 31 participating states/cities, 2000–2007.

	Homeless WIC		Non-homeless WIC			Homeless WIC vs. non-homeless WIC	
	No.[*]	%[*]	No.[*]	%[*]	P value[†]	Odds ratio[‡]	95% CI[‡]
Maternal age, years							
<19	31,137	9	518,214	12	<0.01	1.0	–
19–25	164,708	49	2,146,748	51		1.5	1.3–1.7
26–29	66,146	20	745,169	18		1.7	1.5–2.0
≥30	72,356	22	826,094	20		1.8	1.5–2.1
Race							
Caucasian	240,700	73	2,712,240	65	<0.01	1.0	–
African-American	63,318	19	1,156,050	27		1.3	1.2–1.5
Other	25,783	8	318,911	8		0.9	0.8–1.1
Missing	3125		30,224			1.3	0.9–1.8
Ethnicity							
Non-Hispanic	154,487	47	3,202,235	78	<0.01	1.0	–
Hispanic	173,690	53	884,098	22		4.1	3.7–4.5
Missing	4749		131,092			0.9	0.7–1.2
Maternal education, years							
<12	164,912	51	1,329,966	32	<0.01	1.0	–
12	113,492	35	1,747,833	42		0.7	0.6–0.8
>12	47,360	15	1,110,220	27		0.6	0.5–0.7
Missing	8583		48,206			1.4	1.1–1.8
Marital status							
No	212,206	64	2,506,816	59	<0.01	1.0	–
Yes	121,770	36	1,727,165	41		0.8	0.7–0.9
Missing	371		2243			1.5	0.4–5.7
Region							
East	62,182	19	775,326	18	<0.01	1.0	–
Midwest	105,801	32	1,234,093	29		1.1	1.0–1.3
South	97,500	29	1,567,982	37		0.8	0.7–0.9
West	68,864	21	658,824	16		1.1	0.9–1.2
Government aid 12 months prior to delivery[δ]		0		0			
No	140,759	67	1,629,740	70	<0.01	1.0	–
Yes	68,352	33	704,244	30		1.2	1.1–1.3
Missing	109,731		1,646,449			0.5	0.4–0.6
Health insurance							
No	274,098	82	2,708,552	64	<0.01	1.0	–
Yes	58,613	18	1,509,602	36		0.5	0.4–0.6
Missing	1635		18,071			0.7	0.4–1.2
Medicaid							
No	261,610	79	3,199,096	76	<0.01	1.0	–
Yes	70,652	21	1,021,828	24		0.9	0.8–1.0
Missing	2085		15,301			1.4	0.8–2.4
Smoke ≥ 100 cigarettes last 2 years							
No	216,787	66	2,836,445	67	0.16	1.0	–
Yes	110,920	34	1,369,858	33		1.6	1.5–1.8
Missing	6640		29,922			1.7	1.1–2.6
Drink alcohol last 2 years		0		0			
No	169,214	52	2,010,934	48	<0.01	1.0	–
Yes	158,737	48	2,192,481	52		1.1	1.0–1.2
Missing	6396		32,810			1.2	0.8–1.8
Pre-pregnancy body mass index (kg/m²)							
Underweight (<18.5)	18,615	7	259,890	7	0.82	1.0	–
Normal weight (18.5–24.9)	126,159	48	1,877,117	48		0.9	0.8–1.1
Overweight (25–29.9)	62,919	24	905,490	23		0.9	0.8–1.1
Class I & II obesity (30–39.9)	45,783	17	695,671	18		1.0	0.8–1.7
Class III obesity (≥40)	11,745	4	162,644	4		1.1	0.9–1.5
Missing	68,056		320,661			1.4	0.8–1.2
Pre-conception multivitamin use							
0 times/week	251,665	76	3,010,566	71	<0.01	1.0	–
1–3 times/week	20,127	6	325,046	8		0.9	0.8–1.0
4–6 times/week	8810	3	146,351	3		1.0	0.8–1.2
Daily	50,892	15	733,065	17		0.9	0.8–1.0
Missing	2854		21196			1.1	0.7–1.7

Table 3
Demographic and health characteristics among homeless WIC[a] and homeless non-WIC women completing the PRAMS[b] survey in 31 participating states/cities, 2000–2007.

	Homeless WIC		Homeless non-WIC			Homeless WIC vs. homeless non-WIC	
	No.[*]	%[*]	No.[*]	%[*]	P value[†]	Odds ratio[‡]	95% CI[‡]
Maternal age, years							
<19	31,137	9	7629	7	<0.01	1.0	–
19–25	164,708	49	41,963	41		0.9	0.7–1.2
26–29	66,146	20	22,854	22		0.8	0.6–1.1
≥30	72,356	22	29,883	29		0.7	0.5–0.9
Race							
Caucasian	240,700	73	75,992	75	0.09	1.0	–
African-American	63,318	19	16,605	16		1.1	0.9–1.4
Other	25,783	8	8771	9		0.9	0.7–1.1
Missing	3125		795			1.4	0.7–3.0
Ethnicity							
Non-Hispanic	154,487	47	48,110	48	0.71	1.0	–
Hispanic	173,690	53	52,546	52		0.9	0.7–1.1
Missing	4749		1506			1.0	0.6–1.7
Maternal education, years							
<12	164,912	51	44,454	44	<0.01	1.0	–
12	113,492	35	35,191	35		1.0	0.8–1.2
>12	47,360	15	20,327	20		0.9	0.7–1.1
Missing	8583		2357			1.0	0.6–1.7
Marital status							
No	212,206	64	53,043	52	<0.01	1.0	–
Yes	121,770	36	49,112	48		0.7	0.6–0.9
Missing	371		175			0.5	0.1–4.6
Region							
East	62,182	19	18,297	18	<0.01	1.0	–
Midwest	105,801	32	29,213	29		1.1	0.8–1.3
South	97,500	29	34,423	34		0.8	0.6–1.0
West	68,864	21	20,396	20		1.1	0.8–1.3
Government aid 12 months prior to delivery[§]							
No	140,759	67	51,254	77	<0.01	1.0	–
Yes	68,352	33	15,297	23		1.5	1.2–2.0
Missing	68,351		15,297			1.4	1.0–1.9
Health insurance							
No	274,098	82	68,841	67	<0.01	1.0	–
Yes	58,613	18	33,270	33		0.5	0.4–0.6
Missing	1635		219			2.6	0.7–9.6
Medicaid							
No	261,610	79	84,097	83	0.02	1.0	–
Yes	70,652	21	17,453	17		1.2	0.97–1.5
Missing	2085		799			0.7	0.3–1.9
Smoke ≥ 100 cigarettes last 2 years							
No	216,787	66	66,911	67	0.77	1.0	–
Yes	110,920	34	33,435	33		0.9	0.8–1.2
Missing	6640		1983			1.0	0.6–1.8
Drink alcohol last 2 years		0		0			
No	169,214	52	50,859	50	0.56	1.0	–
Yes	158,737	48	49,939	50		1.0	0.8–1.2
Missing	6396		1531			1.4	0.7–2.5
Pre-pregnancy body mass index (kg/m^2)							
Underweight (<18.5)	18,615	7	7052	8	<0.01	1.0	–
Normal weight (18.5–24.9)	126,159	48	46,797	55		1.1	0.8–1.5
Overweight (25–29.9)	62,919	24	17,768	21		1.5	1.1–2.1
Class I & II obesity (30–39.9)	45,783	17	11,164	13		1.7	1.2–2.4
Class III obesity (≥40)	11,745	4	2591	3		1.9	1.1–3.4
Missing	68,056		16,820			1.6	1.1–2.3
Pre-conception multivitamin use							
0 times/week	251,665	76	73,986	73	0.22	1.0	–
1–3 times/week	20,127	6	6651	7		0.9	0.7–1.3
4–6 times/week	8810	3	3936	4		0.8	0.5–1.2
Daily	50,892	15	16,420	16		1.0	0.8–1.2
Missing	2854		1336			0.6	0.3–1.2

Georgia, Louisiana, Mississippi, North Carolina, South Carolina), and West (Alaska, Colorado, Hawaii, New Mexico, Oregon, Utah, Washington). An urban/rural evaluation was also performed but limited because only 16 of the 31 PRAMS cities/states included this variable in their survey.

PRAMS weighting process

Each participating state conducts a systematic sample of 100–250 new mothers every month from mothers who recently gave birth, from a frame of eligible birth certificates. States typically oversample low weight births and stratify by the mother's race and ethnicity. Three weighting variables are provided in the PRAMS data file, a sampling weight, non-response weight, and non-coverage weight. These weights are described in detail elsewhere (CDC, 2009). Multiplying together the three components of the weights produces the analysis weight, which is interpreted as the number of women like themselves in the population that each respondent represents. The weighted equivalent to the 128,365 pregnant women included in the study is 4,672,901.

Mothers' responses are linked to birth certificate data, which contain demographic and medical information collected through the state's vital records system. Responses are then weighted to be representative of all women who gave birth in each state during that year. Assessment of the PRAMS data involved statistical software that takes into account the complex sampling designs.

Statistical techniques

Two main comparison groups were considered. First, homeless and non-homeless WIC participants were compared according to selected demographic variables, pre-pregnancy health variables, prenatal care, and infant outcome variables. Second, WIC and non-WIC homeless women were compared according to the same list of variables. Bivariate comparisons were evaluated using the chi-square test and multiple logistic regression models were used to calculate odds ratios adjusted for the selected demographic and health variables. Mean numbers of prenatal care visits, gestational age, and infant birth weight were also compared between homeless and non-homeless WIC recipients and between WIC and non-WIC homeless women using analysis of variance.

Post-stratification weights, described above, were applied to obtain representative population-based estimates of all homeless women giving birth in PRAMS. Ninety-five percent confidence intervals were calculated for the odds ratios and two-sided tests of significance were used, based on the 0.05 level. Statistical analyses were derived from Statistical Analysis System (SAS) software, version 9.2 (SAS Institute Inc., Cary, NC, USA; 2007).

Results

Homeless status and WIC usage among homeless pregnant women in the PRAMS survey are presented according to area in Table 1. Overall, 4% of women who completed the PRAMS survey were homeless and 76% of homeless pregnant women participated in WIC. Homelessness was significantly greater in the West and Midwest compared with the East, but not significantly different between the East and South. This was also true after adjusting for maternal age, education, race/ethnicity, and marital status (data not shown).

Selected demographic variables, pre-pregnancy BMI, and pre-conception multivitamin use were measured as potential predictors of WIC utilization among homeless pregnant women. Demographic and health characteristics of non-homeless WIC and homeless WIC women are presented in Table 2. A comparison between homeless WIC and homeless non-WIC women is presented in Table 3. Among women in the WIC program, homelessness was significantly more common in older women, African-American women, Hispanic women, less educated women, unmarried women, women receiving government assistance, uninsured women, women without Medicaid support, women who smoke, and women who drink alcohol. Among homeless women, WIC status was significantly greater among younger women, unmarried women, women receiving government aid, uninsured women, women with higher BMI, and women residing in the Midwest.

Because of the large number of PRAMS cities/states not including information about urban/rural setting (i.e., Arkansas, Colorado, Illinois, Maryland, Maine, Michigan, Mississippi, North Carolina, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, and West Virginia), this variable was considered in a separate model. Urban pregnant women compared with rural pregnant women participating in WIC were significantly more likely to be homeless (OR = 1.4, 95% CI = 1.2–1.8), after adjusting for the variables listed in Table 2. The urban/rural variable was not significantly associated with WIC status among homeless women.

WIC status was used to predict maternal-related health behaviors (included prenatal care visits [as reported on the birth certificate], breastfeeding initiation and duration, and well-baby checkups) and infant health outcomes (birth weight and gestational age [as reported on the birth certificate], length of hospital stay, and admission to the neonatal intensive care unit). Maternal health behaviors and infant health outcomes among non-homeless WIC and homeless WIC women are shown in Table 4. A comparison between homeless WIC and homeless non-WIC women is presented in Table 5. Among women in the WIC program, homelessness was significantly greater in those who did not have prenatal visits in the first trimester, had fewer prenatal visits, whose child was in intensive care, who breastfed but less than one week, and who did not have any well-baby checkups. Among homeless women, WIC status was significantly greater among women who had prenatal visits, had longer gestational age, had a higher birth weight, had breastfed their child, and had their child sleep on their side/back versus their side.

Discussion

The prevalence of homelessness among women in this study was 4%, which translates into approximately 1 in every 26 women aged 15–49 years in the United States (U.S. Census Bureau, 2008). Among WIC participants, those who reported experiencing homelessness were more likely to be older, African-American, Hispanic, less educated, unmarried, receiving government assistance, uninsured, and women who smoked and drank alcohol, which was generally consistent with other studies and our first hypothesis (Baggett et al., 2010; Baggett and Rigotti, 2010; Tuten et al., 2003). Consistent with other studies, alcohol and tobacco use and being uninsured negatively impacted infant health outcomes in our study (American Academy of Pediatrics, 2000; Dietz et al., 2010).

Homeless women who accessed WIC were more likely to be overweight or obese prior to pregnancy, younger, less educated,

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Notes to Table 3:

Of the 31 PRAMS cities/states, Montana and Vermont did not collect information on ethnicity; Georgia and New York City did not collect information on government aid; Vermont did not collect information on BMI.

[a] WIC indicates The Special Supplemental Nutrition Program for Women, Infants, and Children.

[b] PRAMS indicates Pregnancy Risk Assessment Monitoring System.

[*] Estimates were weighted to represent all homeless women who gave birth.

[†] Based on the Rao–Scott chi-square.

[‡] Based on weighted data, with the estimated odds ratios and 95% confidence intervals adjusted for the other variables listed in the table.

[δ] Government aid includes welfare, public assistance, general assistance, food stamps, or supplemental security income. This variable does not include WIC. Other includes income assistance from family or friends, unemployment, child support/alimony, and/or social security/disability.

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Table 4
Selected maternal health behaviors and infant health outcomes among homeless and non-homeless WIC[a] women from PRAMS[b] states/cities, 2000–2007.

	Homeless WIC		Non-homeless WIC			Homeless WIC vs. non-homeless WIC	
	No.*	%*	No.*	%*	P value[†]	Odds ratio[‡]	95% CI[‡]
Prenatal visits in first trimester							
No	131,985	41	1,213,358	29	<0.01	1.0	–
Yes	193,429	59	2,933,608	71		0.7	0.6–0.8
Missing	8933		89,259			0.9	0.7–1.2
Infant length of hospital stay							
<1 days	18,238	6	161,285	4	<0.01	1.0	–
1–2 days	159,574	49	2,297,312	55		0.8	0.6–0.9
3–5 days	115,961	36	1,392,244	33		0.9	0.7–1.1
≥6 days	29,427	9	327,647	8		1.0	0.8–1.2
Not born in hospital	2503	1	12,496	0		2.5	1.5–4.1
Missing	8643		45,241			1.4	1.0–2.0
Infant in intensive care unit							
No	276,239	85	3,662,250	88	<0.01	1.0	–
Yes	48,461	15	516,353	12		1.2	1.1–1.3
Missing	9647		57,622			1.7	1.3–2.2
Breastfeeding initiation after delivery							
No	29,094	24	577,123	31	<0.01	1.0	–
Yes	89,713	76	1,267,470	69		1.0	0.8–1.2
Missing/skip	210,526		2,263,730			1.8	1.3–2.4
Breastfeeding duration							
<1 week	6018	5	83,729	5	<0.01	1.0	–
1–3 weeks	12,189	10	192,623	11		0.7	0.5–1.1
4–7 weeks	11,773	10	184,121	10		0.7	0.5–1.1
≥8 weeks	58,467	50	790,324	43		0.7	0.5–0.9
Did not breastfeed	29,095	25	577,123	32		0.7	0.5–1.0
Missing/skip	211,792		2,280,403			1.2	0.8–1.7
Well-baby checkups, any							
No	14,686	5	89,693	2	<0.01	1.0	–
Yes	299,583	95	3,998,357	98		0.6	0.5–0.7
Missing/skip	20,078		148,174			0.9	0.7–1.2
Baby sleep position							
Side	78,328	25	864,447	21	<0.01	1.0	–
Back	164,853	52	2,246,914	55		0.9	0.8–1.0
Stomach	35,372	11	675,192	16		0.8	0.7–0.9
Side/back	23,985	8	188,812	5		1.1	0.9–1.3
Side/stomach	3275	1	37,610	1		1.0	0.7–1.4
Back/stomach	3260	1	34,146	1		1.1	0.7–1.7
All 3 positions	6240	2	49,895	1		1.1	0.8–1.6
Missing/skip	19,033		139,210			1.6	1.3–1.9
	Mean	SD	Mean	SD			P value[δ]
No. of prenatal care visits	9.5	0.1	10.1	0.0			<0.01
Gestational age, weeks	38.4	0.0	38.4	0.0			0.41
Birth weight, grams	3182	9	3182	2			0.99

Note: Of the 31 PRAMS cities/states, Alabama, Montana, and North Dakota did not collect information on breastfeeding.
[a] WIC indicates The Special Supplemental Nutrition Program for Women, Infants, and Children.
[b] PRAMS indicates Pregnancy Risk Assessment Monitoring System.
* Estimates were weighted to represent all homeless women who gave birth.
[†] Based on the Rao–Scott chi-square.
[‡] Based on weighted data, with the estimated odds ratios and 95% confidence intervals adjusted for the variables listed in Table 2.
[δ] Based on the t-test, adjusted for the variables listed in Table 2.

unmarried, and to receive government aid compared with homeless non-WIC users. Bitler and Currie (2005) also reported that WIC participants were more likely to have higher BMI. This may be because a pre-pregnancy BMI ≥ 26.1 is considered a medical or nutritional risk factor for WIC eligibility (Food and Nutrition Service [FNS], 2010). However, it is also possible that heavier women are more interested in accessing government programs or that WIC participants accessed other food assistance programs, thereby increasing access to food and in the potential for excessive caloric intake (Gibson, 2003, 2006; Kaiser, 2008; Webb et al., 2008; Zedlewski and Rader, 2005). In addition, homeless women in the Midwest were more likely to access

WIC. Although federally-funded, WIC is a state-administered program, which allows state flexibility in their promotion efforts used to encourage participation and in providing nutrition education (V. Ho, Special Supplemental Nutrition Programs—Midwest Region, Food and Nutrition Service, USDA, personal communication, October 12, 2010). Perhaps, states within the Midwest region differed in their outreach efforts to the homeless population compared with states in other regions.

The results support our second hypothesis, in that WIC participation among homeless women was positively associated with beneficial maternal health behaviors, such as increased initiation

Table 5
Selected maternal health behaviors and infant health outcomes among homeless WIC[a] and homeless non-WIC women from PRAMS[b] states/cities, 2000–2007.

	Homeless WIC		Homeless non-WIC			Homeless WIC vs. homeless non-WIC	
	No.[*]	%[*]	No[*]	%[*]	P value[†]	Odds ratio[‡]	95% CI[‡]
Prenatal visits In first trimester							
No	131,985	41	44,709	45	0.02	1.0	–
Yes	193,429	59	54,501	55		0.7	0.6–0.8
Missing	8933		3119			0.7	0.4–1.1
Infant length of hospital stay							
<1 days	18,238	6	5300	5	0.43	1.0	–
1–2 days	159,574	49	48,311	48		1.0	0.7–1.3
3– days	115,961	36	34,828	35		1.0	0.7–1.4
≥6 days	29,427	9	11,226	11		0.7	0.5–1.1
Not born in hospital	2503	1	824	1		0.8	0.3–2.1
Missing	8643		1841			1.3	0.7–2.2
Infant in intensive care unit							
No	276,239	85	83,547	84	<0.01	1.0	–
Yes	48,461	15	16,394	16		0.9	0.7–1.1
Missing	9647		2388			1.2	0.8–1.9
Breastfeeding initiation after delivery							
No	29,094	24	9630	30	<0.01	1.0	–
Yes	89,713	76	22,436	70		1.4	1.1–1.9
Missing/skip	210,526		69,365			0.6	0.4–1.0
Breastfeeding duration							
<1 week	6018	5	947	3	0.24	1.0	–
1–3 weeks	12,189	10	2604	8		0.7	0.3–1.7
4–7 weeks	11,773	10	3254	10		0.6	0.2–1.4
≥8 weeks	58,467	50	15,344	48		0.6	0.3–1.3
Did not breastfeed	29,095	25	9630	30		0.4	0.2–1.0
Missing/skip	211,792		69,651			0.3	0.1–0.7
Well-baby checkups, any							
No	14,686	5	5312	6	0.18	1.0	–
Yes	299,583	95	86,404	94		1.3	0.9–1.8
Missing/skip	20,078		10,614			0.7	0.4–1.0
Baby sleep position							
Side	78,328	25	25,127	27	0.37	1.0	–
Back	164,853	52	48,920	53		1.1	0.9–1.4
Stomach	35,372	11	9322	10		1.3	0.9–1.7
Side/back	23,985	8	4872	5		1.6	1.1–2.3
Side/stomach	3275	1	978	1		1.1	0.5–2.2
Back/stomach	3260	1	888	1		1.2	0.5–2.9
All 3 positions	6240	2	1836	2		0.9	0.5–1.8
Missing/skip	19,033		10,386			0.6	0.4–0.8
	Mean	SD	Mean	SD			P value[δ]
No. of prenatal care visits	9.5	0.1	8.5	0.2			<0.01
Gestational age, weeks	38.4	0.0	38.2	0.1			<0.01
Birth weight, grams	3182	9	3109	14			<0.01

Note: Of the 31 PRAMS cities/states, Alabama, Montana, and North Dakota did not collect information on breastfeeding.
 [a] WIC indicates The Special Supplemental Nutrition Program for Women, Infants, and Children.
 [b] PRAMS indicates Pregnancy Risk Assessment Monitoring System.
 [*] Estimates were weighted to represent all homeless women who gave birth.
 [†] Based on the Rao–Scott chi-square.
 [‡] Based on weighted data, with the estimated odds ratios and 95% confidence intervals adjusted for the variables listed in Table 2.
 [δ] Based on the *t*-test, adjusted for the variables listed in Table 2.

and duration of prenatal care visits, and infant health outcomes. WIC's mission includes providing referrals to outside medical services, which may have promoted earlier and longer use of prenatal care (Oliveira and Frazão, 2009). It is also plausible that homeless women were encouraged by their prenatal care clinic to enroll in WIC (Kahler et al., 1992) and that the homeless women enrolling in WIC were more motivated to engage in healthy behaviors to improve their infant's health (Besharov and Germanis, 2001).

Homeless WIC participants were also more likely to initiate breastfeeding than homeless non-WIC women, which offers maternal and infant health benefits (Ip et al., 2007). Perhaps WIC staff promoted breastfeeding, thus increasing their likelihood to initiate breastfeeding (Murimi et al., 2010). However, among PRAMS women in the WIC program, homelessness was greater among those who breastfed less than one week. Barriers to breastfeeding among WIC participants have included sore nipples and pain, perceptions of inadequate milk supply, and social support networks' attitudes about breastfeeding (Heinig et al., 2009). It is possible that these barriers would be heightened for homeless women because of inadequate access to lactation resources, concerns about inadequate milk production, or because of returning to the workforce (Dennis, 2001; Heinig et al., 2006; Kimbro, 2006).

A study limitation is that the PRAMS data is self-reported and retrospective, thus potentially introducing bias. In addition, some PRAMS cities/states did not include certain variables, which may affect the representation of our results. A high percentage of missing information on government aid and breastfeeding means that results involving these variables should be interpreted with caution. The duration of homelessness could not be determined and whether the mother was still experiencing homelessness at the time of survey administration is unknown nor could we assess if women resided in shelters, with family or friends, or on the streets.

PRAMS data are weighted to be representative of all pregnant women in the participating states. However, because only women with a residential location were contacted, it may not be representative of all homeless pregnant women but possibly representing more advantaged homeless women than those without a home base. Future research is needed to evaluate the impact of WIC on maternal health behaviors among homeless women without a home base.

In conclusion, the current study indicates that accessing WIC during pregnancy was associated with positive health behaviors, such as breastfeeding initiation, prenatal care use, and improved infant health outcomes. However, 24% of homeless pregnant women in our study did not access WIC. Perhaps, places frequented by homeless individuals, such as soup kitchens, food banks, and homeless shelters, can educate childbearing-aged women about the WIC program. Collectively, it is important for nutritionists, especially those affiliated with WIC, and other health care professionals to encourage homeless women to enroll in this government program as a means to promote healthy pregnancy outcomes.

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