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Assessing Immunization Interventions in the Women, Infants, and Children (WIC) Program

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Abstract

Background—Vaccination promotion strategies are recommended in Women, Infants, and Children (WIC) settings for eligible children at risk for under-immunization due to their low-income status.

Purpose—To determine coverage levels of WIC and non-WIC participants and assess effectiveness of immunization intervention strategies.

Methods—The 2007–2011 National Immunization Surveys were used to analyze vaccination histories and WIC participation among children aged 24–35 months. Grantee data on immunization activities in WIC settings were collected from the 2010 WIC Linkage Annual Report Survey. Coverage by WIC eligibility and participation status and grantee-specific coverage by intervention strategy were determined at 24 months for select antigens. Data were collected 2007–2011 and analyzed in 2013.

Results—Of 13,183 age-eligible children, 5,699 (61%, weighted) had participated in WIC, of which 3,404 (62%, weighted) were current participants. In 2011, differences in four or more doses of the diphtheria, tetanus toxoid, and acellular pertussis (DTaP) vaccine by WIC participation status were observed: 86% (ineligible); 84% (current); 77% (previous); and 69% (never-eligible). Children in WIC exposed to an immunization intervention strategy had higher coverage levels than WIC-eligible children who never participated, with differences as great as 15% (DTaP).

Conclusions—Children who never participated in WIC, but were eligible, had the lowest vaccination coverage. Current WIC participants had vaccination coverage comparable to more affluent children, and higher coverage than previous WIC participants.

Introduction

Since 1996, the Advisory Committee on Immunization Practices (ACIP) has recommended implementation of interventions in Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) settings to promote vaccination of low-income preschool-aged eligible children at risk for under-vaccination.[1–3] Interventions are based on assessment of a child's immunization status and referral to a provider if under-immunized (i.e., Assessment

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and Referral [A&R]) and may be supplemented by additional strategies.[3] Supplemental strategies may include monthly voucher pick-up (MVP); outreach and tracking (O&T); and parental incentives (PI). Descriptions are well documented.[4,5]

Several studies[6–16] demonstrated the effectiveness of WIC-based strategies. However, no studies assessed coverage across multiple years and few compared coverage between WIC and non-WIC participants.[5,17,18] Therefore, the aims of this study were to determine (1) 2007–2011 coverage levels of children based on their WIC status and (2) coverage levels by intervention strategy.

Methods

Sample

Data from the 2007–2011 National Immunization Surveys (NIS) were used to identify children representative of non-overlapping geographic areas, including the 50 U.S. states, eight U.S.-affiliated jurisdictions, six urban areas, and U.S. Virgin Islands (since 2009). Children are identified through a household telephone survey. Beginning in 2011, children may have been included from cell phone respondents. NIS sampling and analytical methodologies are previously described.[19]

The 2010 WIC-Linkage Annual Report Survey (WIC-LARS) was used to collect grantee-specific information on WIC sites. Data include number of WIC sites conducting immunization linkage activities and strategy utilized. The survey is completed by grantee immunization programs annually. Prior approval of data collection activities was granted by CDC's Research Ethics Review Board.

This analysis was limited to children aged 24–35 months residing in areas that provided WIC-LARS data, resulting in the inclusion of 54 geographic areas (hereafter, referred to as "grantees"). Children with missing provider type (n=126) or demographics (n=61) were excluded. In 2011, of the 13,508 children aged 24–35 months with provider data, 13,183 children were eligible for inclusion. Characteristics of eligible children were similar from 2007 to 2011; thus, data from 2011 are highlighted.

NIS data were used to assess the following provider-verified immunizations at age 24 months: ≥4 doses containing diphtheria, tetanus toxoids, and acellular pertussis (DTaP), ≥1 dose of measles, and the 4:3:1:3:3:1:4 vaccine series (≥4 doses of DTaP, ≥3 doses of polio, ≥1 dose of measles, ≥3 doses of *Haemophilus influenza* type b (Hib), ≥3 doses of hepatitis B (HepB), ≥1 dose of varicella, and ≥4 doses of pneumococcal conjugate vaccine (PCV), modified with the exclusion of Hib (hereafter, referred to as "4:3:1:*:3:1:4") due to the 2007–2009 shortage.[20,21]

WIC status was based on parental responses to NIS questions as to whether a child ever and were currently receiving WIC benefits. Children never participating in WIC were further categorized based on their eligibility at time of interview, defined as having family income ≤185% of the federal poverty level. The four resulting groups were (1) WIC ineligible; (2)

WIC eligible/never participated; (3) WIC eligible/previous participant; and (4) WIC eligible/current participant.

Grantees implementing supplemental strategies among the majority of its total WIC sites were categorized by the strategy most widely implemented, as reported in the 2010WIC-LARS. A grantee implementing the principal intervention only or with supplemental strategies was categorized as A&R Only or A&R Plus, respectively.

Data Analysis

Coverage by WIC status was examined. Estimates were adjusted for race (non-Hispanic white, non-Hispanic black, Hispanic, Asian, and other); mother's age (≤19, 20–29, and ≥30 years); mother's education (less than versus high school graduate); region (city, suburb, and rural); health insurance; and immunization facility (private, public, military/hospital/other, and mixed).

Data were obtained from the 2011 NIS and 2010 WIC-LARS to determine grantee-specific estimates, by strategy, for current WIC participants and ineligibles at 24 months. Comparison between current and ineligible participants was conducted to test for differences in coverage.

Logistic models were used to determine coverage estimates and SEs. All models were estimated using SUDAAN, version 11 (RTI International, Research Triangle Park NC), to account for survey probability sampling and weighting. Data were collected during 2007–2011 and analyzed in 2013.

Results

In 2011, 5,699 (61%, weighted) of 13,183 children had a history of WIC participation, of which 3,404 (62%, weighted) were enrolled at the time of interview. Among children who never participated, 687 (13%) were WIC-eligible. Race, mother's age and education, region, health insurance, and immunization facility differed significantly by WIC status (data not shown).

Differences in immunization coverage were observed at age 24 months. WIC-eligible children who never participated had the lowest rates for nearly all vaccines from2007 to 2011 (Table 1). Their series coverage ranged from 7% to 16% and 5% to 19% lower than WIC-ineligible and current participants, respectively. Similarly, significant gaps between previous and current WIC participants existed for nearly all vaccines from 2007 to 2011. Previous participants had series coverage ranging from 1% (2009) to 10% (2010) lower than current participants. No significant differences in coverage for any vaccine were observed between current participants and children ineligible for WIC, except for DTaP in 2010.

In comparing series coverage at 24 months between current participants and more affluent ineligibles, 23 (88%) of 26 grantees categorized as primarily implementing A&R Only strategies had no significant differences in coverage (Table 2). These 23 grantees had coverage among current participants ranging from 54% to 87% (median=72%), similar to that among ineligibles, ranging from 57% to 85% (median=72%). However, in three

grantees, coverage among current participants was 19%–24% lower compared to ineligibles. Similar results were seen among grantees categorized as primarily implementing A&R Plus strategies. Series coverage at 24 months among current participants (range=56%–88%, median=68%) was comparable to ineligibles (range=61%–89%, median=74%) (Table 2).

Discussion

These results support earlier findings on the benefits of WIC-based immunization interventions.[5,17,18] Furthermore, the study reveals that eligible children who remain in WIC tend to have immunization coverage comparable to more affluent children. However, not all eligible children are benefiting from WIC. This study estimated that 8% of eligible children never made use of the program and among children who dis-enrolled, 72% still met income eligibility at time of interview.

The study findings should be considered within the context of limitations. First, WIC status was assessed at the time of interview and may be misclassified at age 24 months. Second, this study was unable to determine intervention by WIC site. Intervention was determined at the grantee level and may not represent what a child received. Studies determined MVP[7,9,11,14] and increased assessments[22] as effective strategies. Although measures were unavailable to determine which strategies led to increased coverage, grantee-specific rates suggest strategies are beneficial. Third, this study was unable to control for grantee-level factors potentially influencing coverage, including WIC resources, staffing, and variation in policies.[18,23] Finally, this study is cross-sectional, thereby precluding a causal link, and data, although weighted to be representative, may remain biased.

Poverty remains a predictor for under-vaccination; however, low-income children participating in WIC were shown to have immunization rates comparable to more affluent children. Although the Vaccines for Children program has bridged gaps, coverage among poorer children remains lower.[24] Thus, increased efforts to enroll and retain eligible children in WIC are needed to ensure they benefit from vaccination promotion strategies.

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Table 1

Coverage at 24 months, by WIC eligibility and status, 2007–2011 NIS, % SE (weighted)

Doses	WIC eligibility, participation status, and coverage at 24 months[a]			
	WIC ineligible (*n*=6,797 [unweighted])	WIC eligible, never participated (*n*=687 [unweighted])	WIC eligible, previous participant (*n*=2,295 [unweighted])	WIC eligible, current participant (*n*=3,404 [unweighted])
2007				
DTaP, ≥4	86 (1.0)	**79 (2.7)**[c]	**76 (1.7)**[c]	**84 (1.1)**[d]
Measles, ≥1	94 (0.6)	**89 (2.1)**[c]	**89 (1.3)**[c]	**94 (0.7)**[d,e]
4:3:1:*:3:1:4[b]	68 (1.4)	61 (3.7)	**59 (1.8)**[c]	**66 (1.6)**[d]
2008				
DTaP, ≥4	85 (1.1)	**75 (3.0)**[c]	**78 (1.6)**[c]	**83 (1.2)**[d,e]
Measles, ≥1	93 (0.8)	**88 (2.3)**[c]	**90 (1.3)**[c]	**94 (0.8)**[d,e]
4:3:1:*:3:1:4[b]	70 (1.3)	**63 (3.2)**[c]	**63 (1.9)**[c]	**69 (1.5)**[d]
2009				
DTaP, ≥4	83 (1.3)	**69 (3.4)**[c]	**76 (1.7)**[c,e]	**83 (1.1)**[d,e]
Measles, ≥1	91 (1.1)	**85 (2.3)**[c]	**90 (1.1)**[e]	**93 (0.8)**[e]
4:3:1:*:3:1:4[b]	69 (1.4)	**53 (3.5)**[c]	**62 (1.9)**[c,e]	**72 (1.4)**[d,e]
2010				
DTaP, ≥4	86 (1.0)	**77 (3.6)**[c]	**77 (1.7)**[c]	**82 (1.3)**[c,d]
Measles, ≥1	91 (0.8)	91 (1.8)	90 (1.1)	**93 (0.8)**[d]
4:3:1:*:3:1:4[b]	68 (1.3)	**57 (4.1)**[c]	**63 (1.9)**[c]	64 (1.5)
2011				
DTaP, ≥4	86 (1.1)	**69 (3.0)**[c]	**77 (1.7)**[c,e]	**84 (1.1)**[d,e]
Measles, ≥1	92 (0.7)	**83 (2.6)**[c]	**90 (1.2)**[e]	**94 (0.7)**[d,e]
4:3:1:*:3:1:4[b]	72 (1.4)	**56 (3.1)**[c]	**64 (1.9)**[c,e]	**71 (1.4)**[d,e]

Note: Logistic regression estimates adjusted for race, mother's age and education, region, health insurance, and immunization facility; weighted to account for sampling. Boldface indicates statistical significance.

[a] WIC income eligibility and participation status determined at time of interview; income eligibility based on family income ≤185% of federal poverty level.

[b] 4:3:1:*:3:1:4= ≥4 doses of DTaP, ≥3 doses of poliovirus, ≥1 dose of measles, ≥3 doses of Hib, ≥3 doses of HepB, ≥1 dose of varicella, and ≥4 doses of PCV, excluding Hib.

[c] Significant difference in coverage compared to children never receiving WIC benefits and not income eligible ($p<0.05$).

[d] Significant difference in coverage compared to children previously receiving WIC benefits ($p<0.05$).

[e] Significant difference in coverage compared to children never receiving WIC benefits and income eligible ($p<0.05$).

DTaP, diphtheria, tetanus toxoids, and acellular pertussis–containing vaccine; HepB, hepatitis B; Hib, *Haemophilus influenza* type b; NIS, National Immunization Surveys; PCV, pneumococcal conjugate vaccine; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 2

Grantee-specific coverage, by intervention, WIC eligibility, and status, 2011 NIS and 2010 WIC-LARS, % (SE)

Coverage[a] at 24 months in grantees categorized as A&R Only[b]			Coverage[a] at 24 months in grantees categorized as A&R Plus[b]		
Awardee (*n*)	**WIC ineligible[c]**	**WIC eligible, current participant[c]**	**Awardee (*n*)**	**WIC ineligible[c]**	**WIC eligible, current participant[c]**
Arizona (141)	64 (7.5)	63 (10.0)	Alabama (214)	69 (6.2)	66 (5.7)
Arkansas (158)	83 (4.4)	73 (6.5)	Alaska (137)	74 (6.2)	65 (7.5)
California (235)	77 (5.0)	72 (5.0)	Chicago (231)	76 (4.2)	76 (7.2)
Colorado (216)	72 (7.1)	87 (5.9)	Connecticut (232)	75 (3.6)	64 (8.6)
Delaware (174)	73 (5.7)	66 (7.5)	Dist of Columbia (213)	77 (3.9)	72 (7.5)
Georgia (186)	**88 (3.2)**	**64 (7.1)**	Florida (182)	79 (4.5)	67 (7.4)
Houston (173)	60 (6.2)	73 (5.8)	**Hawaii (157)**	**65 (8.3)**	**86 (4.6)**
Indiana (210)	79 (4.6)	67 (6.7)	Idaho (144)	61 (7.0)	73 (8.8)
Iowa (181)	80 (4.1)	59 (11.7)	Illinois (189)	70 (5.4)	58 (9.1)
Maine (155)	72 (5.0)	79 (5.7)	Kentucky (144)	89 (3.2)	85 (6.3)
Michigan (210)	75 (5.0)	73 (7.2)	Louisiana (138)	70 (6.5)	83 (5.6)
Minnesota (148)	**82 (3.9)**	**59 (10.3)**	Maryland (356)	77 (3.8)	68 (7.8)
Missouri (207)	68 (5.1)	54 (7.3)	Massachusetts (182)	83 (3.3)	88 (9.8)
Nebraska (166)	**85 (3.5)**	**66 (9.3)**	Mississippi (155)	77 (6.4)	81 (5.2)
Nevada (157)	68 (6.4)	64 (9.4)	New Hampshire (135)	72 (5.4)	65 (11.0)
New Jersey (178)	67 (4.5)	70 (8.2)	New York (145)	68 (4.8)	74 (9.9)
New Mexico (148)	79 (4.7)	76 (6.2)	North Carolina (138)	72 (6.2)	72 (8.4)
New York City (160)	61 (5.8)	67 (6.4)	North Dakota (139)	78 (6.3)	64 (11.3)

Coverage[a] at 24 months in grantees categorized as A&R Only[b]			Coverage[a] at 24 months in grantees categorized as A&R Plus[b]		
Awardee (*n*)	**WIC ineligible[c]**	**WIC eligible, current participant[c]**	**Awardee (*n*)**	**WIC ineligible[c]**	**WIC eligible, current participant[c]**
Ohio (164)	85 (4.4)	81 (5.9)	Pennsylvania (372)	73 (4.0)	73 (5.9)
Oklahoma (138)	57 (9.6)	63 (7.3)	South Dakota (141)	83 (4.9)	66 (10.9)
Oregon (155)	71 (5.8)	71 (10.6)	Tennessee (134)	76 (6.3)	64 (8.2)
Rhode Island (222)	71 (4.1)	76 (6.8)	Texas (716)	71 (5.1)	71 (4.3)
South Carolina (116)	71 (7.3)	74 (7.3)	Utah (188)	73 (5.1)	56 (10.8)
Vermont (148)	75 (5.9)	73 (6.7)	Wyoming (147)	66 (6.7)	58 (11.2)
West Virginia (186)	74 (5.0)	65 (5.6)			
Wisconsin (187)	77 (4.4)	79 (6.9)			

Note: Boldface indicates significant difference in coverage compared to WIC-ineligible children ($p<0.05$). Logistic regression estimates weighted to account for sampling.

[a]Coverage defined as up to date on 4:3:1:*:3:1:4 series= ≥4 doses of DTaP, ≥3 doses of poliovirus, ≥1 dose of measles, ≥3 doses of Hib, ≥3 doses of HepB, ≥1 dose of varicella, and ≥4 doses of PCV, excluding Hib.

[b]Based on intervention primarily implemented among majority of grantee WIC sites.

[c]WIC income eligibility and participation status determined at time of interview; income eligibility based on family income ≤185% of federal poverty level.

A&R, assessment and referral; DTaP, diphtheria, tetanus toxoids, and acellular pertussis–containing vaccine; HepB, hepatitis B; Hib, *Haemophilus influenza* type b; NIS, National Immunization Surveys; PCV, pneumococcal conjugate vaccine; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; WIC-LARS, WIC Linkage Annual Report Survey.