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This study demonstrates how community-based immunization promotion reduced immunization disparities. In 2002 to 2004, the coalition enrolled 3,748 children younger than 5, with 1,502 aged 19 to 35 months in April 2004. Disparity reduction was assessed by comparing coalition immunization coverage rates (4:3:1:3:3) to the National Immunization Survey 2003 rates. Logistic regression was used to assess factors contributing to up-to-date immunizations. Coverage increased from 46.0% at enrollment to 80.5%, matching nationwide rates for all ($t = 0.87$) or White ($t = 1.99$) children. The 78% for African Americans was higher than 73% for U.S. African American children ($t = 2.90$); 84% for Latinos was higher than 77% for U.S. Latinos ($t = 2.32$). Being current with age-appropriate immunizations at enrollment ($OR = 9.8$), being Latino ($OR = 1.6$), and participating through child health insurance enrollment ($OR = 4.9$), Women, Infants, and Children ($OR = 3.1$), or child care or parenting ($OR = 1.9$) programs increased immunization coverage. Embedding immunization promotion into existing community programs was successful in eliminating immunization disparities. Most effective programs were those with direct linkages to health care systems or that targeted young children.

Keywords: *community based; child health promotion; childhood immunization; health disparities*

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Immunization disparities for children in communities of color widened during the 1996 to 2001 period (Chu, Barker, & Smith, 2004). These racial and ethnic disparities are multifactorial in origin. Families in communities of color tend to be poorer, have lower access to care, and receive fragmented, lower quality health care (Institute of Medicine, 2002). These communities also have a higher proportion of recent immigrants, who are frequently undocumented and linguistically isolated (Higgins & Metzler, 2001; Hohmann & Shear, 2002). Evidence shows that the most effective strategies for the reduction of immunization disparities have been comprehensive and multifaceted, with a mixture of provider strategies for tracking and reminder-recalls with community outreach (Szilagyi et al., 2000; Wood and American Academy of Pediatrics Committee on Community Health Services, American Academy of Pediatrics Committee on Practice and Ambulatory Medicine, 2003). Most of these programs have been developed by health provider organizations who reached into the community, rather than by communities working within (Browngeohl, Kennedy, Krotki, & Mainzer, 1997; Wood et al., 1998). Yet, immunization promotion is particularly well suited to a community-based effort because it is inclusive of all children in the community. Surprisingly little research has been reported on the effectiveness of community-owned and community-based strategies for promoting immunizations (Barnes, Friedman, Namerow, & Honig, 1999; Hoekstra et al., 1998; Irigoyen & Findley, 1998).

The objective of this study is to document how immunization promotion can be integrated into existing

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community service programs, to become truly community based, illustrating this with a case study of a coalition of communities of color in northern Manhattan, New York City. In the 1990s after the measles epidemic, parallel immunization promotion initiatives were launched by provider and community groups. Between 1996 and 2000, the Northern Manhattan Immunization Partnership worked to improve provider knowledge, decrease missed opportunities to vaccinate, and improve immunization delivery at provider offices and clinics (Findley et al., 2003). Simultaneously, two networks were established by community groups to promote immunizations. In 1999, the provider and community groups joined efforts and launched the Northern Manhattan Start Right Coalition, with the overall goal to reduce childhood immunization disparities. The program was guided by the principles

of community-based, participatory research and evaluation, which emphasize community leadership in program goals, design, and implementation (Israel, Schulz, Parker, & Becker, 1998; Minkler & Wallerstein, 2003; Mutha, Allen, & Welch, 2002). After 2 years of planning and piloting, the coalition agreed on a strategy and began implementing the immunization promotion program. This article reports on the implementation of the Start Right program and documents the narrowing of childhood immunization disparities for children enrolled in the program.

METHOD

Study Setting

Northern Manhattan includes the communities of Harlem and Washington Heights, among the most disadvantaged in the city and nation. Almost two thirds of the families have incomes 200% below the poverty level, and a third receive income supplement (U.S. Bureau of the Census, 2000). In 2000, the population was 421,820, of whom 52% were Latinos and 38% African Americans. Harlem is predominantly African American (77%), whereas Washington Heights is predominantly Latino (74%). Two out of five residents (40%) in these communities are foreign born, the majority from the Dominican Republic but also from West Africa and other Latin American countries (Lobo, Salvo, & Virgen, 1996; U.S. Bureau of the Census, 2000). These communities have a very rich cultural heritage and are well networked, with a large variety of community organizations. Some of the city's largest multiservice organizations are based in northern Manhattan and are leaders in developing innovative strategies for promoting health insurance, housing and community advocacy, community-based schools, and women's health initiatives. These organizations became the founding members of the Start Right coalition.

The Program

Start Right is a community-based immunization promotion program of outreach and tracking for children younger than 5 in northern Manhattan, New York City (Findley, Irigoyen, Sanchez, et al., 2004). The program was designed, implemented, and directed by a coalition of 23 community organizations, including 5 community social service organizations, 8 child care providers, 2 housing advocacy organizations, 3 Women, Infants, and Children (WIC) programs, 3 primary care provider networks, 1 city agency, and 1 academic partner. The Columbia University Mailman School of Public Health is the coalition lead agency, and two community-based organizations are hubs for Washington

Heights (Alianza Dominicana) and Harlem (Harlem Congregations for Community Improvement).

The Start Right program was developed through an interactive process that selected best-practices recommendations for child health promotion using the perspective of the members' own previous experiences in promoting immunizations or child health. The following best practices for immunization and health promotion were selected: linking health promotion with community social service programs (Green & Kreuter, 1999; Israel, Checkoway, Schulz, & Zimmerman, 1994; Van Ryn & Heaney 1997), use of peer health educators (Brach & Fraser, 2000; Eng, Parker, & Harlan, 1997; Lewin et al., 2005; Offit, 2002), patient tracking at provider sites (Briss et al., 2000; Rodewald et al., 1999; Szilagyi et al., 2002), and shared accountability among partners (Institute of Health Promotion, Research University of British Columbia, n.d.; Israel et al., 1998).

The coalition opted for integrating immunization promotion activities into ongoing programs at community organizations rather than creating a separate immunization program. The coalition members' prior experience lead to the selection of the following programmatic areas: Head Start and other child care programs, parenting programs for pregnant women and mothers with infants and young children, facilitated child health insurance enrollment, the supplemental program for WIC, faith-based parenting programs, and housing assistance organizations. Coalition members adopted a goal of empowering parents participating in programs at their organization to be active partners in keeping their children immunized and healthy. Rather than adding another layer of staff, the main actors at each organization would be a corps of peer health educators, who were already working in other programmatic areas at the organization. Each organization adapted the coalition implementation guide to fit its own programs so that they could capitalize on multiple and regular contacts with families as the context for educating and reminding parents about immunizations. Finally, we facilitated linkages between the community organizations and community health care providers so that they could work together to immunize children, including being alert to all opportunities to vaccinate. The evaluation component of the program was approved by the Columbia University Medical Center Institutional Review Board.

The Start Right intervention consisted of health education, reminders, follow-up, and incentives, all delivered in the context of the routine programs offered by coalition members. At each of the organization's programs, parents were invited to participate in the program, and for those who consented, they were offered the Start Right intervention, both immunization education and

reminders, within the program. For example, parents followed at parenting programs, such as Healthy Families, were told about the Start Right program and invited to participate at regular meetings with their case workers. Reminders and other follow-up efforts were made at the time of routine encounters with the parents and by special follow-up cards and calls about immunizations from the program staff. Some organizations implemented Start Right in only one of their programs, and others at several programs. Across all organizations, Start Right parents were recruited from 32 different educational and social service programs. The most common recruitment programs were facilitated enrollment for health insurance (25% of children); WIC or welfare program offices (37%); parenting programs, including home visiting programs (18%); child care or Head Start programs, including family day care provider networks (13%); and housing or tenant advocacy programs (5%). A very small number joined the program by referral from primary care practices (2%). Half (50%) of the parents were recruited through personalized contact with organization staff, the remainder through a variety of group outreach activities.

A critical component of the Start Right program was training the organization's staff to provide immunization education and support. Start Right developed training modules on immunization basics, vaccination card reading, tips on educating parents, and tracking families. By April 2004, 732 staff from the 18 community-based organizations had been trained. This training integrated the use of the detailed implementation guidelines for each programmatic area and trained staff on when to approach parents about immunizations, how to determine child vaccination status, how to convey immunization messages, and, most important, how to integrate follow-up and feedback to parents within routine program activities. The coalition also developed its own educational tools to use with parents, including a bilingual flyer with pictures and facts about vaccine-preventable diseases, the vaccination schedule recommended by the Advisory Committee on Immunization Practices (ACIP), and contact information for members of the Start Right coalition. Coalition members complemented this flyer with other immunization education materials, depending on the questions and concerns raised by parents. Parents participating in Start Right received education about immunizations through group education sessions and one-on-one contacts, intensive reminders to the parents before a child's immunizations were due, and follow-up to make sure that the child received the immunizations. Parents received an average of 5.1 contacts with explicit Start Right messages or information, in a combination of group educational and

one-on-one interactions. These repeated follow-ups were provided in the context of each organization's ongoing program activities in which the parents participated. For example, at the child care programs, the reminders were given directly to each parent by the child care staff, whereas for those participating in parenting programs, they were given at the appropriate home visit or case management visit.

The coalition also maintained strong linkages to health care providers with the goal that every child would have a medical home. Start Right staff helped parents maintain connections to their primary care providers, for example by making appointments or escorting parents to appointments. Staff also helped parents choose a primary care provider when enrolling in a health insurance plan. At the same time, Start Right staff maintained direct connections with the primary care providers, making presentations about immunizations at practices and inviting families to enroll in Start Right.

Each organization maintained records for the families it enrolled and was responsible for follow-up reminders and reading of the immunization cards. Children left the program at age 5 or when they had completed all immunizations required by age 3. When a child had completed preschool immunizations, the parent received a small gift, such as an age-appropriate book.

Sample

Between 2002 and 2004, 4,859 parents heard about Start Right, 3,750 were eligible and invited to participate, 3,748 enrolled, and only 2 declined participation. After enrollment, 199 parents were lost to follow-up, of whom only 25 parents explicitly dropped out of the program. To enable comparison to the National Immunization Survey (NIS; which reports only on children 19-35 months of age), Zell, Ezzati Rice, Battaglia, and Wright (2000) report on children in the program who were 19 to 35 months of age at April 16, 2004. Their target sample size was 1,505, to detect a 0.5% difference from the NIS coverage rates, with 95% confidence and an 80% power of a Type II error. There were 1,502 children 19 to 35 months of age in our program as of April 16, 2004, which was sufficient for the proposed analyses.

Data Sources

To track immunizations and minimize the problem of record scatter (Stille & Christison-Lagay, 2000; Stokley, Rodewald, & Maes, 2001; Yusuf et al., 2002), the coalition

created its own data warehouse for children enrolled in the program, including vaccination records from three sources: a hospital immunization registry (EzVAC), the NYC Citywide immunization registry (CIR), and the parent hand-held cards. Each coalition member had a copy of the records for children enrolled through his or her organization, which were updated through monthly exchanges (upload and download) with the main database housed at the Columbia University Medical Center, which had the responsibility for updates from the EzVAC and CIR immunization registries. Of the 3,748 children enrolled in this period, 66% were included in the hospital registry or the CIR, and 96% had parent held cards. A child match algorithm used the child's names, date of birth, gender, mother's name, and, if available, Medicaid number. This algorithm allowed for errors in spelling and date of birth entry, and all possible matches were hand reviewed before determining that a child was not in the registry. Immunization doses delivered within a 3-day window were considered a single dose, to eliminate possible double counting related to delays in data entry. Coverage rates are reported for children enrolled between 2002 and 2004, as of April 16, 2004.

Measures

The primary outcome measure was up-to-date (UTD) coverage at age 19 to 35 months as of April 16, 2004, for the 4:3:1:3:3 series (4 diphtheria-tetanus-pertussis, 3 polio, 1 measles-mumps-rubella, 3 *Haemophilus influenzae* b, and 3 Hepatitis B), as recommended by the ACIP (Centers for Disease Control and Prevention, 2003a, 2003b, 2003c). Start Right coverage rates were calculated for all children in this cohort and for each racial/ethnic subgroup.

The 4:3:1:3:3 immunization rates for children in Start Right were compared to the national rates, as reported by the NIS 2003. The national comparison groups were children 19 to 35 months of age in the United States and in New York City, by racial and ethnic group (White non-Latino, African American non-Latino, and Latino; Centers for Disease Control and Prevention, 2003a, 2003b, 2003c). The coverage rates for Washington Heights were compared to rates for Latino children in the NIS survey; those of children in Harlem were compared to coverage for African American children in the NIS survey. One-sample *t* tests were used to assess significant differences between the average immunization rates at 19 to 35 months of age for children in Start Right compared to the coverage rates for NYC and U.S. children, as reported by the NIS. Logistic regression analyses were used to assess the relative contribution of different child and

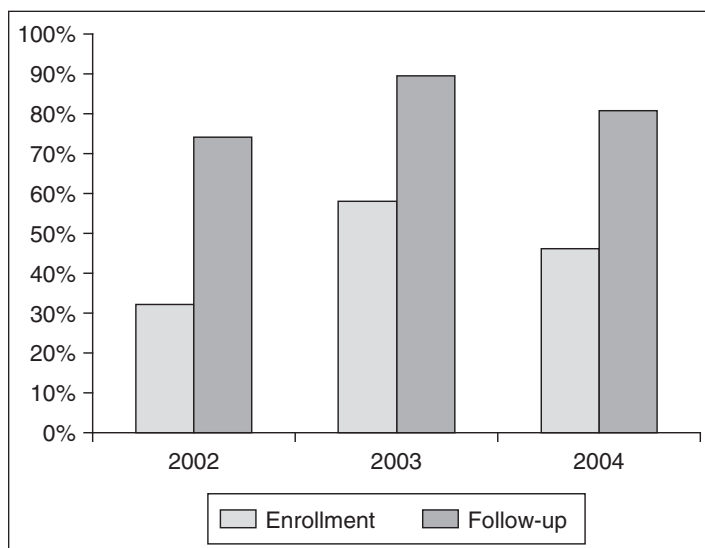


FIGURE 1 Start Right Immunization Coverage Rates (4:3:1:3:3) at Enrollment and Follow-Up by Enrollment Cohort (Children 19 to 35 Months of Age at April 2004 Follow-Up)

TABLE 1
Vaccination Coverage Levels (4:3:1:3:3) Among Start Right Participants Versus U.S. and New York City National Immunization Survey

Racial and Ethnic Group	National Immunization Survey 2003				Start Right (2002-2004)	
	U.S. Sample		NYC Sample		Total	
	%	±%	%	±%	%	±%
Total	79.4	0.9	72.7	6.7	80.5	4.8
White, non-Latino	82.5	1.1	—	—	—	—
African American	73.0	3.2	—	—	78.4	4.7
Latino	77.0	2.1	73.7	9.5	83.7	4.9

SOURCE: 2003 National Immunization Survey.

program factors to being UTD with immunizations as of April 16, 2004. In the logistic regressions, we used the following independent variables: time since enrollment (days), age of the child at enrollment, gender, Latino ethnicity (yes-no), immunization status at enrollment, community-based organization, and program strategy. Program strategies were ranked from 1 to 4 by level of interaction with the health care system, independent of the Start Right program. Level 4, the highest, included primarily facilitated enrollment programs for child

health insurance and the small numbers of referrals from provider offices. Level 3 included WIC, food stamp, and income maintenance programs, Level 2 included child care and parenting programs, and Level 1 included housing assistance, faith-based organizations, and community fairs.

RESULTS

At enrollment, 46% of the children 19 to 35 months were UTD with the 4:3:1:3:3 immunization series, significantly below the national average for all children for 2003. Immunization coverage rates increased to 80.5% by April 2004 (see Figure 1). The gain in coverage varied by year of enrollment in Start Right, being the highest for children enrolled in 2002 ($n = 568$). The 2004 coverage rates were highest for the cohort of children enrolled in 2003 ($n = 524$), among whom 90.0% were UTD.

In Table 1, the immunization coverage rates of Start Right participants were compared against the NIS 2003 national and city averages. As of April 2004, Start Right participants had an immunization coverage rate of 80.5%, no longer significantly below the national average of 79.4% ($t = 0.87$; see Figure 2). African American children, those living in Harlem ($n = 281$), had an immunization rate of 78.4%, significantly higher than the 73.0% for U.S. African Americans ($t = 2.90$). Latino children, those living in Washington Heights ($n = 1,221$), had an immunization rate of 83.7%, significantly higher than the 77.0% for Latino children in the United States ($t = 2.32$). The 80.5% rate for all children in the program significantly exceeded the 72.7% average for NYC ($t = 4.32$) and the NYC Latino rate of 73.7% ($t = 3.75$). Although the Start Right children's coverage rate was below that for U.S. White, non-Latino children (80.5% vs. 82.5%), this difference was not significant ($t = 1.99$, $p = .078$).

The logistic regression equation had a predictive value of .37 (Nagelkerke R^2), with a 77% correct classification rate (see Table 2). The most powerful predictor of being UTD with immunizations was immunization status at enrollment (OR = 9.81, 95% CI = 7.6-12.8). Latino children were more likely to be UTD than were African American children (OR = 1.56, 95% CI = 1.1-2.1). Neither age at enrollment nor gender had a significant influence on immunization status. The program strategy

TABLE 2
Predictors of Up-to-Date (UTD) Immunization Status, Children 19 to 35 Months of Age Enrolled in Start Right

	Adjusted Odds Ratios (AOR)	95% Confidence Interval for AOR	
		Lower	Upper
Immunization status at enrollment (1 = UTD, 0 = not UTD)	9.81	7.55	12.75
Gender (1 = male, 2 = female)	1.10	0.87	1.39
Age at enrollment (days)	1.00	1.00	1.00
Latino ethnicity (1 = Latino, 0 = Other)	1.56	1.14	2.13
Program strategy (reference = housing or faith-based organization)			
Child care and parenting	1.89	1.16	3.08
Women, Infants, and Children and income maintenance	3.07	1.93	4.87
Facilitated enrollment and medical referral	4.87	2.84	8.36
Organization	0.98	0.94	1.03
Constant	.12		
Cox and Snell R^2	.270		
Nagelkerke R^2	.371		
% correctly classified	76.7		

NOTE: $N = 1,502$.

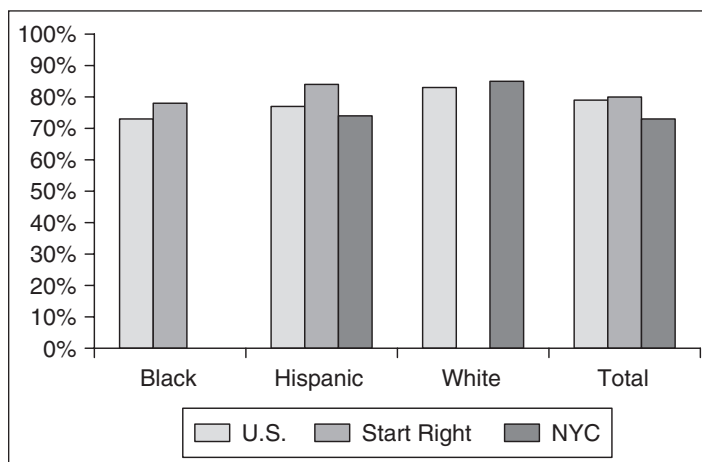


FIGURE 2 Immunization Coverage Rates for Start Right Versus U.S. and New York City National Immunization Survey 2003

through which children participated significantly affected their immunization outcomes. Compared to children participating in Start Right through housing or faith-based programs, children were more likely to be UTD if they participated through facilitated enrollment and medical referral programs (OR = 4.87, 95% CI = 2.8-8.4), WIC and income maintenance programs (OR = 3.07,

95% CI = 1.9-4.9), or child care and parenting programs (OR = 1.89, 95% CI = 1.2-3.1).

DISCUSSION

This study demonstrated that integration of immunization promotion into existing community service programs is an effective method to identify eligible parents and to provide timely education and reminders about immunizations for their children. Importantly, the program appears to have contributed to the reduction of immunization disparities in two New York City communities of color. At the end of the observation period (2002-2004), children enrolled in Start Right no longer had immunization coverage levels below the national average.

A major factor contributing to the increase in immunization coverage for children participating in the program was community ownership of the program (Minkler & Hancock, 2003). Community ownership grew through the process by which the Start Right program evolved from the concerns of selected community organizations through the articulation of strategies and implementation by these same organizations and their leadership. This was key in engaging each community organization's creativity, commitment, and

energy. Just as immunization champions at primary care practices are critical to improving immunization delivery in health care settings, each of these organizations had one or more immunization champions who set the standards for child health advocacy at their organization and lead the process. These staff members were committed to the coalition and to ensuring the organization's participation in the program, both at the management and the operational levels.

At each organization, the coalition embedded immunization promotion into educational and social service programs already working with parents of young children. This embodies the principle of building on strengths to reinforce and build the capacity of community organizations (Minkler & Wallerstein, 1997). The coalition implementation guides were developed with coalition member input and were specifically designed to promote community competence to engage parents in the issues of immunization. The detailed guides showed how program staff could integrate Start Right education and messages at the appropriate points in their own schedule, making it feasible, efficient, and sustainable. In addition, by making immunization promotion an add-on instead of a stand-alone program, each organization could have multiple points of entry into the program. It was not unusual for a single organization to recruit and enroll parents through three or more different social service programs, for example, from parenting programs, child care provider networks, or programs helping parents enroll their children in health insurance.

Another factor contributing to the success of the program was taking the immunization message out of the doctor's office and into the community, which is consistent with suggestions to shift communications in the direction of mutual exchange models and away from communications with a high degree of physician control (Roter & Hall, 1997). The central actors in our program were peers, fellow community residents. Reminders were community based and community delivered, generally in the context of other routine activities, such as when parents picked up their children at day care or when staff in a parenting program made a home visit. In this way, immunizations and their intricate scheduling were demystified and culturally accessible to the families. Three studies provide strong evidence that community-based, lay health workers can increase immunization coverage in both adults and children (Barnes et al., 1999; Krieger, Castorina, Walls, Weaver, & Ciske, 2000; Lewin et al., 2005), and our findings are consistent with these studies. It is one thing to have a nurse or a physician indicate that a child needs immunizations, but quite another to hear it from a neighbor. Not only did the coalition use the proven strategies of reminders, tracking, and positive

feedback to parents (Briss et al., 2000; Szilagyi et al., 2000), these were delivered in a culturally competent manner and community context that undoubtedly enhanced the communicative power of the message.

The most effective programs were those with more direct linkages to the health care system and those dealing with young children. The order of effectiveness was, first, facilitated enrollment and referrals from medical providers; second, WIC and income maintenance programs; and, finally, day care and parenting programs. This suggests that there may have been a synergistic effect between the immunization promotion activities and those that already had a specific health content or a focus on health and welfare of children. For example, day care programs routinely monitor immunization status and offer health-related programs to parents; thus, there are regular opportunities to add an immunization message to a health-related communication. In addition, these programs incorporate regular interaction between the program and the parents. For a program seeking to promote immunizations through repeated reminders, these additional opportunities for interaction facilitate the delivery of these messages. In contrast, adding immunization programs into the housing or faith-based organization programs was less effective perhaps because they had fewer health-related events on which to piggyback. They also may have had fewer occasions to interact, for example, only on a monthly basis. In addition, staff in these programs may have been less attuned to health and immunization issues, and the families themselves may not have prioritized health concerns at the time they were trying to resolve other issues. These findings suggest the need to pay attention to the organizational context when implementing health-promotion activities, as has been recommended by others (Glanz, 1997). Where possible synergies exist, health promotion programs can capitalize on them, and where they do not, additional efforts may be needed to create the opportunities for synergism not naturally present in the programs.

An innovative feature of the program was the creation of an immunization data warehouse integrating provider and community sources of immunization data. If the program had not used information from the parents, providers, and the immunization registries, it would not have been possible to track the progress of the families toward completing their children's immunizations. As in other inner-city communities, children's immunization records were scattered among the several providers from whom they received care (Shefer, Webb, & Friedman, 1998; Stille & Christison-Lagay, 2000; Yusuf et al., 2002). The decentralized data warehouse was critical to enabling

the program staff to stay current with a particular child's immunization status, so that they could give timely reminders and, when completed, congratulations. At the same time, the report feature of the data warehouse allowed each organization to keep track of how well it was doing with its group of parents. These reports were discussed at coalition meetings and provided the opportunity for all coalition members to participate in problem solving and suggestions of alternative activities that might work better. Hence, the data warehouse was a critical feature of the coalition's goal of maintaining organizational accountability.

Although the program reduced immunization disparities among both Latinos and African Americans, the Latino children ended up with higher coverage rates, a finding further confirmed by the logistic regression analyses. The regression analyses controlled for differences in program strategy and community organization, so program implementation does not appear to explain the Latino effect. One possible mechanism for the Latino effect may have been the facilitated enrollment program, which was very effective in the Latino community, with several thousand Latino families enrolled into child health insurance programs between 1998 and 2004 (Perez, Findley, Mejia, & Martinez, 2005). A recent study shows that children who had recently obtained health insurance were more likely to see providers for routine care, which includes immunizations (Kempe et al., 2005), and this could explain both the Latino effect and the especially powerful effect of the facilitated enrollment strategy. The Latino effect could also reflect cultural differences between the two communities of color, which lead to different uptake or response among Latinos than among African Americans. The coalition's experience mirrors the national experience, whereby the immunization differentials for Latino children have narrowed more than for African Americans (Chu et al., 2004). This coalition, like others, needs to better understand the particular cultural nuances of immunization promotion among African American families and incorporate these into the educational and reminder process.

This study is subject to the limitations of aggregate comparisons, namely that we did not control for other factors operating in the community that could affect these results. It was not possible to obtain comparable data for a cohort of children elsewhere in New York City, as nowhere else was immunization status measured consistently with all three sources. Nor was it possible to control for recent changes in health insurance structure and access to care when Medicaid managed care became increasingly prevalent in the community. Expansion of child health insurance during this period could have disproportionately affected immunization coverage for

previously uninsured Latino children of recent immigrants, independent of their participation in the program. In addition, there were vaccine shortages during the study period, which may have adversely affected children's access to vaccines. Although a strength of the study methods is the reliance on three complementary sources of data for tracking of immunizations, each one of these sources may be incomplete. Finally, the focus on the ethnic differences between the Harlem and Washington Heights communities hides the racial and cultural diversity within both communities.

In conclusion, this study documents how a community-based immunization program recruited and involved thousands of parents. Each of the member organizations worked through multiple windows of opportunity to encourage parents to immunize their children. Programs with more frequent opportunities for interaction with parents, and particularly health-related interactions, appear to provide the greatest potential for integration of health promotion. Through this integration, the program has been effective at promoting immunizations and reducing immunization disparities. That these activities are fully embedded within the routine organizational programs of each organization bodes well for sustainability of the program and the lasting elimination of disparities.

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