Immunization Status and Sociodemographic Characteristics: The Mediating Role of Beliefs, Attitudes, and Perceived Control

Radmila Prislin, PhD, James A. Dyer, PhD, Craig H. Blakely, PhD, MPH, and Charles D. Johnson, PhD

ABSTRACT

Objectives. This study examined how immunization-related beliefs, attitudes, and perceived control mediate up-to-date immunization among various sociodemographic groups.

Methods. Statewide estimates of immunization rates among children up to the age of 2 years were obtained via a multistage cluster sample. In-person interviews were conducted with 4832 parents. Information about immunization was obtained from official records or from health care providers.

Results. Differences in immunization among sociodemographic groups were mediated by beliefs about objective barriers to immunization, protection, medical contraindication, safety concerns, distrust, and natural immunity. Protection beliefs contributed to positive attitudes toward immunization; beliefs in natural immunity and safety concerns contributed to negative attitudes. Beliefs about objective barriers, distrust, safety concerns, and medical contraindications influenced perceived control over immunization. Positive attitudes and a strong sense of control contributed to higher immunization rates.

Conclusions. These findings provide a basis for efficient educational campaigns by specifying which beliefs should be bolstered (because they facilitate proper immunization) and which should be targeted for change (because they hinder proper immunization) in various sociodemographic groups. (*Am J Public Health.* 1998;88:1821–1826)

Despite improving trends, immunization rates among the nation's 2-year-olds are still suboptimal,[1] especially among children of certain socioeconomic characteristics. Recent population-based estimates of the immunization status of Texas children[2] revealed low up-to-date immunization rates among African Americans and children receiving Aid to Families with Dependent Children (AFDC). The opposite was found for children in well-educated families and children enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Although valuable, findings on sociodemographic correlates of immunization cannot explain underlying causes of the phenomenon. Understanding causality is a sine qua non for improving immunization. This study sought to explain a process through which the aforementioned sociodemographic characteristics influence immunization practices.

Drawing on theories of health behavior[3] and modeling approaches to immunization,[4] this study examined how parents' beliefs mediate their children's immunization. Our causal model assumes that immunization is a planned behavior preceded by consideration of relevant beliefs. Parents presumably consider the consequences of immunization and consequently form their attitudes about immunization practices. Parents also assess external factors impinging on their decisions (e.g., accessibility of health providers) and consequently develop a sense of their control over their children's immunization. Individuals with positive attitudes and perceptions of personal control are more likely to have their children immunized. This model is based on the theory of planned behavior[5] but omits the theoretical construct of a subjective norm because our preliminary analyses revealed that it exerted no influence on immunization.

The proposed model was tested through the following objectives: (1) to determine the structure of immunization-related beliefs in a representative sample of parents of children under 2 years of age in Texas, (2) to determine how these beliefs vary across sociodemographic groups, and (3) to determine how these beliefs influence attitudes and perceptions of control to eventually mediate children's up-to-date immunization status.

Methods

Sample

Our goal was to obtain statewide estimates of immunization rates; thus, we used a multistage cluster sample to select households. First, counties were sampled so that 10 were preselected on the basis of their population size. Twenty additional counties were randomly chosen from the remainder of the state with selection probabilities proportional to the number of 1992 births. For 26 counties, a 3-stage sampling procedure (census block groups, blocks, housing units) was used to select households. In 4 sparsely populated counties, children were randomly selected from birth records. The sample was adjusted to the state population distribution by means of poststratification weights.[6] All of the analyses involved weighted data and took into account the survey design.

Radmila Prislin is with the Department of Psychology, San Diego State University, San Diego, Calif. James A. Dyer, Craig H. Blakely, and Charles D. Johnson are with the Public Policy Research Institute, Texas A&M University, College Station, Tex.

Requests for reprints should be sent to Radmila Prislin, PhD, Department of Psychology, San Diego State University, San Diego, CA 91182-4611 (e-mail: rprislin@sunstroke.sdsu.edu).

This article was accepted March 11, 1998.

Data Collection Procedure

Households were screened for children 2 to 24 months of age either by visiting the home or by obtaining information from neighbors. Each household was visited up to 3 times. More than 116 000 households were screened to obtain 4832 interviews. In households with more than one age-eligible child, an interview was conducted referencing a single, randomly selected child. Assuming that all 1349 households that refused participation had a child of adequate age, a conservative estimate of the response rate is 78%.

Beliefs, attitudes, perception of control, and sociodemographic characteristics were assessed through in-person interviews, in English or Spanish, with a child's parent or legal guardian. For 72% of respondents, information about immunization was obtained from the child's official immunization records signed by medical care providers. For 28% of respondents without records or with incomplete records, self-reported measures were taken and later verified by obtaining medical records from all providers. Respondents were paid $10 for participation.[6]

Outcome Measure

Up-to-date immunization status was defined in accordance with the recommendation of the Advisory Committee on Immunization Practices.[1] Children were considered up to date if they were 3 to 4 months of age and had received 1 diphtheria–tetanus–pertussis (DTP) and 1 oral polio vaccine (OPV), if they were 5 to 6 months of age and had received 2 DTP and 2 OPV vaccines, if they were 7 to 15 months of age and had received 3 DTP and 3 OPV vaccines, or if they were 16 to 24 months of age and had received 4 DTP, 3 OPV, and 1 measles–mumps–rubella (MMR) vaccine.

Mediator Variables

Responses to 2 items assessing attitudes were correlated ($r = 0.58$, $P < .0001$) and averaged into an index of attitudes. Responses to 2 items assessing perceived control over immunization were correlated ($r = 0.50$, $P < .0001$) and averaged into an index of perceived control. Beliefs were measured with a 19-item scale. All mediators were assessed on 5-point Likert-type scales[7] with higher numbers indicating more favorable attitudes, more perceived control, and stronger beliefs.

Predictor Variables

Ethnicity/race was defined as a self-classification as White, African American, Hispanic, or other. WIC status and AFDC status were defined as enrollment or nonenrollment. Education was measured on a 20-point scale ranging from "never attended school" to "graduate school." Race/ethnicity was mildly related to AFDC ($r = -0.11$) and moderately related to education ($r = -0.42$).

Regression Analyses

The proposed mediation process by which sociodemographic characteristics affect immunization was tested in a series of regression analyses.[8] In these analyses, we examined whether predictors (sociodemographic groups) affected the outcome (up-to-date immunization). We also assessed whether each variable in the hypothesized causal chain affected the subsequent variable when all prior variables, including the predictors, were controlled (i.e., sociodemographic characteristics affect beliefs, which affect attitudes and perceived control, which eventually determine immunization). Finally, we examined whether the predictors exerted no effect on the outcome, or whether the effect was significantly smaller, when the mediating variables were controlled (e.g., WIC enrollment exerts no influence on up-to-date immunization when controlling for beliefs, attitudes, and perceived control).

Results

Principal Component Analysis of Immunization-Related Beliefs

Principal component analysis (oblimin rotation) of the belief scale extracted 6 factors explaining 55.8% of the total variance. Factor loadings are presented in Table 1. The first factor was defined by beliefs about external, objective barriers to immunization. A subjective barrier, not having the time to take a child to get immunized, loaded negatively on this factor, which was labeled objective barriers. The second factor, protection, was defined by 4 beliefs about immunization as an efficient means of protection against diseases. The third factor, medical contraindications, was defined by an accurate belief (the flu) but also by an erroneous belief (a cold) about contraindications to immunization. The fourth factor, safety concerns, was defined by 2 items describing concerns about the safety and efficacy of vaccines. The fifth factor, distrust, was defined by items questioning medical professionals' expertise and demeanor and by not knowing when to take a child for immunization. The sixth factor, natural immunity, was defined by the belief that it is better to develop immunity by getting sick than by receiving vaccines, which are often considered potentially harmful.

The barriers and distrust factors were moderately correlated ($r = 0.30$), indicating that respondents who perceived many objective barriers to immunizations also tended to distrust medical professionals. As would be expected, the protection and natural immunity factors were negatively correlated ($r = -0.26$). All further analyses involving beliefs included 6 beliefs dimensions operationalized as average scores on the defining items.

Regression Analyses Testing Mediation

The logit regression model predicting up-to-date immunization from sociodemographic characteristics revealed that African Americans were less likely to be immunized than Whites (adjusted odds ratio [OR] = 0.70, 95% confidence interval [CI] = 0.56, 0.87), whereas Hispanics and Whites did not differ (adjusted OR = 1.12, 95% CI = 0.96, 1.32). Education level (adjusted OR = 1.48, 95% CI = 1.17, 1.89) and WIC enrollment (adjusted OR = 1.81, 95% CI = 1.54, 2.13) were associated with higher immunization status. Receiving AFDC was associated with lower immunization status (adjusted OR = 0.67, 95% CI = 0.53, 0.84).

Regression models predicting beliefs from sociodemographic characteristics showed that ethnicity/race was significantly related to natural immunity ($b = 0.07$, $P < .005$), medical contraindication ($b = -0.06$, $P < .005$), and protection beliefs ($b = 0.03$, $P < .005$). No group believed strongly in natural immunity; Whites showed the strongest tendency (mean = 1.26), and African Americans showed the least tendency (mean = 1.49), to reject this belief. Whites (mean = 3.37) and those in the "other" ethnicity/race category (mean = 3.50) believed more strongly in medical contraindications to immunizations than African Americans (mean = 2.83) and Hispanics (mean = 3.03). All groups believed in the protective value of vaccination, with Hispanics (mean = 4.90) and those in the "other" category (mean = 4.89) being somewhat more convinced than African Americans and Whites (both means = 4.81).

As education level increased, safety concerns ($b = -0.05$, $P < .001$) decreased (Figure 1). Although to a smaller degree, education also tended to decrease distrust ($b = -0.02$, $P < .001$) and increase concern about medical contraindication ($b = 0.03$, $P < .001$).

In comparison with those not enrolled in the WIC program, respondents enrolled in the

TABLE 1—Factor Structure of Immunization-Related Beliefs (n = 4832)

Belief	Barriers	Protection	Medical Contraindications	Safety Concerns	Distrust	Natural Immunity
Immunizations cost too much	0.72					
Doctors/clinics that can immunize my child are not open when I can get there	0.70					
Doctors/clinics than can immunize my child are hard to reach	0.67					
It is difficult for me to find the time to take my child to get immunized	–0.60					
It is difficult for me to find out where I can get my child immunized	0.44					
Caring parents make sure that their children get all necessary vaccines		0.74				
Children who don't get immunized can develop common childhood diseases later on in their lives when these diseases are more dangerous		0.65				
Immunizations are the best way of protecting my child against dangerous childhood diseases		0.53				
It is the responsibility of parents to get their children immunized		0.40				
A child with a cold should not get immunized			0.83			
Seriously ill children, such as children with high fevers, should not get immunized			0.83			
I wonder about the safety of the vaccine they give to my child				0.86		
I wonder if the vaccine they give to my child works				0.80		
Doctors and clinic staff to whom I can take my child for immunizations usually treat me unkindly					0.83	
Doctors and clinic staff to whom I can take my child for immunizations don't know what they are doing					0.74	
I don't know when I should take my child to a doctor or clinic for immunizations					0.51	
Healthy children do not need immunizations						0.79
It is better for a child to develop immunity by getting sick than to get a vaccine						0.70
Immunizations can do more harm than good for my child						0.59

program perceived fewer barriers to immunization (b = –0.10, $P < .005$), were more likely to trust medical care providers (b = –0.09, $P < .005$), were more likely to believe in the protective value of immunization (b = 0.04, $P < .005$), and were less likely to believe in natural immunity (b = –0.06, $P < .005$). However, they expressed more safety concerns (b = 0.18, $P < .005$) (Figure 2).

Recipients of AFDC believed more strongly in natural immunity (mean = 1.47) than nonrecipients (mean = 1.32; b = 0.14, $P < .0001$). Also, recipients distrusted medical staff more (mean = 1.45) than nonrecipients (mean = 1.33; b = 0.11, $P < .0001$).

Further tests of mediation involved regression analyses predicting attitudes and perceived control from immunization-related beliefs while controlling for sociodemographic variables. Belief in the protective value of immunization contributed to positive attitudes, whereas beliefs in natural immunity and, to a smaller degree, safety concerns contributed to negative attitudes (overall $R^2 = 0.25$; F = 268.75, $P < .0001$). Perceived control over immunization was primarily diminished by barriers and distrust and, to a smaller degree, by safety concerns and medical contraindication beliefs (overall $R^2 = 0.10$; F = 91.91, $P < .0001$). Subsequent analysis revealed that attitudes and perceived control significantly influenced up-to-date immunization: The more positive the attitudes and the stronger the sense of personal control, the better the immunization status (Figure 3).

Analyses predicting immunization status from sociodemographic characteristics while simultaneously controlling for all mediators revealed that the contribution of WIC decreased to insignificance ($P > .40$). Thus, the effects of WIC on immunization were completely mediated by beliefs, attitudes, and perceived control. Predictive contributions of ethnicity/race, education, and AFDC, although smaller, remained significant ($P < .05$), suggesting that the effects of these variables on immunization were partially mediated by beliefs, attitudes, and perceived control.

Discussion

This study reveals that sociodemographic characteristics influence children's immunization primarily through parental beliefs, which, in turn, determine attitudes and perception of control over their children's immunization. Our results reveal 6 basic beliefs about immunization. Beliefs about ensuring immunity through immunization contribute strongly to favorable attitudes toward immunization. Beliefs in natural immunity and, to a smaller degree, concerns about the safety of vaccines contribute to unfavorable attitudes toward immunization and eventually to lower immunization rates.[9,10]

Beliefs about external barriers contributed strongly to a diminished sense of personal control over immunization, thus corroborating previous hypotheses about the negative effects of specific barriers such as logistical problems[11–13] and costs of services.[14] A novel finding is that distrust in medical professionals diminishes a sense of personal

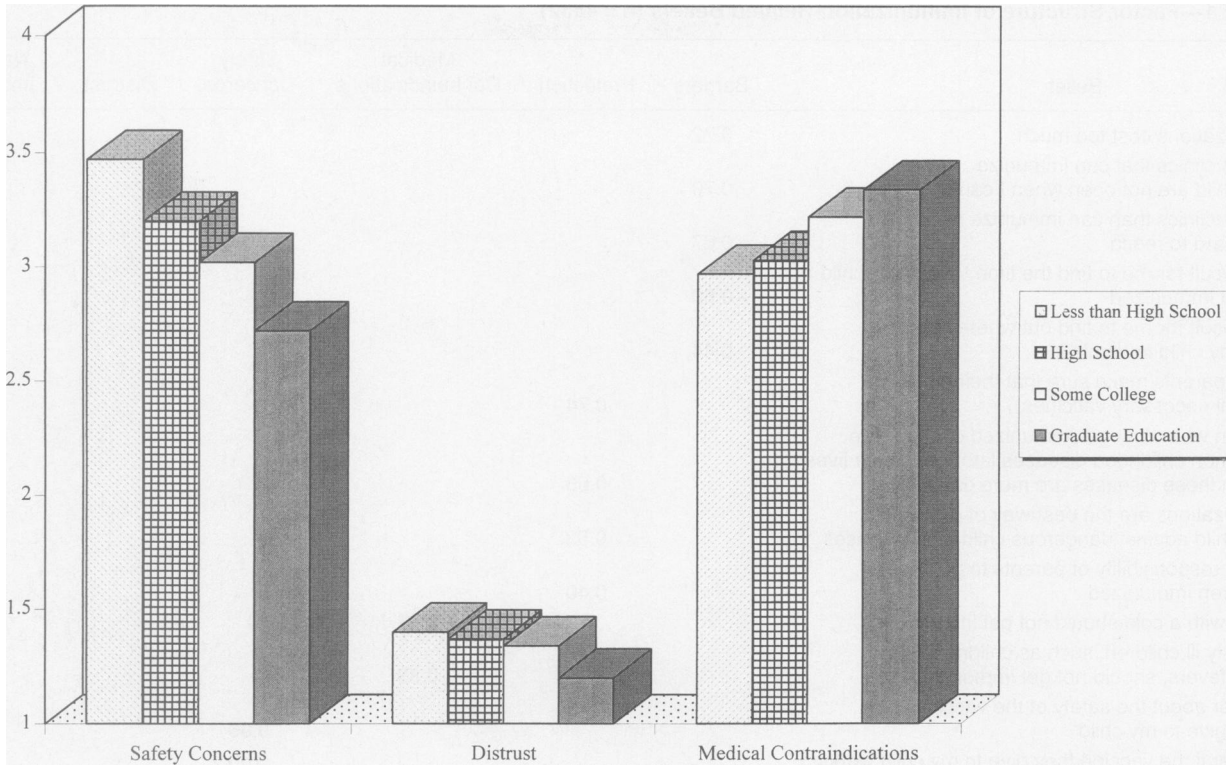


FIGURE 1—Immunization-related beliefs among various education level groups.

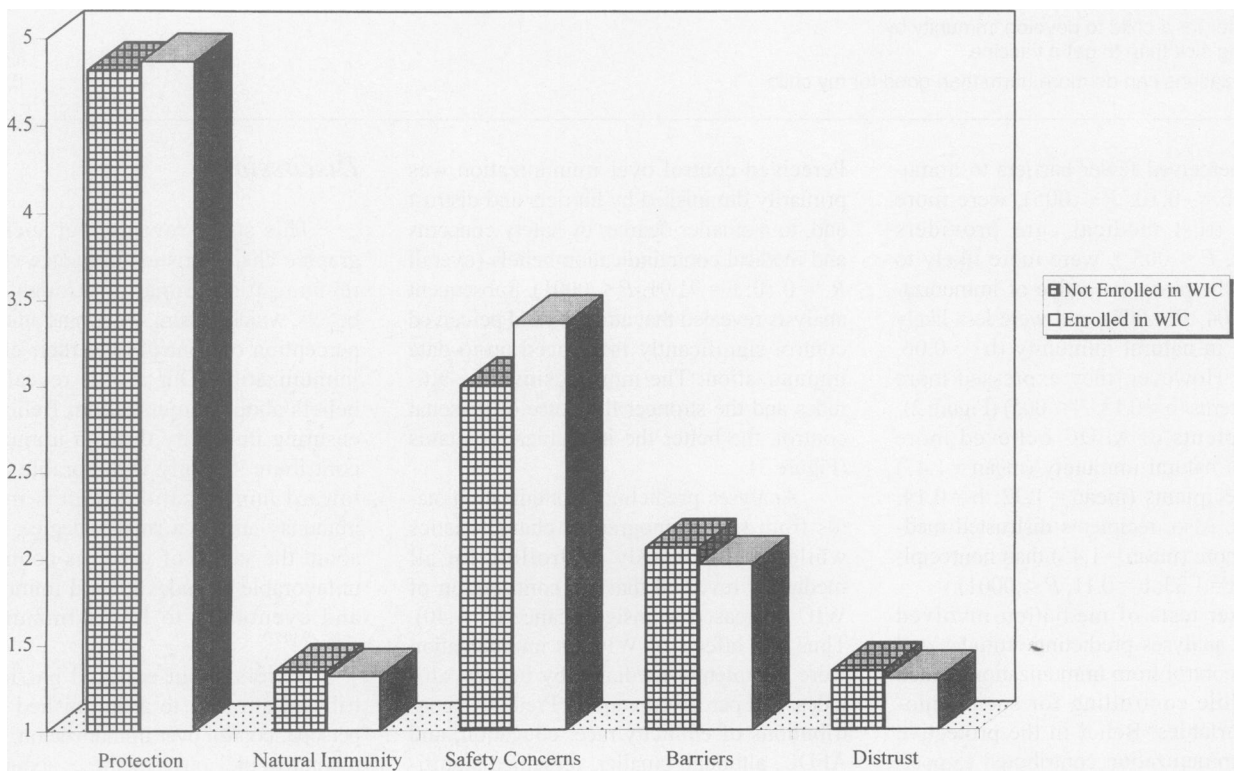
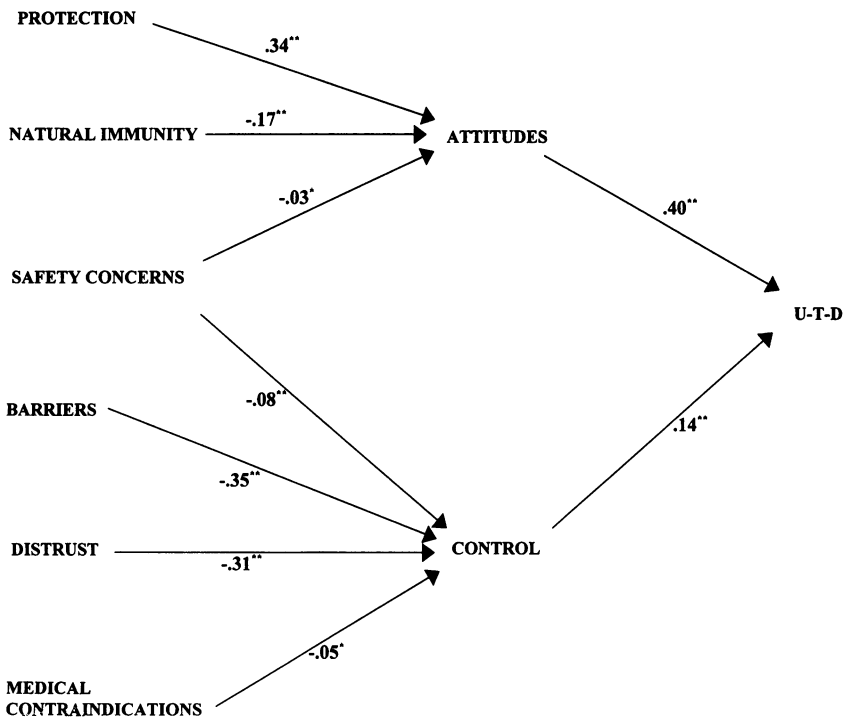


FIGURE 2—Immunization-related beliefs among WIC program participants and nonparticipants.



Note. Shown are the beta coefficients associated with the various paths revealed by regression analyses testing mediation.

FIGURE 3—Immunization-related beliefs, attitudes, and perceived control as determinants of up-to-date (U-T-D) immunization.

control as much as external barriers. Safety concerns and beliefs about contraindications to immunization also lowered immunization rates, although they were weaker predictors. Contraindications include both justified (the flu) and unjustified (a cold) factors.

Immunization-related beliefs appear to mediate the relationship between parents' sociodemographic characteristics and their children's immunization status. Thus, parental ethnicity/race affects immunization status through beliefs about the protective value of immunization, through opposite beliefs about natural immunity, and through beliefs about medical contraindications to immunization. A constellation of somewhat stronger beliefs in natural immunity and somewhat weaker beliefs in protection by immunization results in less positive attitudes and lower immunization rates among African Americans than among Hispanics and Whites. Interestingly, low immunization rates among African Americans do not seem to be caused by concerns about medical contraindications. To the contrary, in comparison with Whites (and those in other race/ethnicity groups), African Americans are significantly less worried about medical contraindications.

Parental education affects immunization primarily through beliefs about the safety of vaccines and through distrust in medical professionals. Better educated parents are less concerned about the safety of vaccines and less distrustful of medical professionals, resulting in their stronger sense of control and, consequently, in higher immunization rates among their children. Yet, in comparison with less educated parents, those well educated are more likely to worry about contraindications, among which they include a cold. Considering that unjustified contraindications may account for as much as 20% of underimmunized children,[15] it is particularly worrisome that even well-educated individuals hold such erroneous beliefs.

WIC enrollment affects all beliefs except those about contraindications, indicating that an immunization program offering counseling, assessment, and vaccination in the WIC clinics in Texas is efficient. Program participants, relative to nonparticipants, perceived fewer barriers to their children's immunization and had more trust in medical professionals, developing a stronger sense of personal control. Also, they believed more in vaccination and less in natural immunity. The resultant more positive attitudes toward immunization, together with a stronger sense of control, contributed to higher immunization rates. Surprisingly, however, program participants were more concerned about the safety of vaccines, probably as a result of being thoroughly informed about possible side effects. More adequate reassurance regarding safety should eliminate this unintended effect of the program.

In contrast to WIC, receiving AFDC was associated with poor immunization status, even when other socioeconomic factors were controlled. In comparison with nonrecipients, respondents receiving aid were more likely to believe in natural immunity and to distrust medical professionals. The resultant less favorable attitudes and diminished sense of personal control combined to eventually cause low immunization rates. Undoubtedly, AFDC recipients could benefit from an immunization program similar to that offered to WIC participants.

Conclusion

Our findings provide a basis for planning educational and immunization campaigns by not only determining which sociodemographic groups are likely to have their children underimmunized but indicating possible reasons for underimmunization. Thus, exceptionally low immunization rates among African Americans could be improved through an educational campaign emphasizing the benefits of vaccination over natural immunity. All parents, regardless of their sociodemographic background, need accurate information about medical contraindications to immunization. Parents with little formal education particularly need information about the safety of vaccines, whereas those receiving AFDC need information about the benefits of immunization over natural immunity. This information, however, should be disseminated carefully considering these groups' tendency to distrust medical professionals. In that regard, experiences from the immunization program implemented through the WIC clinics may prove useful, because this program bolstered most factors facilitating proper immunization and reduced most factors hindering it. □

Acknowledgments

This study is part of a project commissioned by the Texas Department of Health and conducted by the Public Policy Research Institute at Texas A&M University.

Preliminary findings were presented at the 123rd Annual Meeting of the American Public Health Association, October–November 1995, San Diego, Calif.

We thank the Texas Department of Health, particularly Diane Simpson, Lucina Suarez, and Erik Svenkerud, for their support of the project and the work they have done on it. Our gratitude extends to

staff members at the Public Policy Research Institute, most notably Randy Booher and Lisa Halperin, for their contribution to the project. Particular thanks are due to Linda Baez and Michelle Strong for technical assistance.

References

1. General recommendations on immunization. In: *Recommendations of the Advisory Committee on Immunization Practices (ACIP)*. Atlanta, Ga: Centers for Disease Control and Prevention; 1994:1038.
2. Suarez L, Simpson DM, Smith DR. Impact of health care access and public assistance factors on immunization levels of children under two. *Am J Public Health*. 1997;87:845–848.
3. Stroebe W, Stroebe MS. *Social Psychology of Health*. Pacific Grove, Calif: Brooks/Cole; 1995.
4. Simpson KN, Biddle AK, Rabinovich NR. A model for estimating the impact of changes in children's vaccines. *Am J Public Health*. 1995;85:1666–1672.
5. Ajzen I. *Attitudes, Personality and Behavior*. Chicago, Ill: Dorsey Press; 1988.
6. Dyer JA, Prislin R, Ringer L. *Methodological Report for Texas Department of Health's 1994 Immunization Survey of Children Under 2*. College Station, Tex: Public Policy Research Institute.
7. Eagly AH, Chaiken S. *The Psychology of Attitudes*. San Diego, Calif: Hartcourt Brace Jovanovich; 1993.
8. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51: 1173–1182.
9. Lewis T, Osborn LM, Lewis K, Brockert J, Jacobsen J, Cherry JD. Influence of parental knowledge and opinions on 12-month diphtheria, tetanus, and pertussis vaccination rates. *Am J Dis Child*. 1988;142:283–286.
10. Szilagyi PG, Rodewald LE, Savageau J, et al. Improving influenza vaccination rates in children with asthma: a test of a computerized reminder system and an analysis offactors predicting vaccination compliance. *Pediatrics*. 1992;6:871–875.
11. National Vaccine Advisory Committee. The measles epidemic: the problems, barriers, and recommendations. *JAMA*. 1991;266:1547–1552.
12. Orenstein WA, Atkinson W, Mason D, Bernier RH. Barriers to vaccinating preschool children. *J Health Care Poor Underserved*. 1990;3: 315–331.
13. Bates AS, Fitzgerald JF, Dittus RS, Wolinsky FD. Risk factors for underimmunization in poor urban infants. *JAMA*. 1994;14:1105–1110.
14. Fielding JE, Cumberland WG, Pettit L. Immunization status of children of employees in a large corporation. *JAMA*. 1994;271:525–530.
15. McConnochie KM, Roghmann KJ. Immunization opportunities missed among urban poor children. *Pediatrics*. 1992;6:1019–1026.