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Hoda Youssef Atta
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PSYCHOSOCIAL DETERMINANTS OF AGE-APPROPRIATE IMMUNIZATIONS
OF INFANTS IN NORFOLK, VIRGINIA

by

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MBBCh November 1984, University of Alexandria, Egypt
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Dissertation submitted to the Faculty of Old Dominion
University in partial fulfillment of the requirement for the
degree of

DOCTOR OF PHILOSOPHY
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DECEMBER, 1994

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**ABSTRACT**

**PSYCHOSOCIAL DETERMINANTS OF AGE-APPROPRIATE IMMUNIZATIONS OF INFANTS IN NORFOLK, VIRGINIA**

Hoda Youssef Atta  
Old Dominion University  
Chair: Dr Clare Houseman

This study represents an investigation of psychosocial factors affecting age-appropriate immunizations of infants in Norfolk, Virginia. A household survey was conducted in Norfolk, Virginia, from 4/93-8/93, to assess immunization coverage of children 12-30 months of age. This survey included a total of 389 children in the target age range. A subset of 201 mothers were randomly selected and reinterviewed to assess their knowledge and attitudes and the relationships of these factors to age-appropriate immunizations at 12 months of age. Sixty-two percent of children were not age-appropriately immunized at 12 months of age. Almost all mothers (99%) considered vaccines to be safe and effective, and these attitudes did not predict age-appropriate immunizations. However, not being age-appropriately immunized was significantly (p<.05) associated with lack of knowledge of vaccines and vaccine-preventable diseases (odds ratio [OR] 2.6, 95% confidence interval [CI] 1.5-4.5); of when to start immunizations (OR 2.2; CI 1.2-4.1); and believing that a child with minor illness should not be immunized (OR 1.9; CI 1.1-3.2). After controlling for education and other demographic variables in multiple logistic regression analysis, knowledge variables continued to predict immunization status. Maternal knowledge about vaccines and diseases were stronger predictors
of age-appropriate immunizations among children receiving their immunizations from a private provider than among those receiving immunizations from a public or a military provider.

Overall the results showed that Norfolk mothers believe that vaccines are safe, and effective. The data suggest that parent education should emphasize specific vaccines and the diseases they prevent; when to begin immunizations; and that immunizations can be given during minor illness.
This work is dedicated to my mother for her love, kindness, ambition, encouragement, sacrifice, and values.
I owe a great deal of debt to God and to many people for the success of this research. First of all, I am deeply grateful to members of my doctoral committee for their kind encouragement and support and valuable assistance.

I am especially indebted to Dr. Clare Houseman, chairman of the committee, who never failed me when I needed advice, who kindly guided me during the entire course of my study, and who provided the opportunity to work at the Center for Pediatric Research that provided me with great experiences and helped in accomplishing the degree. My deep gratitude goes to Dr. Ardythe Morrow, who closely supervised me through the completion of the dissertation, who provided valuable advice about the research methodology and the statistical analysis that enhanced the quality of the data analysis and findings. Thank you Ardythe for all your support at every step. I owe you a special debt of gratitude for inspiration and helping in submitting the dissertation grant. My thanks also to Dr. Brenda Nichols for her invaluable advice and kind support.

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CHAPTER I

INTRODUCTION

This chapter provides a background regarding the subject of immunization, the research problem and its significance, the research objectives, and the hypotheses that guided the study. In addition, assumptions and limitations of the study are described.

Background of the Immunization Programs

Importance of Immunization

Immunizations have made a profound impact on the health and well-being of the world’s population. Immunization may be the most powerful and cost-effective method known for prevention of morbidity and mortality from the infectious diseases of childhood. Among children in developed nations, morbidity and mortality from infectious diseases have declined markedly in the past half century in large measure due to widespread immunization. Smallpox, a disease that previously killed and disabled millions of children and adults worldwide, was eradicated in 1977 as a result of the global immunization campaign. Currently, poliomyelitis is nearly eradicated in the Western Hemisphere (CDC, 1992a). These examples attest to the remarkable public health benefits of immunization programs.
In the United States, the use of vaccines has virtually eliminated diphtheria, tetanus, and poliomyelitis (DeQuadros, Andrus, Olive & DeMacedo, 1992; National Institute of Allergy and Infectious Diseases, 1993). The incidence of reported measles decreased by 95% in the United States within 5 years of vaccine licensure in 1963 (Hinman, Brandling-Bennett, Bernier, Kirby & Eddins, 1980; Markowitz et al., 1989). The incidence of pertussis decreased to one hundredth of pre-vaccination levels 10 years after routine immunization began in the United States (Cherry, Baraff & Hewlett, 1989). Incidence rates of paralytic poliomyelitis dropped even more precipitously in the United States; by 1965, the reported incidence was less than 0.5% of a decade earlier, when the first vaccine became available (CDC, 1988).

Prior to licensure of Haemophilus influenza type b (Hib) conjugate vaccines, Hib was the leading cause of bacterial meningitis in the United States, affecting 10,000 to 15,000 infants per year. Hib conjugate vaccines were first licensed for use in the United States in December 1987 and restricted to children at least 18 months old. Licensure of Hib was extended to infants at least two months of age in October 1990 (American Academy of Pediatrics, 1991; CDC, 1991a). Following licensure of Hib conjugate vaccines there were significant reductions in the incidence of Hib invasive disease and related morbidity and mortality. Among U.S. children less than 5 years of age, the incidence of Hib invasive disease
decreased by 71% from 37 per 100,000 persons in 1989 to 11 cases per 100,000 persons in 1991 (Adams, et al., 1993). Reductions of 85% or greater were in areas of the U.S. with reportedly high vaccine coverage (National Institute of Allergy and Infectious Diseases, 1993).

Vaccines are highly economical and represent an efficient use of society’s resources. Prevention of infectious diseases is far more cost effective than treatment of patients who are ill with infectious diseases. An added benefit that derives from the vaccine use is the potential for decrease in both direct and indirect health care costs which is of particular importance in the current era of escalating health care costs.

Numerous studies conducted in the United States (Hinman, 1988; Peter, 1992) have substantiated that immunization services have high favorable cost-benefit ratio, which is the ratio of the reduction in the costs of the disease to the costs of the vaccination program. The measles-mumps-rubella (MMR) vaccine program was estimated to yield savings of nearly $1.4 billion in disease costs in 1983 with an estimated $14.40 saved for each $1 spent on MMR vaccination (White, Kaplan & Orenstein, 1985). A similar analysis regarding pertussis vaccination found that each $1 spent on pertussis vaccine was associated with $2.10 in health care costs (Hinman & Koplan, 1985). Hib vaccine has been estimated to save $400 million for
every annual cohort of children that is vaccinated (National Institute of Allergy and Infectious Diseases, 1993).

Immunization Schedule

The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics (AAP) recommend that by 15 to 18 months of age all children should complete a schedule of vaccination that includes four doses of diphtheria and tetanus-toxoid and pertussis (DTP); three doses of oral polio vaccine (OPV); one dose of measles, mumps, rubella vaccine (MMR); and three to four doses of haemophilus influenza type b conjugate vaccine (Hib) (CDC, 1994a; Committee on Infectious Diseases, 1991). In addition, hepatitis B vaccine has been recommended since 1991 for the universal immunization of infants (CDC, 1991b). The schedule recommended by the ACIP and AAP is based on the earliest possible age which provides adequate antibody response and a minimum accepted interval between doses for boosting antibody response.

Statement of The Problem

Immunization Coverage of U.S. Children

Protecting children against vaccine-preventable diseases is a national health priority. One of the National Health Objectives for the Year 2000 is to vaccinate 90% of children with the primary series by their second birthday (objective
The Chilnook Immunization Initiative (CII) is a recent comprehensive national response to the undervaccination of U.S. children announced by the President in 1993. The goals of CII are to 1) eliminate indigenous cases of diphtheria and Hib disease among children under five years of age; measles, poliomyelitis, rubella, and tetanus among children aged less than 15 years by 1996; 2) increase vaccination coverage levels to at least 90% among 2-year old children by 1996 for each of the vaccinations recommended routinely for children except hepatitis B for which 90% coverage is targeted for 1998 and 3) establish a vaccination-delivery system that maintains and further improves high coverage levels (CDC, 1994b).

As a result of school immunization laws, over 95% of U.S. children are fully immunized at the time of school enrollment. However, immunization rates for preschool-aged children are significantly lower. Recent investigations in United States inner city areas found that only 40 to 60% of children involved in outbreaks of vaccine-preventable diseases had completed the recommended immunization series by two years of age (CDC, 1991c; Orenstein, Atkinson, Mason & Bernier, 1990; NVAC, 1991). Retrospective immunization coverage surveys of the school health records of children entering kindergarten or first grade in the 1990 to 1991 and the 1991 to 1992 school years were conducted in 21 U.S. cities and localities. These surveys revealed that the proportion of children who were up
to date with immunizations by their second birthday, based on the schedule of 4 DTP, 3 OPV, and 1 MMR vaccine doses ranged from 11% to 58%. Among the cities and localities surveyed, the median percent of two-year old children up-to-date was 44%. When only properly spaced doses were considered the coverage levels were a median of 5% points lower than when all doses were considered (Zell, Dietz, Stevenson, Cochi & Bruce, 1994).

Regarding coverage level for specific vaccine, Stehr-Green, Zell, and Eddins (1993) studied the trend in antigen-specific coverage level by examining reports of children’s vaccination histories which were collected during the U.S. Immunization Surveys between 1962 and 1985 and the National Health Interview Survey (NHIS) in 1991. These data showed that the coverage among 2-year-olds with three or more doses of DTP gradually dropped from a peak of 78% in 1967 to 67% in 1991. Coverage with three or more doses of OPV dropped from a peak of 64% in 1975 to 52% in 1991. However, according to NHIS data, immunization coverage increased in 1992 to 83% with three doses of DTP and 72% with three doses of OPV (CDC, 1994).

Under-immunization of Urban Preschool-aged children

Immunization coverage of U.S. preschool-aged children varies by area of residence, with coverage lower in cities than in suburban or rural areas (CDC, 1992b; Stevenson, 1993). A retrospective survey of school enterers in two rural
counties in Nebraska showed that the up-to-date rates at the first birthday and the second birthday were 85% and 64% respectively (CDC, 1992b). Lower immunization coverage of children residing in urban areas is an international phenomenon (WHO/UNICEF, 1985).

Immunization coverage is particularly low among minorities and socio-economically disadvantaged groups. A survey in Chicago schools to determine the age at which pupils received measles vaccine revealed that in the predominantly white schools, 80% of the students had received measles vaccine before their second birthday. However, in predominantly Hispanic or black schools, only 50% of the pupils received measles vaccine before their second birthday (CDC, 1990a).

Norfolk retrospective school enterer data.

The immunization rates in Norfolk are similar to the rates found in many U.S. inner cities. Retrospective analysis by Virginia Department of Health, Burea of Immunization, of 345 records of Norfolk children who entered in kindergarten in 1991 to 1992 showed that 45% of children at 24 months of age were appropriately immunized (based on the schedule of 4 DTP, 3 OPV, and 1 MMR vaccine doses). At one year of age, only 66% of children had up-to-date immunizations (based on 3 DTP and 2 OPV vaccine doses). The rates of childhood immunizations in Norfolk are lower than those in the state of Virginia as a whole.
**Childhood Immunization Rates in Other Countries.**

The rates of early childhood immunization in the United States compare poorly with other western industrialized nations and many developing countries. In 1988-1989, sixteen countries had immunization rates higher than those in the United States, including Bulgaria, Hungary, Greece, Brazil, China, Mexico, North Korea, Chile, and Romania (Shea, 1991). Comparing immunization rates in the U.S. to those in Europe, diphtheria immunization in the U.S. averages 41% lower than European rates, poliomyelitis immunization coverage is 67% lower in the U.S. than in Europe, and the U.S. immunization rate for measles is 23% less than that of Europe (Williams, 1990).

**Consequences of Under-immunization**

Experience confirms that when immunization programs falter, dramatic increases in preventable diseases ensue. Epidemics of pertussis occurred in Europe and Japan in the mid-1970s as a result of reduced pertussis immunization (Cherry, Baraff & Hewlett, 1989; Kimura & Kuno-Sakai, 1987; Miller, Alderslade & Ross, 1982). The consequences of the decline in the number of children immunized in the United States include epidemics of measles (CDC, 1986, 1987a; Markowitz, et al., 1989), mumps (Cochi, Preblud & Orenstein, 1988), pertussis (CDC, 1987b, 1988) and rubella cases (CDC, 1991d).
The incidence of measles in the United States was low from 1981 through 1988, with a record low of 1,497 measles cases reported in 1983. However, from 1989 to 1991 in the United States, a resurgence of measles resulted in an estimated 55,000 reported measles cases, 11,000 hospitalizations, and 130 deaths (CDC, 1994b). During that period, numerous measles outbreaks occurred in many cities throughout the United States, including Washington (CDC, 1990b), Houston (CDC, 1990a), Los Angeles (CDC, 1989), New York city (CDC, 1991e), and Chicago (CDC, 1990c).

The burden of morbidity and mortality from measles has been greatest among unvaccinated preschool-aged children (Atkinson, Hadler, Red & Orenstein, 1992; Markowitz, et al.; 1989, McGrath, Swason, Weems & Barbour, 1992). From 1985 to 1989, only 8% of measles cases aged 0 to 4 years had a history of measles vaccine (Orenstein, Atkinson, et al., 1990). Twenty-nine of the 41 measles-related deaths that occurred in 1989 were children under 5 years of age. Approximately one-half of the reported cases and more than half of the measles-related deaths in 1990 were among preschool-aged children (CDC, 1991f). Surveillance of measles in the United States in 1991 showed that seven outbreaks accounted for 70% of reported cases and these seven outbreaks involved predominantly preschool-aged children. Surveillance data also demonstrated that the measles incidence rates among American Indians, Hispanic, and black children less than 5 years of age were 4
times that for non Hispanic white children (Atkinson, Hadler, Redd & Orenstein, 1992). Similar results were reported from ecological analysis of national measles surveillance data during the decade 1980-1989, in which the majority of cases in counties reporting measles every year occurred in unvaccinated preschoolers (Hersh et al, 1992).

By the late 1980s, birth defects from congenital rubella syndrome had almost disappeared in the United States as a result of the success of rubella immunization. Only two cases of this syndrome were reported in 1989. However, in 1991 there were 47 cases of congenital rubella syndrome reported. The lowest number of postnatal rubella cases ever reported in the United States was 225 in 1988, but during 1989-1991, the number of reported cases of postnatal rubella increased 500% from 396 in 1989 to 1,401 in 1991 (CDC, 1991d, 1992c; Lee, Ewett & Frederick, 1992). During 1991, more than nine outbreaks of postnatal rubella occurred among the Amish in more than six states (Briss, Fehrs, Hutcheson & Schaffner, 1992; CDC, 1991g).

The incidence of pertussis in the United States increased almost fourfold from 0.5 cases per 100,000 population to 1.8 cases per 100,000 population between 1981 and 1990 (CDC, 1992c). In 1993, a provisional total of 6,335 cases of pertussis were reported compared to 3,935 reported cases in 1992. Of the 4,989 pertussis cases reported in 1993, for whom age was known, 44% were infants and 21% were 1-4
years of age (CDC, 1994b). Large outbreaks of pertussis occurred in Chicago and Cincinnati, where the disease was concentrated among young infants, many of whom were not age-appropriately vaccinated (National Immunization Program, 1993). Pertussis was documented as a cause of large outbreaks among adolescents and young adults in Massachusetts and Maryland in 1992. In Massachusetts a total of 225 cases of pertussis were identified among persons within the community who ranged from 5 months to 46 years of age (CDC, 1993).

There is reason to believe that the actual impact of vaccine-preventable-diseases may be significantly higher than the published reports based on estimated under-reporting. Sutter and Cochi (1992) evaluated national reporting of pertussis-associated hospitalization and mortality in the United States, 1985 through 1988, and found that the completeness of reporting hospitalizations to the CDC was 32 percent and the completeness of reporting pertussis deaths was 33 percent. The completeness of measles reporting in the United States as a whole is not known. While some have suggested that measles reporting is at least 80% complete (Hersh, et al., 1992; Hinman, et al., 1980). An investigation of a large outbreak in New York city in 1991 found that only 45% of measles cases diagnosed in 12 hospitals were reported (Davis, et al., 1993).
Significance of This Study

Studies have shown that the causes of poor vaccine uptake are complex and involve factors relating to health professionals, health institutions, and parents (National Vaccine Advisory Committee, 1991). High vaccination levels at school entry demonstrate that obstacles to vaccinations are eventually overcome. Therefore, the responsibility for low immunization coverage among preschool-aged children does not rest solely with the health care system (Hinman, 1990; Orenstein, Atkinson & et al., 1990). In a review of literature, Jones, Moon, and Clegg (1991) found that parental choice is the strongest determinant of the child’s immunization status. Heggenhougen and Clements (1987), in their extensive review of the immunization literature, concluded that there is no single set of reasons for explaining low childhood immunization rates that is valid across regional, national, cultural, or socioeconomic groupings. The relative importance of factors which influence immunization rates vary widely in different locations and cultures. Location specific studies are important to examine why some populations use, or do not use, available immunization services (Cutts, Diallo, Zell & Rhodes, 1991).
Parental Education: A National Strategy to increase immunization rates

Incomplete public awareness and lack of public demand for immunizations were found to be major barriers to successful immunization in a recent report issued by the National Vaccine Advisory Committee (1991). Parental education regarding achieving full immunization of children at the appropriate age is a key component of the President's Comprehensive Childhood Immunization Initiative, announced in 1993 (Robinson, Sepe & Lin, 1993).

While parent education is a national goal, the data are conflicting regarding the importance and effectiveness of present education efforts. In a study of the effect of hospital-based educational intervention on immunization rates, postpartum mothers were randomly assigned to participate in a 10-15 minute discussion on the importance of immunizations and were given an education handout plus a mailed reminder letter when the child was two months of age. There was no significant difference between the intervention and the control groups in the immunization rates at 2, 4, and 12 months of age (Oeffinger, K.C. Roaten, Hitchcock & Oeffinger, P.K., 1992). Vernon, Conner, Shaw, Lampe, and Doster (1976) evaluated the effect of school-based educational intervention on immunization rates. Their findings indicated no impact of educational programs on immunization rates. Cutts, Orenstein, and Bernier (1992) stated that these previous educational
interventions were not successful because they failed the specific informational needs of those populations. Needs assessment is critical for planning an effective educational intervention.

Justification of This Research

Educational needs assessment requires current information on the psychosocial factors which influence parental immunization seeking behavior. Assessment of parental knowledge, perceptions and attitudes about immunization is needed for designing successful strategies to achieve the national goal of educating parents regarding achieving full immunization of their children at the appropriate age. Further, understanding the psychosocial factors that influence immunization seeking behavior of parents will assist program planners, policy makers, and health workers to improve the vaccine delivery system. In view of the above, the present study investigated the various psychosocial determinants of delayed immunization in Norfolk, Virginia. The results of the study will assist in the design and improvement of educational interventions to increase immunization levels of preschool-aged children.

Statement of Purpose

Research Question

Are age-appropriate immunizations of infants affected by the psychosocial characteristics of mothers and the
interaction of these factors with specific characteristics of health care institutions that provide immunizations?

Research Aims

The specific objectives of this study were to:

1. Assess the immunization-related knowledge, attitudes, and beliefs of mothers and the association of these factors with age-appropriate immunization of their infants.

2. Determine the effect of different cues to action (reminder message from a health worker, advice from a health professional, and parent-held immunization record) on age-appropriate immunizations of infants.

3. Evaluate the preventive health behavior of mothers in regard to the use of prenatal care services, breast feeding, and the use of well-baby care services in relation to age-appropriate immunization of their infants.

4. Determine the relationship between the psychosocial factors and the sources of immunizations either private or non-private services.

Research Hypothesis

The following hypotheses were proposed to guide the study:

1. Mothers of age-appropriately immunized infants are more knowledgeable, have more positive attitudes about
immunizations, are more exposed to cues to action, and are more likely to use other preventive health services than mothers of infants who are not age-appropriately immunized.

2. The effects of these psychosocial factors on age-appropriate immunization are influenced by health care institutions that provide immunization.

Assumptions

It is assumed that mothers are the primary caretakers of children and are responsible for obtaining immunizations for their children. Therefore, factors that influence their immunization seeking behaviors determine the actions they took regarding obtaining immunizations for their children.

Limitations of The Study

This study has strengths in terms of including a population-based sample of 201 mothers of 12 to 30 month old children who were representative of the population in the city of Norfolk. Further, the child’s immunization status was objectively determined from the child’s records at home and or from the health provider and data were collected by home-based interview with the mothers. However, there are limitations to consider:

1. First, because the survey is cross-sectional in design it does not provide time orientation to association, i.e. does
not establish which factor comes before another. Thus, it does not establish causality. Nevertheless, the study was able to address logical orderings of relationships among the selected variables and their association with age-appropriate immunization.

2. The child's immunization history was not obtained from parental recall, however, parental recall may be a problem in other aspects especially regarding the timing and the number of the child's wellbaby visits.

3. The possible biases in the data collection process are due to the fact that several interviewers were involved in the collection of data. Almost all interviewers were mature in terms of age and they received standardized training regarding data collection techniques. Interviewers' understanding of the importance of immunization might have influenced the way they asked the questions or their recording and interpretation of the responses. However, this less of a problem because the questions were asked in more than one way. For example, using both closed and open ended questions.
CHAPTER II

REVIEW OF LITERATURE

The aim of this chapter is to present a review of the theories and studies relating to the various factors that determine parental immunization seeking behavior. First, the theoretical literature of preventive health behavior is discussed, then, the empirical literature is presented.

Theoretical and Conceptual Framework

Several models have been advanced (Wallston and Wallston, 1984) regarding the role of social and psychological factors in health. Many of these models share common dimensions (Cummings, Becker & Maile, 1980). However, few models are comprehensive in nature and none are seen as totally adequate (Prentice-Dunn & Rogers, 1986). Most notable have been the frameworks advanced by Hochbaum (1958), Rosenstock (1966), Rosenstock (1974), Ajzen and Fishbein (1980), Bandura (1986), and Prentice-Dunn and Rogers (1986).

One of the frameworks most commonly used to understand and predict health-promoting behavior is the Health Belief Model (HBM). The model originates from a well-established body of psychological and behavioral theory which hypothesizes that behavior depends mainly upon the value placed by an individual
on a particular goal and the individual’s expectation of the likelihood that a given action will achieve that goal. The origin of the HBM can be traced back to the 1950s when a group of social psychologists in U.S. Public Health Service attempted to understand infrequent acceptance of preventive practices such as screening tests for the early detection of asymptomatic disease (Hochbaum, 1958). The model was also applied to behavior in response to diagnosed illnesses, particularly compliance with medical regimens (Becker, 1974). The HBM has received substantial empirical support from a number of preventive health behavior, sick-role behavior, and clinic utilization studies, some of which were prospective in design (Janz & Becker, 1984).

In 1974, Rosenstock formally formulated the HBM to consist of four dimensions:
1) Perceived susceptibility- refers to the subjective perception of risk of vulnerability to a health threat.
2) Perceived severity- consists of one’s perception of the seriousness of the health threat.
3) Perceived benefits- consists of the efficacy of an action designed to prevent or reduce the threat of illness.
4) Perceived barriers- refers to assessment of the negative consequences that might be associated with preventive behavior, such as cost, inconvenience, accessibility factors, negative perceptions of health services, and side effects. The susceptibility and severity components, in combination,
mobilize the individual to act, whereas the cost-benefit analysis of perceived benefits minus assessed cost provides the individual with a preferred course of action.

It is considered that health beliefs motivate the individual to act but that behavior will not occur unless a cue to action is present. Such cues can be internal (e.g., symptoms) or external (e.g., mass media messages, or advice reminder from health care providers). Socio-demographic factors and structural variables such as knowledge and awareness might affect the individual’s perception and thus indirectly influence health-related behavior.

Researchers have identified other variables that might be added to the Health Belief Model to improve its predictiveness and utility. Rosenstock, Strecher, and Becker (1988) reformulated the model by incorporating the concept of self-efficacy (the individual’s assessment of his/her ability to carry out health-promoting behavior successfully). Becker (1979) suggested making it less individualistic by including factors such as locus of control and social support. Other researchers have included the concept of behavioral intentions (Mullen, Hersey & Iverson, 1987).

Other factors, in addition to those previously identified in the original or the modified version of the HBM, have been shown to influence preventable health behaviors. Health status of the individual was identified as a factor to explain decisions to use preventive health services. It has been
hypothesized that people in poor health or those having some kind of disability may be more or less likely to participate in preventive programs (Schwoon and Schmoll, 1979).

In addition to the factors included in the Health Belief Model, Rosenstock and Kirscht (1974) pointed out the importance of environmental and structural factors in influencing health behaviors. Mcleory, Bibeau, Steckler and Glanz in 1988, proposed an ecological perspective for health promotion which emphasizes the role of health belief factors, institutional factors, community factors, and public policy.

In the present study, some of the preceding concepts included in the HBM or proposed by other researchers will be used to examine the behavior of mothers in regard to obtaining age-appropriate immunization for their infants.

Review of Previous Research

The HBM categories will be used as a framework to organize and classify various research findings pertaining to parents' health behavior and the immunization status of their children.

Attitudes and Beliefs

Psychological information, such as perceptions of disease susceptibility, severity, and vaccine efficacy were shown to influence the immunization decisional process when vaccines were newly introduced (Rosenstock, Derryberry & Garriger,
1959). Early descriptive studies showed the relationship of parental attitude and the acceptance of Salk polio vaccine (Clausen, Seidenfeld & Deasy, 1954; Glasser, 1958; Merril, Hollister, Gibbens & Haynes, 1958). McGrath, et al. (1992) analyzed a measles outbreak in Michigan. Their results revealed that mothers of measles cases perceived immunization as unimportant.

**Perceived Susceptibility**

Markland and Durand (1976) investigated socio-psychological factors affecting infant immunization by surveying parents of two-year old children in Missouri. Their results showed that parents of adequately immunized infants were more aware of disease risk than parents of inadequately immunized infants. During 1977-1978, a survey of public attitudes toward immunization was conducted by the Opinion Research Corporation (ORC) for the Centers for Disease Control (CDC) to determine factors that influence consumers' intent to receive or have their children receive immunizations. The results of the survey indicated that perceived personal susceptibility to a disease (Asian flu, influenza B, swine flu, diphtheria, mumps, pertussis, measles, tetanus, rubella, typhoid, smallpox, rabies, polio) and perceived likelihood of local occurrence of a disease were important variables in determining the intent of consumers to seek vaccination for themselves and their children (Riddiough, Willems, Sanders &
Kemp, 1981). In a national immunization study conducted in the United Kingdom, Peckham, Senturia, and Ades, (1989) mailed questionnaires to 1793 health professionals and 3394 parents of two year old children in seven districts with high coverage and eight districts with low coverage for measles and pertussis vaccines. The study results indicated that parental factors associated with low immunization uptake included low social class, large family size, presence of a chronically ill child in the family, and low parental attitude scores which assessed severity and infectivity of diseases and efficacy and safety of vaccines. Of these factors, the parental attitude score had the greatest influence on immunization coverage.

Perceived Severity

Results of Markland and Durand's study (1976) showed that parents of adequately immunized infants were more aware of disease seriousness than those of inadequately immunized infants. In the Opinion Research Corporation (ORC) survey, perceived seriousness of disease ranked as the fifth most discriminating variable in multivariate analysis (Riddiough et al., 1981). Recently, Feigelman, Stanton, Rubin, and Cartelli (1993), in Baltimore, investigated compliance with measles post-exposure prophylaxis among families with children eligible for prophylactic vaccination. In a multiple logistic regression analysis, only the perceived severity of measles significantly predicted compliant behavior.
Perceived Efficacy

Markland and Durand’s study (1976) indicated that parents of adequately immunized infants in Missouri had more awareness of vaccine efficacy and of protection afforded by vaccines compared to parents of inadequately immunized infants. An investigation of the relationship between health beliefs and use of well-baby services among high risk mothers attending a maternal child health clinic revealed that perceived efficacy of immunizations and perceived benefits of well-baby services significantly predicted the number of immunizations received during the first six months. However, health beliefs were not predictive of the number of well-baby clinic visits (Kviz, Dawkins & Ervin, 1985). A survey was conducted in Britain of 201 parents attending three child health clinics to see why many parents did not have their children immunized against measles. This survey showed that 63% of parents did not believe that immunizations are effective in preventing measles (Blair, Shave & Mckay, 1985).

Perceived Barriers

Vaccine side effects.

Substantial decline in the incidence of vaccine-preventable-diseases, including the virtual elimination of some diseases, results in declining awareness of the health benefits of a vaccine and its impact on disease. At the same time, adverse events following the use of vaccines receive
greater attention. These concerns about potential adverse events may lead to reductions in vaccine coverage and recurrence of epidemic disease (Cherry, 1984).

In the Opinion Research Corporation (ORC) survey, perceived vaccine safety ranked as the fourth most discriminating variable in predicting consumers' use of vaccines (Riddiough, et al, 1981). Lewis et al. (1988) conducted a retrospective study in Utah to investigate the influence of parents' opinions regarding pertussis vaccine on infant diphtheria, tetanus, and pertussis (DTP) immunization rates by mailing questionnaires to parents of 2975 children born in June, 1985. The study showed that 67% of parents were worried about the DTP vaccine and parents who were worried were more likely to have their children partially immunized or unimmunized. The data revealed that 18 percent of children did not receive immunizations because their parents were either worried about the vaccine or they did not think it was important.

Fears over the safety of the measles vaccine have had an effect on immunization levels in the United Kingdom. A random sample of 93 parents of two year old children were interviewed by Carter and Jones in 1985 in an attempt to determine the causes of failure of a measles immunization program. The results revealed that 34% of parents did not regard measles as a serious disease and only 44% considered the measles vaccine to be safe.
Illness of the child.

Parental attitude regarding vaccinating a child with minor illness have been shown to affect immunization coverage. Lewis et al. (1988) in their study in Utah, found that the most common reason for incomplete DTP immunization was illness at the time the vaccination was due. McGrath, et al. (1992) in analyzing a measles outbreak in Michigan, found that children having respiratory tract infection, allergies, asthma, or being breast fed were reasons given by mothers which prevented the child from getting vaccinated against measles. In 1993, Abbotts and Osborn investigated the reasons for not being immunized on schedule among children using public health clinics in Utah. Minor illness in the child was the most common reason mothers gave for delaying immunizations.

Temporary intercurrent infection or allergy accounted for 38% of noncompliance with immunizations in an English study (Klein, Morgan & Wansbrough-Jones, 1989).

Inadequate access to care.

Accessibility to health care is an important factor that determines health behavior (Cummings, Becker & Maile, 1980). The National Advisory Committee (1991) reported that low immunization rates reflected, in part, inadequate access to preventive care. A national telephone survey of access to health care conducted in 1986 by The Robert Wood Johnson
Foundation showed that children who were uninsured and poor were less likely to have seen a physician in the past year and uninsured preschool children were less likely to have up-to-date immunizations (Wood, Hayward, Corey, Freeman & Shapiro, 1990). The National Center for Health Statistics (1990) reported that more than 15% of preschool-aged children are covered neither by health insurance nor Medicaid and almost 10% have no regular source of care. However, Cutts, Orenstein and Bernier (1992) noted that while provision of health insurance increases service utilization, it does not guarantee high immunization rates.

**Health service barriers.**

Several studies have documented satisfaction with health services as an important determinant of preventive health services utilization. Earlier, Rosenstock, Derryberry, and Carriger (1959) identified convenience as a factor which influenced use of polio vaccine services. Dutton (1978) and Rundall and Wheeler (1979) reported that perceived service barriers and negative attitudes of consumers towards the type of health services available to the poor had greater influence on receipt of immunization by the lower socioeconomic group than cost or the direct effect of payment for service. National survey data of Hispanic families showed that inconvenient clinic hours and locations are leading barriers to care (Estrado, Trevino & Ray, 1990).
March and Channing (1987) found that the use of preventive care services varied greatly by income between communities in the United Kingdom, despite the availability of free medical care for all. In a national British immunization study, parent’s attitudes towards the health services were associated with incomplete immunization (Peckham, Senturia & Ades, 1989).

Published reports document the failure of the health system to provide acceptable immunization services to persons in the lower socio-economic groups. In the United States, a survey of 54 of the largest immunization projects that receive federal grant funds showed that half had policy or resource barriers that limited access to immunization. Identified barriers to immunization access included insufficient clinic staff, insufficient clinic hours, inaccessible locations, immunizations being available by appointment only, requirements for physical examinations, need for physician referral, requirement for enrollment in well-baby clinics, and financial screening and/or vaccine administration fees (Orenstein, Atkinson, Mason & Bernier, 1990).

In the private sector, fragmentation of care is a barrier that parents may face. The high cost of vaccination by private physicians forces some parents to seek immunizations in public clinics because the majority of insurers fail to cover vaccination. A recent survey found that only 45% of employment based conventional health insurance plans covered
basic childhood immunizations (Health Insurance Association of America, 1989). Vaccine price increases have limited physician delivery of immunizations and changed referral patterns (Arnold, 1992; Hueston, Meade & Mainous, 1992). A study conducted in Texas revealed that, between 1979 and 1988, the percentage of children referred by physicians for immunization to public clinics increased by 693% (Schulte et al., 1991).

Another problem is the lack of a uniform data system to keep track of all children and to identify those in need of a dose of vaccine. The majority of public and private providers have no comprehensive system to identify and notify individuals who need immunization or to assess overall immunization levels in their client populations (Hinman, 1990). Thus, appropriate immunization currently depends on a motivated parent who views immunization as a priority.

**Cues to Action**

Cues to action, both verbal and written, play an important role in triggering the person to participate in the proposed action (Rosenstock, 1974). Cues to action can be given by media attention, advice from others, educational materials, parent reminders or by other methods.

Tollestrup and Hubbard (1991) in their evaluation of the effect of mailed reminders on compliance with the recommended schedule for DTP immunization among 393 under-five children receiving immunization from a health department found that
nine out of 68 noncompliant mothers mentioned forgetting the due date as a reason for not returning to the clinic at the appropriate time. In a survey conducted at a health immunization clinic in Edmonton, Canada, 14 percent of parents were unaware that immunizations were needed (Sawyer, Akgungor, Crick & Jennings, 1985).

Media Influence

The media has a great influence on people's attitudes. In the study conducted by Markland and Durand (1976), greater media exposure was associated with more immunization. The media may also have a negative effect as shown from a study by Lewis et al. (1988), in which parents cited the media as the main information source for their anxiety regarding the safety of DTP immunizations.

Advice From Others

Studies conducted in the 1950s on polio vaccine acceptance indicated that the decision to seek vaccination was influenced by others who are important to that person. Rosenstock (1959) concluded that people who were not completely vaccinated against poliomyelitis could best be reached through personal contact. Glasser (1958) demonstrated that persons who participated in immunization programs were more likely to have discussed the program with friends or with physicians. Belcher (1958) reported that in one community the
people who had presumably respectable position (e.g. physicians, teachers, ministers) effectively encouraged individuals to seek vaccination against poliomyelitis. The findings of the study conducted by Gray, Kesler, and Moody (1966) on polio vaccination confirmed the positive influence of friends on compliance with immunization. However, in the study by Lewis et al. (1988), parents who received their information about vaccine problems from family and friends were misinformed regarding the relative risks of DTP vaccination and pertussis illness. Blair, Shave and McKay (1989) in England, reported that consultation with a health care professional had no influence on parent decision regarding measles vaccination.

Health Education Materials

Health education materials (pamphlets, posters, leaflets, etc.) can provide further cues to action. Fulginiti (1984) argues that verbal communication alone is insufficient and should be reinforced by easy to understand written documents. A study conducted by Clayton, Hickson, and Miller (1994) found that parents who received pamphlets learned more about vaccines and were more eager to obtain immunizations for their children. However, the present vaccination information materials have been criticized as being too long, complex, and anxiety provoking. A survey of health officials indicated that
they consider the present immunization brochures to be a major obstacle to the immunization program (Marwick, 1992).

Immunization Reminders

Different types of reminder-recall systems, using letters, postcards, personal phone calls, or home visits have shown improvements in clinic attendance rates.

Mailed reminder.

A Rhode Island study examined the effect of mailing a computer-generated motivational prompt to parents of two month old infants on immunization initiation. This study showed a 10 percent increase in immunization initiation among parents contacted compared to those not contacted among lower and upper class families. Middle class families demonstrated a non-significant five percent increase (Byrne, Schaffer, Dini & Case, 1970). The Ohio Department of Health has reported favorable results using a single general prompt mailed to parents of children at high risk of failure to receive vaccination according to socioeconomic correlates (parental education and family size). When compared with a no-contact, at risk control group, the general prompt produced a 16 percent increase (Young, Halpin, Johnson, Irvin & Marks, 1980). Yokely and Glenwick (1984) evaluated the impact of four procedures: a general prompt, a client-specific prompt, a specific prompt with increased public health clinic access,
and a specific prompt with monetary incentives, on motivating parents of deficient preschoolers to obtain immunization for their children. All interventions, except the general prompt, produced some evidence of improvement when compared with the control group. In Washington State, compliance with the recommended interval for DTP immunizations was increased 34% among parents who received two reminders compared to the control group (Tollestrup & Hubbard, 1991).

**Telephone calls.**

Recently, Stehr-Green, Dini, Lindegren and Patriarca (1993) studied the effect of computer generated telephone reminders on the rate of on-time immunization among preschoolers in two public clinics in Atlanta. Their results indicated that a single reminder increased the rate of on-time vaccination by two-fold.

**Personal contacts.**

The results of studying the effect of service aides on an infant immunization program in North Central Texas showed that after contact with aides 44 percent of non-responders reported subsequent immunization (Moore, Morris, Burton & Kilcrease, 1981).
**Parent-held Immunization Record**

Patient-held records have been advocated as a means of increasing patient knowledge and compliance in the health care process (Giglio et al., 1978). In 1981, McCormick, Shapiro and Starfield examined the association between use of a parent-held immunization record and compliance with the recommended immunizations for the first year. Their findings indicated that immunization rates were higher among infants for whom the records were available compared with infants whose parents did not keep their immunization records. A literature review by Dickey (1993) concluded that patient-held minirecords have been widely and successfully employed to improve use of preventive care services for children particularly with regard to immunizations. An Australian study further supported the importance of the parent-held child health record (Volkmer, Gouldstone & Ninnes, 1993).

**Modifying Factors**

**Socio-Demographic Factors**

Certain parental sociodemographic factors have consistently been associated with under-immunization of U.S. children under two years of age including low educational level of either parent, large family size, low age level of either parent, low socioeconomic status, and nonwhite race (Markland & Durand, 1976; Marks, Halpin, Irvin, Johnson & Keller, 1979). Recently, Bobo, Gale, Thapa and Wassilak (1993)
in their study of a population based sample of 1163 children in Oregon found that later birth order, low family income, low maternal education, and unmarried status of parents predicted failure to immunize children on schedule. Peckham, Senturia and Ades (1989) in their study of immunization uptake in England and Wales found that lower social class, presence of older siblings and of chronically ill children in the family were associated with lower uptake.

Research in developing countries has documented other parental and child risk factors including home delivery, language barrier (Cutts, Roddrigues, Colombo & Bennett, 1989) individual social deprivation, lack of prenatal care, place of birth that is rural versus urban, and the late start of the immunization series (Bhattacharya, 1990; Fassin & Jeannee, 1989). Family type, gender and maternal employment have also been found to influence lack of age-appropriate immunization (Pillai & Conaway, 1992).

Knowledge

Research on the effect of knowledge on immunization has revealed that adequately immunized children tend to be found in families whose parents are more aware of immunizations and vaccine preventable diseases (Dalphinis, 1986; Markland & Durand, 1976). During a measles outbreak investigation in Michigan, mothers interviewed mentioned "did not know about free immunization", "thought immunization was unimportant", 

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and "thought the age for measles vaccination was 2 years" as reasons for missing measles immunization (McGrath et al., 1992). A recent survey of 416 active duty pediatric dependents served by the National Naval Medical Center indicated that parental unfamiliarity with the recommended schedule was the most common reason for noncompliance with immunization requirements (Lopreiato & Moriarty, 1993).

Parental knowledge has been documented from research in other countries to be associated with children's immunization status. A knowledge, attitudes and practice study in India revealed that low vaccine awareness and lack of dose-related knowledge among urban, educated parents was the main factor behind non-immunization of children (Shah, Sharma & Van, 1991). Coreil, Augustin, Holt and Halesy (1989) compared mothers of completely vaccinated children with mothers of incompletely vaccinated children in a case-control study in Haiti and found that knowledge of vaccines was the strongest predictor of vaccination status. A study using focus groups in Togo revealed that mothers' beliefs, and knowledge, social and cultural norms and practices, and experiences with health services influenced the acceptability of childhood immunization (Eng, Naimoli, J., Naimoli, G., Parker & Lowenthal, 1991). An Iranian study showed that mothers' lack of knowledge about the immunization schedule was the major determinant in delaying the immunization schedule (Nasseri, Latifi, Azordegan, Shafii & All-E-Agha, 1990).
Health Care Institutions

Organizational factors have been found to be an important determinant of immunization coverage. Peckham et al. (1989) conducted a national immunization study in the United Kingdom and investigated the characteristics of 88 practices. The practice characteristics evaluated included the number of partners in the practice and logistics of immunization provision. Their results showed that a low practice organization score was associated with low immunization uptake and was related to parental attitude score. Negative attitudes were common among patients served by practices that were less well organized.

Other health service factors identified as important determinants of childhood immunization include health professionals' knowledge and attitudes and missed opportunities for administering vaccines.

Provider attitudes and practices.

The knowledge of health professionals regarding immunization policies is often inadequate. Surveys of health professionals in hospitals and public clinics in a variety of locations in the United States and the United Kingdom have shown that minor illnesses and other clinical conditions are frequently misidentified as contraindications to vaccination (Cutts, Zell, et al., 1992; Hatton, 1990; Moules, 1987; Nicoll, 1985; Peckham, Senturia & Ades, 1989; Reid, 1989). In
a survey of families with children eligible for measles vaccination in South London, mothers gave advice of a health professional as the most frequent reason for children not being vaccinated (Adjaye, 1981).

Professional misperceptions of true contraindications and reluctance to administer multiple vaccines simultaneously results in missed opportunities for vaccination. It has been found that in immunization clinics, approximately 20 percent of opportunities to administer vaccines are missed (Cutts, Zell, et al., 1992). Jones, White, Campbell and Farrell (1988) estimated that immunization levels among clinic patients in Virginia could have been increased by 20 percent if providers had taken advantage of opportunities for simultaneous vaccination.

Missed opportunities.

Failure to screen a child's immunization eligibility and to provide vaccination at the same place providing curative services results in missed immunization opportunities. Studies have documented missed opportunities for immunization that occur when a child who is eligible for vaccination attends other health care services but immunization status is not assessed and immunizations are not offered. During a measles outbreak in Dade County, Florida, almost 50% of the undervaccinated children had made a contact with a medical
provider at a time when they could have been vaccinated (Hutchins et al., 1989).

Research also indicates the occurrence of missed opportunities during well-child care visits. Szilagyi et al., (1993) conducted a retrospective medical chart review in seven primary care settings in Rochester, NY. The findings indicated that more than 20% of all visits were missed opportunities and that a more than 50% reduction in under-vaccination time could be achieved by eliminating missed opportunities at all types of visits. Farizo, Stehr-Green, Markowitz, and Patriarca (1992) reviewed the immunization records of 238 children who visited a Los Angeles comprehensive care unit. They found that in about one-third of children, at least one opportunity was missed to administer MMR vaccine and approximately one-fourth of these missed opportunities occurred during well-child care visits. Similar findings were reported by McConnochie and Roghmann (1992) and Rodewald et al. (1993), in their studies of immunization missed opportunities in primary care facilities.

Missed opportunities for vaccinations during medical encounters have also been reported from surveys of health departments (Guyer, Baird & Hutcheson, 1976; Hanes, 1988), an emergency department (Bell, Lopez, Pinto-Martin, Casey & Gill, 1994; Lindegren, Atkinson, Farizo & Stehr-Green, 1990), a pediatric inpatient unit (Tifft & Lederman, 1988), and health clinics in developing countries (Cutts, Zell, Soares & Diallo,

Reasons for missed opportunities includes failure of physicians to assess immunization status in emergency departments and inpatient units and misunderstanding of vaccine contraindications in public health clinics (Cutts, 1990; Orenstein, Atkinson & Mason 1990).

Summary of Literature Review

There seems to be a large amount of literature concerning preventive health behavior and some of the attitudes, beliefs, and perceptions that correlate with this behavior (Ajzen & Fishbein, 1980; Bandura, 1986; Cummings, Becker & Maile, 1980; Hochbaum, 1958; Rosenstock, 1974). However, recent empirical literature relating parental psychosocial factors with health behavior of immunization is limited. Also, the studies that do relate these concepts have provided some conflicting results.

Besides the general lack of recent research in the area, the research that exists is lacking in several areas. First, immunization is rarely well defined. For example, in The Opinion Research Corporation’s study (Riddiough et al., 1981), immunization was defined as individuals’ desires or intentions to get immunization for themselves or for their children. That definition was not objective enough. The problem of lack of specific definition was also noted in the earlier studies for acceptance of Salk polio vaccine (Clausen, Seidenfeld & Deasy,
Existing studies in which immunizations were objectively measured were limited. The few studies in which immunization status was objectively measured were based on either compliance with specific vaccine, e.g., DTP vaccine (Lewis et al., 1988), or compliance with up-to-date immunizations (Markland & Durand, 1976). Further research is needed to identify the different factors that determine obtaining age-appropriate immunizations for children.

The current study examined the various psychosocial and sociodemographic factors of mothers who complied or did not comply with their children's immunization schedule. Immunization status of the child was determined from the child's health records obtained from the health provider and/or from the parent-held immunization records. Furthermore, this study described the important cues to action that motivated the mothers in obtaining age-appropriate immunizations for their children.
CHAPTER III

RESEARCH METHODS

This chapter describes the research methodology used in the study. At first a discussion of the survey study within which the current study was nested is presented. Secondly, a description of the research design, sampling procedures, and sample size are presented. Finally, a discussion of scales of measurements, data analysis, and operational definitions of variables are included.

Background of the Consortium-Based Immunization Project

In October 1992, the Centers for Disease Control and Prevention funded a consortium-based demonstration project in Norfolk to improve immunization coverage among children under two years of age. The project consists of three stages: (1) a baseline community survey conducted from March through August 1993 to establish the pre-intervention immunization coverage of children under two years of age in Norfolk (the intervention city) and Newport News (the comparison city); (2) an intervention phase which began in November, 1993 with the interventions determined by a community consortium; and (3) a post-intervention survey to be conducted in 1995. The start date of the project was 10/1/92.
Sampling Procedure

From March−August 1993, a household survey was conducted to assess immunization coverage among preschool children in Norfolk and Newport News. A two stage cluster sampling technique was used to generate a probability proportional to size (PPS) sample of households in Norfolk and Newport News. This method assures that more densely populated areas of cities contribute more "clusters" to the sample than sparsely populated areas. In each city, 55 clusters were selected of 120 dwelling units per cluster. Dwelling units included houses, individual apartments, and trailers.

First, 55 census tract block groups per city were systematically selected with replacement from a list by using the cumulative sum of households by block group. For each selected census tract and block group, all households in that block group were mapped and divided into clusters of 120 households each. The total number of household clusters of each census tract block group were listed and a predetermined number of clusters per block group were selected by simple random sampling without replacement. In Norfolk, city maps were used to draw preliminary maps for sampling purposes. These maps were verified by field surveys which were conducted to verify and correct the maps.
Norfolk Population and Sample Size

Trained interviewers screened 6,458 households in Norfolk and a similar number in Newport News in order to determine whether the household had a child from 12 to 30 months of age (see Appendix, Schedule A). This review focuses on Norfolk only, as the Newport News data were not included in this study. The screening process in Norfolk identified 417 eligible households with at least one eligible child. In 49 eligible households, the respondent refused to participate, which resulted in a 12% refusal rate. An interview was completed in 368 households (88%). Twenty households had more than one eligible child. Thus, there was a total of 389 children in Norfolk surveyed for immunization coverage.

Data Collection

The baseline immunization survey data were collected by interviewing parents or primary care takers of the child at home using a structured questionnaire (see Appendix, Schedule B). The baseline survey was initiated in April 1993. The baseline interview took about 15 to 20 minutes.

The baseline immunization survey questionnaire.

Data of the the baseline immunization survey were collected using a structured interview schedule (Schedule B) that included the following sections:
1. **Household composition:** This section included questions concerning individuals living in the household, their ages, occupations, and their relationships to the eligible child.

2. **Immunization history:** This section included questions about availability of the immunization card or record. If the card was available at home the date of each immunization given to the child was recorded by the interviewers.

3. **Health care providers:** This section involved a list of names and locations of all the clinics where the child has received immunizations and a question asking about where the respondents usually went to get immunizations. This section also included three open ended questions concerning the reasons for choosing a certain location as the usual immunization place, reasons for not having one immunization place, and their opinions regarding the importance of immunizations.

4. **Health care coverage:** This section included questions concerning health care insurance coverage, health care plans, and coverage for immunizations.

5. **Barriers to immunization:** This section posed several open ended questions regarding having problems getting to the clinic, with clinic hours, getting appointments, and with waiting time. Questions were asked about how much they paid for the child’s last immunizations and other
indirect costs such as transportations and baby sitter fees. Questions related to the respondent’s knowledge about free immunization places and times to go for shots were also asked.

6. **Socio-demographics**: This section involved questions about respondent’s ethnicity, education, family income, participation in WIC program or AFDC program, family income, and finally an open ended question concerning suggestions for improving immunization services.

Immunization histories were recorded from the child’s immunization record. After the interview, respondents were asked to sign a form authorizing release of copies of all immunization records from each of their child’s health care providers.

**The Reliability Study**

Beginning in May 1993, prior to the completion of the baseline household survey in Norfolk, a reliability study and the maternal psychosocial survey were initiated. The reliability study and the psychosocial survey were combined for logistical efficiency. One-hundred-fifty households were randomly selected from eligible households identified during baseline interviews (Schedule B). Interviewers were sent to these 150 households as a reliability check, during which they were to verify the date of birth and the immunization history of the study child. In addition, they were trained to conduct
the psychosocial interview (Schedule C). After completion of
the Schedule B verification and Schedule C interview, the
interviewer contracted five households on either side of the
index house which, according to the baseline survey were not
expected to have an eligible child. These households were
contracted to re-assess the completeness of ascertainment of
eligible children during the original baseline survey. If an
eligible child was found during this reliability study, a
Schedule B interview was conducted.

The Psychosocial Survey

In order to determine maternal knowledge and attitudes
about immunizations and immunizable diseases, a psychosocial
survey was conducted in Norfolk of a subset of households
identified in the baseline immunization survey.

Selection Criteria

The criteria for selecting a child for the psychosocial
survey was: (1) eligibility for inclusion in the baseline
survey; (2) having an immunization record available at home
for the study child and/or having signed an authorization for
release of medical records from the health providers; and (3)
that the respondent to the baseline survey was the mother.
Sample Size

A random sample of 208 mothers with an eligible child identified in the baseline immunization survey was selected for the psychosocial survey. Seven mothers (3%) refused to participate. If the mother had more than one eligible child, data were collected regarding the youngest eligible child.

Data Collection

A second home-based interview with mothers was conducted using another structured questionnaire (see Appendix, Schedule C) in order to collect data for the psychosocial survey. Psychosocial interviews were initiated in the last week of May and ended July, 1993. The psychosocial questionnaire took about 15 minutes to complete, and was combined with the reliability study. The psychosocial questionnaire was not administered with the baseline survey for compliance reasons, due to the fact that the estimated total length of the interviews combined would be 30-40 minutes. Data collection for the psychosocial survey was conducted by a team of interviewers. Interviewers received standard training regarding the background and objectives of the survey, community approach and interviewing techniques, field survey management, and item by item explanation and rehearsal of the questionnaires.
**Questionnaire development and validation.**

The questionnaire for the psychosocial survey (Schedule C) was developed based upon previous research, existing theories and conceptual frameworks. Initial development of the survey instrument began with a literature review and the identification of pretested questionnaires used for previous studies at other sites. The initial draft of the questionnaire was reviewed by experts for content validity and revised to incorporate their recommendations. The revised draft was pretested on project staff and consortium volunteers. Subsequently, it was pretested on volunteers in accessible clinic sites to examine the sequence and flow of the questions and clarity from the perspective of the respondents. Based on these pretests, the interview schedule was further revised to assure validity and ease of administration.

**Construction of the questionnaire.**

The psychosocial interview questionnaire (Schedule C) included the following sections:

1. **Information source:** This section included questions that addressed the mothers' source of knowledge about immunizations, where the child was born, if information was provided to the mothers at the hospital after delivery, and if the mother had received any reminders about immunizations.
2. Knowledge: This section included open ended questions to ascertain the mothers' knowledge of vaccine-preventable diseases, immunizations, and the age when the child should begin the immunizations.

3. Attitudes: This section included several questions about mothers' opinions of susceptibility to and severity of vaccine-preventable diseases, efficacy and safety of vaccines, their knowledge of vaccine contraindications, their perceptions regarding vaccinating children with minor illnesses, and any reasons for refusing an immunization.

4. Health and demographic background: This section involved questions related to the child's birth weight, use of prenatal care, well-baby care, breast feeding practice, presence of health problems or disability, and changes of residence since the child's birth.

Definitions

Age-appropriate immunization at 12 months of age.

Assessment of immunization status was based on age-appropriate immunization history during the first 12 months of age. A child was considered age-appropriately vaccinated during the first year of life if all three diphtheria, tetanus and pertussis (DTP) vaccine doses and both of the two oral polio virus (OPV) vaccine doses, were administered at the recommended ages (2, 4, and 6 months) plus a 30 days grace
period for each dose used by the CDC for defining delayed immunization (Dietz, Zell, and Stevenson, 1993).

Age-appropriate timing of vaccine doses was defined according to CDC definitions. For DTP immunization, the first dose must be given on or after 42 days of age and before 92 days of age with dose two and three given after a minimum interval of 28 days. The fourth DTP dose must be given at least 184 days after the third dose. For OPV immunization, the first dose must be given on or after 42 days of age and before 92 days of age, with dose two given a minimum of 42 days after the first dose.

Knowledge of vaccines and vaccine-preventable diseases.

Mother’s knowledge of vaccine-preventable diseases and immunizations was summarized by a knowledge score. The score was developed by combining responses to the two free listing questions (see appendix, Schedule C, Q15 and Q16), in which the mother was asked to name the vaccines that the infants and young children should get and the diseases that can be prevented by getting such vaccines. Each response was given a "1" if it was a correct answer and "0" if it was an incorrect answer. Correct responses for diseases included measles, tetanus, polio disease, diphtheria, pertussis, mumps, rubella or German measles, haemophilus influenza, and hepatitis B. Correct responses for vaccines included MMR, DTP, polio vaccine, Hib, and Hep B. Incorrect answers were: scarlet
fever, sickle cell disease, AIDS, rheumatic fever, smallpox, typhoid, ring worms, head lice, ear infection, Rye syndrome, and eye infection.

According to the knowledge score of diseases and vaccines, mothers were divided into tertiles (thirds), the lower tertile with low level of knowledge, the middle tertile with moderate knowledge, and the upper one with high knowledge. Mothers were also divided into two groups according to accuracy of knowledge. A mother had accurate knowledge of diseases and vaccines if no wrong answer was mentioned and had inaccurate knowledge if at least one wrong answer was listed.

**Attitudes toward vaccines and vaccine-preventable diseases.**

Mother's attitudes regarding susceptibility to and seriousness of vaccine-preventable diseases, and safety and efficacy of vaccines were summarized by an attitude score. A 12-item index was constructed by combining responses to questions 18a to 21c in Schedule C (see appendix), in which mothers were asked about their attitudes toward susceptibility to and severity of vaccine-preventable diseases and safety and efficacy of vaccines. The possible responses were coded 3 for very positive response, e.g., "very likely", 2 for just positive, e.g., "likely", and 1 for negative response, e.g., "not likely". The attitude scores were computed as the mean value assigned to the 12 questions and could range from a
minimum of 1 (negative attitude) to a maximum of 3 (positive attitude). The Cronbach's alpha was computed to test the reliability of the score; the coefficient indicated acceptable internal consistency for the scale (0.81).

According to their attitude score, mothers were divided into tertiles. The lower tertile were considered to have the most negative attitude; the middle tertile to have a moderately positive attitude; and the upper tertile to have the most highly positive attitude.

Knowledge of contraindications to vaccination.

A scale for mothers' awareness of vaccine contraindications to immunizations was developed to represent a continuum from incorrect knowledge (misinformation) to correct knowledge of immunizing a child with minor illness. A 5-item index was developed by combining responses from question 23a-23e in Schedule C (see appendix, Schedule C), in which mothers were asked about their opinions regarding immunizing a child with a runny nose, a slight fever, diarrhea, teething, or ear infection. The responses were assigned "1" for a correct answer; "0" for an incorrect answer or for a "don't know" answer. Scores were computed for individuals as the mean values assigned to their responses to the five questions. Thus, the individual scores may range from a minimum of 0 (considered "confused") to a maximum of 1 (considered "aware"). The Cronbach's alpha coefficient testing
the reliability of this scale was 0.62. This indicates marginal reliability of the contraindications scale.

**Data Management and Analysis**

For data processing purposes, a coding instruction manual was prepared. All 201 questionnaires were coded. Regarding open-ended questions, each different response was assigned a different code. In the analysis, coded responses were collapsed to fewer categories. The data were then verified by visual inspection in order to assure consistency and completeness. Logic checks were then performed by examining the frequency distributions and cross tabulations. Errors revealed by this process were subsequently corrected by the investigator.

The data were analyzed using microcomputers. Stata statistical software 3.1 (Stata, Inc., 1993) was used for data analysis. The following statistical measures were used:
1. Descriptive statistics such as frequency distribution, mean, and standard deviation were used to describe the socio-demographic characteristics of the population.
2. Chi-square analysis was used to examine the relationships between the nominal independent variables (for example, each of the socio-demographic variables) and the dependent variable.
3. The t-test was used to test the differences in mean values between immunization status groups.
4. The reliability of the scores used for measuring knowledge, and attitudes were evaluated using Cronbach’s alpha coefficients.

5. Odds ratio and 95% confidence interval were utilized to describe the degree of the association between each of the independent risk factors and the child’s immunization status.

6. Mantel Haenszel stratified analyses were used to test the relationships between each of the risk factors and the independent variable controlling for confounding factors.

7. Multiple logistic regression analysis, adjusted odds ratios and 95% confidence intervals were used to summarize factors associated with immunization status.
CHAPTER IV

RESEARCH FINDINGS

In this chapter the results of the study are presented. Initially, the sociodemographic and psychosocial characteristics of the population are presented. The relationships between each of the independent variables and age-appropriate immunization are examined independently to identify individual risk factors. Stratified analyses were utilized to adjust for the confounding factors. Finally, the factors associated with age-appropriate immunization were analyzed in combination using multiple regression analysis to summarize the predictors for age-appropriate immunization.

Sociodemographic Characteristics of the Population

The sociodemographic background of the sample are presented in Table 1. The participants in this study consisted of 201 mothers. Their age ranged from 15 to 42 years with an average of 27.6 years (S.D. 5.51). Forty-seven percent of mothers were white, 46% were African-American, and 7% were other races. Single-parent families represented 36% of the sample. The number of children, under 18 years of age, in the household ranged from one to six and with a median of 2 children and a mean of 2.3 children (S.D. 1.2).
Table I

Sociodemographic Characteristics of the Study Households.

Percent Age-Appropriately Immunized (AAI), Odds Ratios (OR), and 95% Confidence Intervals (CI)

<table>
<thead>
<tr>
<th>Household Characteristic</th>
<th>N(%)</th>
<th>%AAI</th>
<th>OR(95%CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>9(5%)</td>
<td>33</td>
<td>1.2(0.3-5.1)</td>
<td>0.756</td>
</tr>
<tr>
<td>&gt;=20 years</td>
<td>192(95%)</td>
<td>38</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>white</td>
<td>95(47%)</td>
<td>46</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>nonwhite</td>
<td>106(53%)</td>
<td>31</td>
<td>1.9(1.1-3.4)</td>
<td>0.027</td>
</tr>
<tr>
<td>Child’s gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>104(52%)</td>
<td>37</td>
<td>1.2(0.7-2.1)</td>
<td>0.593</td>
</tr>
<tr>
<td>female</td>
<td>97(48%)</td>
<td>40</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mother’s education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 Years</td>
<td>42(21%)</td>
<td>19</td>
<td>4.8(1.9-11.7)</td>
<td>0.000</td>
</tr>
<tr>
<td>=12 Years</td>
<td>86(43%)</td>
<td>35</td>
<td>2.0(1.0-3.8)</td>
<td>0.035</td>
</tr>
<tr>
<td>&gt;12 Years</td>
<td>70(36%)</td>
<td>53</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mother’s work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>homemaker</td>
<td>140(70%)</td>
<td>40</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>employed</td>
<td>59(30%)</td>
<td>34</td>
<td>1.3(0.7-2.5)</td>
<td>0.418</td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 or more</td>
<td>81(40%)</td>
<td>25</td>
<td>3.6(1.7-7.9)</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>62(31%)</td>
<td>40</td>
<td>1.8(0.8-3.9)</td>
<td>0.104</td>
</tr>
<tr>
<td>1</td>
<td>58(29%)</td>
<td>55</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>not married</td>
<td>73(36%)</td>
<td>22</td>
<td>3.2(1.7-6.2)</td>
<td>0.000</td>
</tr>
<tr>
<td>married</td>
<td>128(64%)</td>
<td>48</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Family income*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>47(24%)</td>
<td>15</td>
<td>7.9(2.7-23.2)</td>
<td>0.000</td>
</tr>
<tr>
<td>medium</td>
<td>123(61%)</td>
<td>42</td>
<td>1.9(0.9-4.2)</td>
<td>0.115</td>
</tr>
<tr>
<td>high</td>
<td>31(15%)</td>
<td>58</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

P value by chi-square test
* Low income = less than $10,000, Medium income = from $10,000 to less than $30,000, High income = $30,000 or more
| Table 1  
(continued) |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Recipient of AFDC</strong>*</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td><strong>Recipient of WIC</strong></td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td><strong>Birth place</strong></td>
</tr>
<tr>
<td>Norfolk</td>
</tr>
<tr>
<td>outside Norfolk</td>
</tr>
<tr>
<td><strong>Moving since the child’s birth</strong></td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td>one time</td>
</tr>
<tr>
<td>two or more</td>
</tr>
<tr>
<td><strong>Usual Imm place</strong></td>
</tr>
<tr>
<td>private doctor</td>
</tr>
<tr>
<td>public clinics</td>
</tr>
<tr>
<td>military clinic</td>
</tr>
<tr>
<td><strong>Insurance for imm</strong></td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td><strong>Pregnancy term</strong></td>
</tr>
<tr>
<td>full term</td>
</tr>
<tr>
<td>premature</td>
</tr>
<tr>
<td><strong>Birth weight</strong></td>
</tr>
<tr>
<td>normal</td>
</tr>
<tr>
<td>low</td>
</tr>
<tr>
<td><strong>Health problem</strong></td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td>yes</td>
</tr>
</tbody>
</table>

* AFDC= Aid For Dependent Children Program  
** WIC= Women, infants, and Children Program  
Imm = Immunization
Regarding education, 21% of the mothers did not complete high school, 43% had a high school diploma, and only 10% graduated from college. The great majority (70%) of mothers were homemakers, 27% had skilled, semiskilled, or clerical jobs, and a small percentage (3%) were professional workers.

With respect to family income, the highest proportion of mothers (61%) had a family income ranging from $10,000 to less than $30,000. Nearly one-fourth (24%) of mothers had an income less than $10,000 and 15% had an income of $30,000 or more. About one fourth (24%) of the sample were AFDC recipients and nearly half (45%) were WIC recipients. More than one third (36%) of children were covered by Medicaid, 46% by Champus, 7% by private insurance, 4% by HMO, and 7% had no health insurance coverage.

Sixty-two percent of the children included in this survey were born in a hospital in Norfolk and the rest were born in a hospital outside the city of Norfolk. Referring to the usual place of immunization, only 16% received their immunizations from public health clinics and a similar percentage (16%) from hospital clinics. The proportion of children receiving immunizations from military clinics (34%) was similar to that from private physicians (34%).

The population of the study was highly mobile. Only 47% of children had lived in the same address since birth, 29% moved one time, and 24% moved twice or more.
Comparing Household Demographic Characteristics to that of Norfolk population

Table 2 shows demographic distribution of the respondents in the psychosocial study, baseline immunization survey, and to Norfolk 1990 Census. Ethnicity, education and income distribution of the subset of population in this study seemed to be comparable to that of the total population involved in the baseline immunization survey and to the Norfolk 1990 census population.

Health Status Indicators

The average age of the 201 children in the study was 22 months (SD 5.66) and the range was 12-30 months. Nearly one-half of the children were males (52%). Only few (9%) had a health problem or disability and a small percentage (12%) were born premature. The average birth weight of children was 7.3 pounds (S.D. 1.44). Only 10% of children had low birth weight (less than 2500 g).

Mothers' Preventive Behaviors

As indicated in Table 3, the great majority (87%) of mothers reported starting their prenatal care in the first trimester of the pregnancy. The American Academy of Pediatrics recommends six well-baby visits during the first 12 months and the first visit should be started by one month of age (Committee on Practice and Ambulatory Medicine, 1988). Less
Table 2
Percentage Distribution of Respondents to the Psychosocial Survey, the Baseline survey, and Norfolk 1990 Census by some Demographic Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Psychosocial Survey</th>
<th>Baseline Survey</th>
<th>Norfolk 1990 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=201</td>
<td>N=389</td>
<td>N=9,365</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>47</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>Black</td>
<td>46</td>
<td>48</td>
<td>46</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Education of the Respondent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=198</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not a high school</td>
<td>21</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>High school diploma</td>
<td>43</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td>Some college</td>
<td>26</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>College graduate</td>
<td>10</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Family Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=172</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $10,000</td>
<td>24</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>$10,000-</td>
<td>31</td>
<td>28</td>
<td>21</td>
</tr>
<tr>
<td>$20,000-</td>
<td>35</td>
<td>36</td>
<td>37</td>
</tr>
<tr>
<td>$40,000-</td>
<td>10</td>
<td>10</td>
<td>28</td>
</tr>
</tbody>
</table>
Table 3

Percent Distribution of the study population, Percent Appropriately Immunized, Odds Ratios and 95% Confidence Intervals by Preventive Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N(%)</th>
<th>%AAI</th>
<th>OR(95%CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal care first trimester</td>
<td>174(87%)</td>
<td>39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Prenatal care later</td>
<td>25(13%)</td>
<td>36</td>
<td>1.1(0.5-2.4)</td>
<td>0.383</td>
</tr>
<tr>
<td>Breast feeding yes</td>
<td>83(41%)</td>
<td>49</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Breast feeding no</td>
<td>118(59%)</td>
<td>31</td>
<td>2.2(1.4-3.6)</td>
<td>0.003</td>
</tr>
<tr>
<td>Age of first well-baby visit 0-2 month</td>
<td>150(80%)</td>
<td>43</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Age of first well-baby visit later</td>
<td>38(20%)</td>
<td>21</td>
<td>2.9(1.4-5.8)</td>
<td>0.006</td>
</tr>
<tr>
<td>Number of well-baby visits in the first year &gt;=5</td>
<td>67(34%)</td>
<td>57</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Number of well-baby visits in the first year 0-4</td>
<td>130(66%)</td>
<td>30</td>
<td>3.1(1.8-5.1)</td>
<td>0.000</td>
</tr>
</tbody>
</table>
than one-fourth (23%) of children started well-baby care by
the age of one month, 57% had their first well-baby visit in
the second month of age, and 20% started well-baby care at
three months or later. A high proportion (38%) of children
had three or fewer well-baby visits in the first year of life,
28% had four, 15% had five, and 19% had completed six visits
in the first year of life. Only 41% of mothers breast fed
their infants.

Immunization Status Variables

As shown in Table 4, 71% of children included in the
psychosocial survey had up-to date immunizations at 12 months
of age. However, only 38% had age-appropriate immunizations at
that age. Table 4 shows immunization rates of the children
included in the psychosocial study, baseline immunization
survey, and rates of Norfolk school enterers, 1991-92. Up-to
date immunization rates of the subset of children in this
study seemed to be comparable to that of the total children
involved in the baseline immunization survey and to the
Norfolk immunization rates obtained by 1991-1992 retrospective
school enterer survey.

Sources of Immunization Information

The results indicated that almost all mothers (97%) had
a source of information about immunizations. The majority of
mothers (75%) had only one immunization information source,
Table 4

Percentage of Up-to-Date and Age-Appropriately Immunized
Children of the Psychosocial, Baseline, and 1991-92
Retrospective School Surveys

<table>
<thead>
<tr>
<th>Immunization Status</th>
<th>Psychosocial Survey (N=201)</th>
<th>Immunization Baseline Survey (N=389)</th>
<th>Norfolk 1991-92 Retrospective School Survey (N=345)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-to date</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 months</td>
<td>69</td>
<td>63</td>
<td>69</td>
</tr>
<tr>
<td>5 months</td>
<td>54</td>
<td>51</td>
<td>--</td>
</tr>
<tr>
<td>7 months</td>
<td>40</td>
<td>39</td>
<td>42</td>
</tr>
<tr>
<td>12 months</td>
<td>71</td>
<td>62</td>
<td>66</td>
</tr>
<tr>
<td>19 months*</td>
<td>39</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>24 months**</td>
<td>53</td>
<td>48</td>
<td>45</td>
</tr>
<tr>
<td>Age-appropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 months</td>
<td>69</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>5 months</td>
<td>53</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>38</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>19 months</td>
<td>21</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

* Number of children of the baseline survey at 19 months was 245 and of the psychosocial survey was 126.
** Number of children of the baseline survey at 24 months was 149 and of the psychosocial survey was 77.
12% had two sources, 5% had three sources, 5% had four or more sources.

Table 5 shows that mothers obtained information about immunization from several sources. The highest percentage of mothers (70%) identified their health providers as their source of information about immunization. In 27% of cases, mothers obtained immunization information from friends and or relatives. Printed material was a source of immunization information for 20% of mothers while mass media was mentioned as a source by only 6% of mothers. Six percent of mothers mentioned other sources including church, day care and social services.

Mothers' Knowledge of Vaccines and Vaccine-Preventable-Diseases

Regarding maternal knowledge of vaccines and vaccine-preventable diseases, 6% of mothers were not able to correctly name one disease, 10% mentioned one correct disease, 13% named two diseases, 16% three, 23% four, 11% five, 12% six, 6% seven, and 2% mentioned eight diseases. Thirteen percent of mothers were unable to name one vaccine. Eighteen percent correctly mentioned one vaccine, 31% mentioned two, 25% mentioned three, and 13% mentioned four vaccines. Knowledge scores of vaccines and vaccine preventable diseases ranged from 0-12, with a mean of 5.7 (S.D. 2.89) and a median of six.
Table 5

**Percent Distribution of the study population, Percent Age Appropriately Immunized, Odds Ratios, and 95% Confidence Intervals by the Information Source**

<table>
<thead>
<tr>
<th>Information Source</th>
<th>N(%)</th>
<th>%AAI</th>
<th>OR(95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health provider</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>141(70%)</td>
<td>40</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>60 (30%)</td>
<td>35</td>
<td>1.2(0.7-2.1)</td>
<td>0.264</td>
</tr>
<tr>
<td>Media</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>13(6%)</td>
<td>62</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>188(94%)</td>
<td>37</td>
<td>2.8(1.0-7.3)</td>
<td>0.037</td>
</tr>
<tr>
<td>Written material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>41(20%)</td>
<td>39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>160(80%)</td>
<td>38</td>
<td>1.0(0.6-1.9)</td>
<td>0.458</td>
</tr>
<tr>
<td>Family/friend</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>55(27%)</td>
<td>36</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>146(73%)</td>
<td>39</td>
<td>0.9(0.5-1.5)</td>
<td>0.364</td>
</tr>
</tbody>
</table>
Regarding accuracy of mothers' knowledge of vaccines and diseases, 40% of mothers incorrectly named at least one disease and or one vaccine.

**Knowledge of When to Start Immunization**

As indicated in Table 6, approximately one-fourth of mothers (24%) did not know that the child should get his/her first series of vaccine by 2 months of age.

**Knowledge of Free Immunization Services**

When mothers were asked where they can go to get free immunizations, 28% did not know a place where immunizations could be given free of charge. Slightly more than one half (53%) of mothers mentioned the public health department as a place for free immunizations, 20% mentioned the military clinic, 4% the WIC office, and 4% a community center and a hospital.

**Knowledge of vaccine contraindications**

Table 7 indicates the reasons given by 47 (23%) mothers for which a child should not get his/her immunizations. Having any health problem (31%), allergy (21%) and fever (15%) were mentioned as contraindications to immunization. Other reasons included ear infection (6%), cold (6%), chicken pox (6%), neurological problem (6%), and religion (2%).
Table 6

Percent Distribution, Percent Age-Appropriately Immunized, Odds Ratios, and 95% Confidence Intervals by Knowledge Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N(%)</th>
<th>%AAI</th>
<th>OR(95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge score*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>70 (35%)</td>
<td>24</td>
<td>3.1(1.7-5.8)</td>
<td>0.001</td>
</tr>
<tr>
<td>moderate</td>
<td>71 (35%)</td>
<td>42</td>
<td>1.4(0.8-2.4)</td>
<td>0.188</td>
</tr>
<tr>
<td>high</td>
<td>60 (30%)</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Knowledge accuracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>accurate</td>
<td>118(60%)</td>
<td>46</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>inaccurate</td>
<td>78(40%)</td>
<td>28</td>
<td>2.1(1.3-3.6)</td>
<td>0.007</td>
</tr>
<tr>
<td>Knowledge of when to start imm.'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>correct</td>
<td>153(76%)</td>
<td>42</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>not correct</td>
<td>48(24%)</td>
<td>25</td>
<td>2.2(1.2-4.1)</td>
<td>0.015</td>
</tr>
<tr>
<td>Knowledge of a free immunization place</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>145(72%)</td>
<td>41</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>56(28%)</td>
<td>32</td>
<td>1.4(0.8-2.5)</td>
<td>0.132</td>
</tr>
</tbody>
</table>

* Knowledge score: Low= greater or equals 4, Moderate= greater or equals 7, High= greater or equals 12 accurate= no wrong answer was given, inaccurate= at least one wrong response
' Imm.= Immunization, Correct= 2 months or earlier, Not correct= later than 2 months

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Table 7
Mothers' Reports of Conditions When a Child Should Not Get an Immunization

<table>
<thead>
<tr>
<th>Reason Given</th>
<th>Percentage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any health problem</td>
<td>31</td>
</tr>
<tr>
<td>Bad reaction to vaccine</td>
<td>38</td>
</tr>
<tr>
<td>Allergy</td>
<td>21</td>
</tr>
<tr>
<td>Fever</td>
<td>15</td>
</tr>
<tr>
<td>Common cold</td>
<td>6</td>
</tr>
<tr>
<td>Ear infection</td>
<td>6</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>6</td>
</tr>
<tr>
<td>Neurological problem</td>
<td>6</td>
</tr>
<tr>
<td>Religion</td>
<td>4</td>
</tr>
</tbody>
</table>

* Some mothers mentioned more than one reason
Attitudes toward vaccines and vaccine-preventable diseases

Mothers' attitudes toward polio, measles, and pertussis (whooping cough) diseases, and toward MMR, DTP, and Polio vaccines were examined. The majority of mothers (99%) considered the vaccines to be safe and effective. More than four-fifths (86%) indicated that an unimmunized child is susceptible to vaccine-preventable diseases while a higher proportion (96%) considered vaccine-preventable diseases to be serious. Measles was more likely to be considered a communicable disease (95%) than pertussis (83%) and poliomyelitis (79%). However, measles was rated as less serious (92%) than pertussis (97%) and poliomyelitis (99%). The scores of mothers' attitudes to diseases and vaccines ranged from 1.5 to three with a mean score of 2.5 (S.D. 0.33) and a median of 2.6.

Attitudes toward immunizing child with minor illness

Regarding mothers' awareness of vaccine contraindications, the majority believed that a child with a mild fever (93%) or with an ear infection (89%) should not receive immunization. A great proportion of mothers were unwilling to immunize a child who had diarrhea (75%) or a common cold (58%). Forty-two percent of mothers believed that a child should not be immunized while he or she is teething. The scores of mothers' attitudes to immunizing a child with a minor illness ranged from 0-1 with a median of 0.2, a mean of 0.21 (S.D. 0.22).
<table>
<thead>
<tr>
<th>Variable</th>
<th>N(%)</th>
<th>%AAI</th>
<th>OR(95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitudes to vaccine and VPDs*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>negative</td>
<td>67 (33%)</td>
<td>34</td>
<td>1.3(0.8-2.2)</td>
<td>0.353</td>
</tr>
<tr>
<td>positive</td>
<td>71 (35%)</td>
<td>41</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>very positive</td>
<td>63 (32%)</td>
<td>39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Understanding of contraindications'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>141 (72%)</td>
<td>35</td>
<td>1.9(1.1-3.2)</td>
<td>0.024</td>
</tr>
<tr>
<td>yes</td>
<td>56 (28%)</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* VPDs= Vaccine-preventable diseases, negative attitude= score less or equals 2.42, positive= score less or equals 2.67 and greater than 2.42, high= score greater than 2.67.

' Misunderstanding= contraindication awareness score less than or equals to the median score (0.2), knowledgeable= score greater than the median score.
Refusing a shot recommended by a health provider

Only twelve mothers (6%) stated that they had ever refused to let their child receive a shot which a doctor or a nurse recommended. The reasons for such refusal included: the child having fever (4 mothers), ear infection (3 mothers), cold (2 mothers), and prematurity (2 mothers). One mother mentioned that the child was too young to get a shot and another one stated that she was not sure of the purpose of the shot.

Cues to action variables

Table 9 shows different cues to motivate mothers to immunize their child. Sixty-three percent of mothers stated that someone talked to them about immunization in the delivery hospital after their child was born. Only 20% of the mothers reported having received a reminder for immunizing their children. Regarding availability of immunization records, in 36% of the sample the child’s immunization records were not available at home.
Table 9

Cues to Action Variables, Percent Distribution, and Percent Age-Appropriately Immunized

<table>
<thead>
<tr>
<th>Variable</th>
<th>N(%)</th>
<th>%AAI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education in the delivery hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>108(63%)</td>
<td>40</td>
<td>0.381</td>
</tr>
<tr>
<td>no</td>
<td>64(37%)</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Reminder from a health provider</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>41(20%)</td>
<td>41</td>
<td>0.320</td>
</tr>
<tr>
<td>no</td>
<td>160(80%)</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Availability of immunization records at home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>129(64%)</td>
<td>43</td>
<td>0.023</td>
</tr>
<tr>
<td>no</td>
<td>72(36%)</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>
Sociodemographic Risk Factors for Lacking Age-Appropriate Immunization

Significant sociodemographic factors that predicted lack of age-appropriate immunizations at 12 months of age were summarized in Table 10.

Maternal education.

Maternal education significantly predicted age-appropriate immunizations (AAI). A higher level of education was associated with a higher rate of age-appropriate immunizations (55% AAI if the mother had more than 12 years of education, 35% AAI if the mother had 12 years of education, and 19% AAI if the mother had less than 12 years of education). Infants born to mothers who did not have college education were 2.6 times (CI: 1.4-4.7) more likely to lack age-appropriate immunizations compared to infants whose mothers were college graduates or had some college education.

Family incomes.

A higher level of income was associated with a higher immunization rate (58%, 42%, and 15% for high, medium and low incomes respectively). Infants who had low rather than medium or high family incomes were 4.8 times more likely to not be age-appropriately immunized (CI: 2.0-11.3).
Table 10

Odds Ratios and 95% Confidence Intervals for Variables Significantly Predicting Lack of Age-Appropriate Immunizations

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sociodemographic variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being nonwhite</td>
<td>1.9</td>
<td>1.1-3.4</td>
<td>0.027</td>
</tr>
<tr>
<td>Maternal education of 12 years or less</td>
<td>2.6</td>
<td>1.4-4.7</td>
<td>0.002</td>
</tr>
<tr>
<td>Having three or more children in the household</td>
<td>2.8</td>
<td>1.5-5.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Having unmarried mother</td>
<td>3.2</td>
<td>1.7-6.2</td>
<td>0.000</td>
</tr>
<tr>
<td>Family income of &lt;$10,000</td>
<td>4.8</td>
<td>2.0-11.3</td>
<td>0.000</td>
</tr>
<tr>
<td>Being an AFDC recipient</td>
<td>3.0</td>
<td>1.4-6.4</td>
<td>0.004</td>
</tr>
<tr>
<td>Moving twice or more since birth</td>
<td>2.2</td>
<td>1.1-4.6</td>
<td>0.030</td>
</tr>
<tr>
<td><strong>Health service factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public/military immunization provider</td>
<td>1.8</td>
<td>1.0-3.3</td>
<td>0.053</td>
</tr>
<tr>
<td><strong>Behavioral variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of breast feeding</td>
<td>2.2</td>
<td>1.4-3.6</td>
<td>0.003</td>
</tr>
<tr>
<td>Having less than five well-baby visits in the first year</td>
<td>3.1</td>
<td>1.8-5.1</td>
<td>0.000</td>
</tr>
<tr>
<td>Starting well-baby care after two months of age</td>
<td>2.9</td>
<td>1.4-5.8</td>
<td>0.006</td>
</tr>
<tr>
<td><strong>Knowledge variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge of vaccines and preventable diseases</td>
<td>2.6</td>
<td>1.5-4.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccines and preventable diseases</td>
<td>2.1</td>
<td>1.3-3.6</td>
<td>0.007</td>
</tr>
<tr>
<td>Lack of knowledge of when to start immunization</td>
<td>2.2</td>
<td>1.2-4.1</td>
<td>0.015</td>
</tr>
<tr>
<td>Misunderstanding of vaccine contraindications</td>
<td>1.9</td>
<td>1.1-3.2</td>
<td>0.024</td>
</tr>
<tr>
<td><strong>Cues to action variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unavailability of the immunization card at home</td>
<td>1.9</td>
<td>1.1-3.1</td>
<td>0.023</td>
</tr>
<tr>
<td>Not receiving immunization information from the media</td>
<td>2.8</td>
<td>1.0-7.3</td>
<td>0.037</td>
</tr>
</tbody>
</table>

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Participation in AFDC.

The percentage of children having age-appropriate immunization among AFDC recipients (21%) was significantly lower than the percentage of age-appropriately immunized children among non-participants in the AFDC program (44%). (P=0.004). Children who were AFDC recipients were less likely to be age-appropriately immunized than those who did not receive AFDC (OR 3.0; CI: 1.4-6.4).

Marital status.

The percentage of children age-appropriately immunized who were born to married mothers was significantly higher (48%) than the percentage among unmarried mothers (22%, P<0.000). Infants of non-married mothers were 3.2 times more likely to not be age-appropriately immunized than those of single mothers (CI: 1.7-6.2).

Ethnicity.

The percentage of white children who were age-appropriately immunized (46%) was significantly higher than the percentage of non-white children having age-appropriate immunization (31%), (P=0.027), (OR 1.9; CI: 1.1-3.4).

Number of children in the household.

As indicated in Table (1), the lower the number of children in the family the higher the age-appropriate
immunization rate (55%, 40%, 25% for one child, two, three or more children respectively). The presence of three or more children in the household was associated with 2.8 (CI: 1.5-5.1) times greater risk of lacking age-appropriate immunizations.

**Mobility of the family.**

The percentage of children having age-appropriate immunization among families who moved two times or more since the child's birth (25%) was significantly lower than the percentage of age-appropriately immunized children among families who did not move (46%). Children who moved two times or more were at 2.2 times greater risk of lacking age-appropriate immunization (OR 2.2; CI:1.1-4.6) compared to those who did not move or moved one time only.

**Mother's age.**

In this study, the comparison of maternal age with age-appropriate immunization rates showed no significant association. The mean age of mothers of age-appropriately immunized children was 28.3 years (S.D. 5.59) which was not significantly different 27.2 years (S.D. 5.45), the mean age of mothers whose children were not age-appropriately immunized. Immunization rates of children of teen mothers (33%) were lower than those of non-teen mothers (38%), however that difference was not statistically significant (P=0.756).
Chronic health problem.

Having chronic illness or disability was associated with 3.1 (CI: 0.9-11.1) times greater risk of failure to immunize on schedule, however this association was marginally significant (P=0.072).

No significant associations with age-appropriate immunizations were noted for insurance coverage; WIC participation; child's gender; birth place; mothers' employment status; pregnancy term; and infant birth weight.

Age-Appropriate Immunization by Provider of Immunization

For the purpose of comparing age-appropriate immunization rates by the health institution which provides the vaccines, children receiving most or all of their immunizations from public health department clinics and public hospital-based clinics are grouped together. These facilities provide free vaccine purchased by federal funds.

The percentage of age-appropriately immunized children for public clinics, military clinics, and private clinics were 28%, 37%, and 47% respectively. There was no significant difference between military clinics and public clinics and also between military clinics and private clinics regarding the percentage of age-appropriately immunized children. Immunization rates of private clinics were significantly different from that of public clinics. Since military clinics are similar to public clinics rather than private clinics
regarding their delivery of services, further analyses were
done by grouping both public and military clinics together as
non-private clinics.

The percentage of age-appropriately immunized children
who received their immunizations from private clinics (47%)
were significantly higher than the percentage of children who
received their immunizations from non-private clinics (33%)
(P=0.053). Children who received their immunizations from
private clinics were 1.8 times more likely to have completed
immunizations on time than those who attended non-private
facilities (OR 1.8; CI:1.0-3.3).

Because, in general, private physicians serve people of
higher socioeconomic status, their children are more likely to
have age appropriate immunizations, regardless of provider.
Controlling for education and income, the association between
private provider and age appropriate immunization no longer
persists (OR 1.7; CI: 0.9-3.2).

Preventive Health Behavior in Relation to Age-Appropriate
Immunization

As indicated in Table 3, the percentage of age-
appropriately immunized children among those who were breast
fed was significantly higher (49%) than that of children
lacking breast feeding (31%), (P=0.003). Lack of breast
feeding was associated with 2.2 times more likeliness of
lacking age-appropriate immunizations (CI: 1.4-3.6).
The start of prenatal care in the first trimester of pregnancy was not related to age-appropriate immunization. However, early start of well-baby care predicted age-appropriate immunization. Infants who obtained their first well-baby care visit later than two months of age were 2.9 (CI: 1.4-5.8) times more likely to not be age-appropriately immunized than infants who started their well-care later. Having fewer well-baby visits predicted lack of age-appropriate immunizations. Children having fewer than five well-baby visits by one year of age were 3.1 (CI: 1.8-5.1) times less likely to be age-appropriately immunized than those who had at least five visits.

Mothers' Knowledge about Immunizations and Age-Appropriate Immunizations

Knowledge of vaccines and vaccine preventable diseases.

The mean knowledge score of mothers of age-appropriately immunized children (6.4; S.D. 2.87) was significantly higher than the mean score of mothers whose children lacked age-appropriate immunizations (5.2; S.D. 2.82), (P=0.002). Children whose mothers had low knowledge of vaccines and vaccine preventable diseases were 2.6 (CI: 1.5-4.5) times less likely to be age-appropriately immunized compared to those of mothers having moderate or high degree knowledge.

Children whose mothers had inaccurate knowledge of vaccines and vaccine-preventable diseases were 2.1 (CI: 1.3-
3.6) times less likely to be age-appropriately immunized compared to those of mothers having accurate knowledge.

Knowledge of when to start immunization.

Children of mothers lacking correct knowledge of when to start immunizations were 2.2 times more likely to not be age-appropriately immunized (25%) than those of mothers having that knowledge (42%), (OR 2.2; CI: 1.2-4.1).

As indicated in Table 11, after controlling for ethnicity, maternal education, family income, or immunization provider, maternal knowledge regarding vaccines and vaccine-preventable diseases continued to predict age-appropriate immunizations. Also, the association between knowledge of when to start immunization and age-appropriate immunizations was still supported after controlling for such confounders.

Mothers’ Attitudes Toward Vaccines and Vaccine-Preventable Diseases in Relation to Age-Appropriate Immunizations

Maternal attitudes regarding susceptibility to and seriousness of vaccine-preventable diseases and safety of and efficacy of vaccines had no effect on age-appropriate immunizations. The mean attitude score of mothers of age-appropriately immunized children (2.52, S.D. 0.33) was similar to that of mothers of children lacking age-appropriate immunizations (2.52, S.D. 0.32). Comparing age-appropriate
Table 11

Adjusted Odds Ratios and 95% Confidence Intervals of the Significant Knowledge, Attitudes, and Cues to Action Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ethnicity</th>
<th>Maternal education</th>
<th>Family income</th>
<th>Immunization provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Knowledge of vaccines and diseases</td>
<td>2.3(1.3-4.1)</td>
<td>2.4(1.4-4.2)</td>
<td>2.3(1.3-4.0)</td>
<td>2.5(1.5-4.4)</td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccine and diseases</td>
<td>2.0(1.2-3.4)</td>
<td>2.2(1.3-3.8)</td>
<td>2.1(1.2-3.6)</td>
<td>2.1(1.2-3.5)</td>
</tr>
<tr>
<td>Lack of knowledge of when to start immunization</td>
<td>2.3(1.2-4.2)</td>
<td>2.4(1.3-4.5)</td>
<td>2.1(1.1-4.0)</td>
<td>2.1(1.1-3.9)</td>
</tr>
<tr>
<td>Misunderstanding of vaccine contraindications</td>
<td>1.6(0.9-2.8)</td>
<td>1.6(0.9-2.7)</td>
<td>1.5(0.9-2.7)</td>
<td>1.7(1.0-3.0)</td>
</tr>
<tr>
<td>Unavailability of immunization records</td>
<td>1.9(1.1-3.1)</td>
<td>2.0(1.2-3.5)</td>
<td>1.7(1.0-2.9)</td>
<td>1.8(1.1-3.1)</td>
</tr>
<tr>
<td>Not receiving immunization information from the media</td>
<td>2.9(1.1-7.6)</td>
<td>1.8(0.6-4.9)</td>
<td>2.6(1.0-7.2)</td>
<td>2.2(0.8-5.9)</td>
</tr>
</tbody>
</table>
immunization rates by level of maternal attitudes (negative, positive, and very positive) showed that children whose mothers had negative attitudes were at 1.3 times greater risk of lacking age-appropriate immunizations than those for whom maternal attitudes were positive or very positive. However, this association was not significant (OR 1.3; CI: 0.8-2.2).

**Understanding of Vaccine-Contraindications in Relation to Age-Appropriate Immunizations**

The mean contraindications score for mothers of age appropriately immunized children (0.23, S.D. 0.23) did not differ significantly from that of children lacking timely immunization (0.20, S.D. 0.22). The percentage of age-appropriately immunized children among mothers who were aware of vaccine contraindication was higher (50%) than the percentage (35%) among mothers who were confused regarding vaccine contraindications (OR 1.9; CI: 1.1-3.2).

As shown in Table 11, the influence of mothers' understanding of vaccine contraindications on age-appropriate immunization became weaker after controlling for ethnicity, education or family income. However, the association between maternal understanding of vaccine contraindications and age-appropriate immunization was still significant after controlling for the immunization provider (OR 1.7; CI:1.02-3.00).
Immunization Rates by Source of Immunization Information and Cues to Action

The media.

Age-appropriate immunization rates were not associated with receiving immunization information from a health provider, from family and friend, or through educational materials. However, receiving information about immunization from the media was positively associated with age-appropriate immunizations (P=0.037). Children whose mothers did not mention the media as an information source were 2.8 (CI:1.0-7.3) times more likely to lack timely immunizations compared to children whose mothers received immunization information from the media.

As indicated in Table 11 the association between the media and age-appropriate immunizations was still significant after controlling for ethnicity and income; however, it became insignificant after controlling for education and immunization provider. After controlling for other information sources including health providers, family and friends, and educational materials, the effect of exposure to the media on immunization rates became stronger (OR 4.3; CI:1.3-14.5).

Immunization records.

Age-appropriate immunization was positively associated with the availability of the child's immunization records at home. The percentage of age-appropriate immunizations among
children with the records was 43% compared to 29% among those without the records (P=0.023). Children for whom records were unavailable were 1.9 times more likely to lack age-appropriate immunizations compared to children with the records (CI: 1.1-3.1). The effect of immunization record was still significant after controlling for ethnicity, education, income and immunization provider (Table 11).

**Effect of immunization records on mothers' knowledge.**

Comparing knowledge and attitudes of mothers with available immunization records to that of mothers without such records showed no significant differences regarding knowledge of and attitudes toward vaccines and vaccine-preventable diseases (Table 12). However, mothers of children for whom the records were available were significantly more knowledgeable of when to start immunization than mothers of children without the records (81% and 68% respectively, P=0.045). Available immunization records were significantly associated with maternal awareness of vaccine contraindications, 67% of mothers with available records expressed misunderstanding regarding immunizing a child with minor illness compared to 80% of mothers without the records (P=0.042).

Being educated about immunization in the hospital after the child's birth and receiving an immunization reminder were not significant predictors of age-appropriate immunizations.
Table 12
Distribution of Significant Knowledge Variables by
Having the Immunization Records at Home

<table>
<thead>
<tr>
<th>Variable</th>
<th>With records</th>
<th>Without records</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of vaccines and vaccine-preventable diseases</td>
<td>N(%)</td>
<td>N(%)</td>
<td>0.464</td>
</tr>
<tr>
<td>low</td>
<td>41(32)</td>
<td>29(40)</td>
<td></td>
</tr>
<tr>
<td>moderate</td>
<td>47(36)</td>
<td>24(33)</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td>41(32)</td>
<td>19(27)</td>
<td></td>
</tr>
<tr>
<td>Accuracy of knowledge of vaccines and diseases</td>
<td>77(60)</td>
<td>41(60)</td>
<td>0.985</td>
</tr>
<tr>
<td>accurate</td>
<td>51(40)</td>
<td>27(40)</td>
<td></td>
</tr>
<tr>
<td>inaccurate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of when to start immunizations</td>
<td>25(19)</td>
<td>23(32)</td>
<td>0.045</td>
</tr>
<tr>
<td>incorrect</td>
<td>104(81)</td>
<td>49(68)</td>
<td></td>
</tr>
<tr>
<td>correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness of vaccine contraindications</td>
<td>85(67)</td>
<td>57(80)</td>
<td>0.042</td>
</tr>
<tr>
<td>misunderstanding</td>
<td>42(33)</td>
<td>14(20)</td>
<td></td>
</tr>
<tr>
<td>knowledgeable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comparing Sociodemographic and Psychosocial characteristics of Study Population by the Immunization Provider

Table 13 shows that children receiving their immunizations from private providers were similar to children receiving their immunization from non-private providers regarding their sociodemographic characteristics except for the family income, number of children in the household, and changing of residence. Children receiving immunization from private providers had a higher income (P=0.002) and fewer siblings (P=0.041) and were less likely to change their residence (P=0.005) compared to children receiving their immunization from non-private providers. There were no significant differences between the above two groups of children regarding maternal age, maternal education, ethnicity, mother’s working and marital status, and insurance coverage for immunizations.

Regarding immunization-related knowledge, attitudes, beliefs, and cues to action, Table 14 indicates that there were no significant differences between private and non-private immunization providers regarding mothers’ level of knowledge of vaccines and vaccine-preventable diseases, mothers’ understanding of vaccine contraindications, availability of immunization records, receiving immunization reminders, and the different sources of information except for the media. However, mothers of children receiving their
<table>
<thead>
<tr>
<th>Variable*</th>
<th>Private providers</th>
<th>Other providers</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N(%)</td>
<td>N(%)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>white</td>
<td>34(52)</td>
<td>59(45)</td>
<td>0.390</td>
</tr>
<tr>
<td>non-white</td>
<td>32(48)</td>
<td>72(55)</td>
<td></td>
</tr>
<tr>
<td>Mother's age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>teen</td>
<td>3(5)</td>
<td>6(5)</td>
<td>0.973</td>
</tr>
<tr>
<td>not-teen</td>
<td>63(95)</td>
<td>123(95)</td>
<td></td>
</tr>
<tr>
<td>Mother's education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 years</td>
<td>14(21)</td>
<td>27(21)</td>
<td>0.410</td>
</tr>
<tr>
<td>=12 years</td>
<td>25(38)</td>
<td>60(47)</td>
<td></td>
</tr>
<tr>
<td>&gt;12 years</td>
<td>27(41)</td>
<td>41(32)</td>
<td></td>
</tr>
<tr>
<td>Family income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$10,000</td>
<td>13(20)</td>
<td>33(25)</td>
<td>0.002</td>
</tr>
<tr>
<td>$10,000-$29,999</td>
<td></td>
<td>87(67)</td>
<td></td>
</tr>
<tr>
<td>=&gt;$30,000</td>
<td>18(27)</td>
<td>11(8)</td>
<td></td>
</tr>
<tr>
<td>Mother's work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>employed</td>
<td>20(30)</td>
<td>37(29)</td>
<td>0.814</td>
</tr>
<tr>
<td>homemaker</td>
<td>46(70)</td>
<td>92(71)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>married</td>
<td>45(68)</td>
<td>81(62)</td>
<td>0.381</td>
</tr>
<tr>
<td>single</td>
<td>21(32)</td>
<td>50(38)</td>
<td></td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one</td>
<td>20(30)</td>
<td>30(23)</td>
<td>0.033</td>
</tr>
<tr>
<td>two</td>
<td>20(30)</td>
<td>41(31)</td>
<td></td>
</tr>
<tr>
<td>three or more</td>
<td></td>
<td>60(46)</td>
<td></td>
</tr>
<tr>
<td>Insurance coverage for immunizations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>50(77)</td>
<td>109(86)</td>
<td>0.122</td>
</tr>
<tr>
<td>no</td>
<td>15(23)</td>
<td>18(14)</td>
<td></td>
</tr>
<tr>
<td>Changing residence since birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>42(64)</td>
<td>51(39)</td>
<td>0.004</td>
</tr>
<tr>
<td>one time</td>
<td>15(23)</td>
<td>44(34)</td>
<td></td>
</tr>
<tr>
<td>two or more</td>
<td></td>
<td>36(27)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 14

**Percent Distribution of Knowledge, Attitudes, and Cues to Action variables by Immunization Provider**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Private provider</th>
<th>Other provider</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge of vaccines and diseases</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>33</td>
<td>36</td>
<td>0.827</td>
</tr>
<tr>
<td>moderate</td>
<td>38</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td>29</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccine and diseases</td>
<td>31</td>
<td>45</td>
<td>0.059</td>
</tr>
<tr>
<td>Incorrect knowledge of when to start immunizations</td>
<td>23</td>
<td>25</td>
<td>0.704</td>
</tr>
<tr>
<td><strong>Attitudes toward vaccines and diseases</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>negative</td>
<td>43</td>
<td>29</td>
<td>0.056</td>
</tr>
<tr>
<td>positive</td>
<td>24</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>very positive</td>
<td>33</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td><strong>Misunderstanding of vaccine contraindications</strong></td>
<td>69</td>
<td>74</td>
<td>0.538</td>
</tr>
<tr>
<td><strong>Having the immunization records at home</strong></td>
<td>59</td>
<td>66</td>
<td>0.312</td>
</tr>
<tr>
<td><strong>Receiving immunization reminder</strong></td>
<td>20</td>
<td>20</td>
<td>0.980</td>
</tr>
<tr>
<td><strong>Verbal education from the provider of immunization</strong></td>
<td>65</td>
<td>72</td>
<td>0.342</td>
</tr>
<tr>
<td><strong>Receiving information from the media</strong></td>
<td>11</td>
<td>4</td>
<td>0.060</td>
</tr>
<tr>
<td><strong>Receiving educational materials about immunizations</strong></td>
<td>18</td>
<td>21</td>
<td>0.686</td>
</tr>
<tr>
<td><strong>Receiving information from family or friends</strong></td>
<td>30</td>
<td>26</td>
<td>0.548</td>
</tr>
</tbody>
</table>

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immunizations from a private provider tended to have more accurate knowledge of vaccines and diseases (P=0.059) and to have more negative attitudes toward vaccines and diseases compared to mothers of children receiving immunizations from non-private providers (P=0.056).

The effects of maternal immunization-related knowledge and attitudes on age-appropriate immunizations were examined for children receiving immunizations from private practices and children receiving immunization from other non-private providers. The results indicated a greater influence of knowledge and attitudes on age-appropriate immunization among children receiving immunization from private practices than among children receiving immunization from non-private practices (Table 15). Low level of knowledge regarding vaccines and vaccine-preventable diseases was associated with 1.5 (CI: 0.8-2.9) times greater risk of lack of age-appropriate immunizations among children receiving the immunizations from a non-private provider compared to 7.1 times (CI: 2.5-20.3) greater risk among children receiving the immunization from a private provider. Table 16 shows that the strong association between low knowledge and age-appropriate immunizations among children receiving the immunization from a private provider continued after controlling for maternal education, family income and ethnicity. A similar trend was also noted for the association between inaccurate knowledge of vaccines and diseases and lack of age-appropriate
<table>
<thead>
<tr>
<th>Psychosocial Variables</th>
<th>Private Provider</th>
<th>Non-private provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Knowledge of vaccines and diseases</td>
<td>7.1 (2.5-20.3)</td>
<td>1.5 (0.8-2.9)</td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccines and diseases</td>
<td>4.1 (1.5-11.0)</td>
<td>1.5 (0.8-2.9)</td>
</tr>
<tr>
<td>Incorrect Knowledge of when to start immunization</td>
<td>2.1 (0.8-5.7)</td>
<td>2.2 (1.0-4.7)</td>
</tr>
<tr>
<td>Negative attitudes toward vaccine and V-P-Ds*</td>
<td>2.2 (1.0-5.1)</td>
<td>1.1 (0.5-2.1)</td>
</tr>
<tr>
<td>Misunderstanding of vaccine contraindications</td>
<td>2.8 (1.1-6.9)</td>
<td>1.3 (0.7-2.7)</td>
</tr>
<tr>
<td>Unavailability of the immunization records</td>
<td>2.0 (0.9-4.6)</td>
<td>1.7 (0.9-3.4)</td>
</tr>
<tr>
<td>Lack of an immunization reminder</td>
<td>1.4 (0.5-3.9)</td>
<td>1.1 (0.5-2.4)</td>
</tr>
<tr>
<td>Lack of verbal education from the provider</td>
<td>1.6 (0.7-3.8)</td>
<td>1.0 (0.5-2.0)</td>
</tr>
<tr>
<td>Not receiving information from the media</td>
<td>3.2 (0.8-13.4)</td>
<td>1.4 (0.3-6.4)</td>
</tr>
<tr>
<td>Not receiving educational materials</td>
<td>1.8 (0.6-5.1)</td>
<td>0.7 (0.3-1.5)</td>
</tr>
<tr>
<td>Not receiving information from family or friends</td>
<td>0.7 (0.3-1.6)</td>
<td>1.2 (0.6-2.3)</td>
</tr>
</tbody>
</table>

* VPDS=Vaccine-preventable diseases
<table>
<thead>
<tr>
<th>Variable</th>
<th>Private Provider OR (95% CI)</th>
<th>Non-Private provider OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of knowledge of vaccines and VPDs*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crude</td>
<td>7.1(2.5-20.3)</td>
<td>1.5(0.8-2.9)</td>
</tr>
<tr>
<td>adjusted for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>6.9(2.4-20.2)</td>
<td>1.4(0.7-2.7)</td>
</tr>
<tr>
<td>income</td>
<td>6.5(2.2-19.3)</td>
<td>1.3(0.7-2.6)</td>
</tr>
<tr>
<td>ethnicity</td>
<td>6.0(2.0-17.6)</td>
<td>1.4(0.7-2.8)</td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccines and VPDs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crude</td>
<td>4.1(1.5-11.0)</td>
<td>1.5(0.8-2.9)</td>
</tr>
<tr>
<td>adjusted for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>5.0(1.8-14.5)</td>
<td>1.4(0.8-2.8)</td>
</tr>
<tr>
<td>income</td>
<td>4.4(1.5-12.6)</td>
<td>1.5(0.8-2.9)</td>
</tr>
<tr>
<td>ethnicity</td>
<td>4.0(1.5-10.9)</td>
<td>1.5(0.8-2.8)</td>
</tr>
<tr>
<td>lack of knowledge of when to start immunization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crude</td>
<td>2.1(0.8-5.7)</td>
<td>2.2(1.0-4.7)</td>
</tr>
<tr>
<td>adjusted for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>1.8(0.6-5.1)</td>
<td>2.6(1.2-6.1)</td>
</tr>
<tr>
<td>income</td>
<td>2.3(0.8-6.8)</td>
<td>2.0(0.9-4.4)</td>
</tr>
<tr>
<td>ethnicity</td>
<td>2.5(0.9-7.2)</td>
<td>2.1(1.0-4.6)</td>
</tr>
<tr>
<td>Misunderstanding of contraindications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crude</td>
<td>2.8(1.1-7.0)</td>
<td>1.3(0.7-2.6)</td>
</tr>
<tr>
<td>adjusted for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>2.4(0.9-6.3)</td>
<td>1.1(0.5-2.3)</td>
</tr>
<tr>
<td>income</td>
<td>2.0(0.7-5.1)</td>
<td>1.2(0.6-2.4)</td>
</tr>
<tr>
<td>ethnicity</td>
<td>2.5(1.0-6.4)</td>
<td>1.2(0.6-2.5)</td>
</tr>
<tr>
<td>Unavailability of the immunization records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crude</td>
<td>2.0(0.9-4.6)</td>
<td>1.7(0.9-3.4)</td>
</tr>
<tr>
<td>adjusted for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>education</td>
<td>2.5(1.0-6.2)</td>
<td>1.9(0.9-3.8)</td>
</tr>
<tr>
<td>income</td>
<td>3.2(1.3-8.2)</td>
<td>1.5(0.7-3.0)</td>
</tr>
<tr>
<td>ethnicity</td>
<td>2.0(0.8-4.6)</td>
<td>1.8(0.9-3.5)</td>
</tr>
</tbody>
</table>
immunizations where the odds ratio was 4.1 (CI: 1.5-11.0) for the private provider children and 1.5 (CI: 0.8-2.9) for the non-private group and that difference still held after controlling for maternal education, family income, and ethnicity. Similarly, misunderstanding of vaccine contraindication was associated with 2.8 (CI: 1.1-6.9) times greater risk of lacking age-appropriate immunizations for infants receiving immunization from a private provider while it was associated with 1.3 (CI: 0.7-2.7) times greater risk for the non-private provider group. However, The effect of lack of knowledge of when to start immunization in the non-private provider group was similar to that of the private provider group (OR 2.2; CI: 1.0-4.7 and OR 2.1; CI: 0.8-5.7 respectively).

Examining the effects of the cues to action variables on age-appropriate immunization for the two groups of providers showed that receiving immunization information from the media strongly predicted age-appropriate immunizations for the private provider group. The effects of immunization records and reminders were nearly consistent for both groups. Children receiving immunizations from private providers had higher age-appropriate immunization rates if they received verbal education from their immunization providers than those who received their immunization from non-private providers. The effects of educational materials and family and friends information sources were not consistent for both groups.
children receiving their immunization from private providers, receiving educational materials was associated with higher immunization rates while family and friends information source was associated with lower rates. The opposite was noted for children receiving immunization from the non-private group.

**Multivariate comparison**

The sociodemographic, health service, knowledge and attitudes, and cues to action variables (listed in Table 10) are examined together using stepwise logistic regression analysis with backward elimination. Of the eight significant demographic and health service factors, only family income of less than $10,000, mother’s not having college education, having more than two children in the household, and moving two times or more since the child’s birth significantly predicted lack of age-appropriate immunization in stepwise logistic regression analysis with backward elimination (see Table 17).

The significant psychosocial variables that predicted lacking of age-appropriate immunizations after controlling for sociodemographic characteristics and usual source of immunizations in logistic regression analysis included lack of knowledge of vaccines and vaccine-preventable diseases and lack of knowledge of when to start immunization.
Table 17

Adjusted Odds Ratios and 95% Confidence Intervals for Variables Associated with Lack of Age-Appropriate Immunization in Logistic Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted odds ratio (95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three or more children in the household</td>
<td>3.1 (1.5-6.3)</td>
<td>0.002</td>
</tr>
<tr>
<td>Family income of less than $10,000</td>
<td>3.9 (1.5-10.5)</td>
<td>0.006</td>
</tr>
<tr>
<td>Maternal education of 12 years or less</td>
<td>2.1 (1.1-4.1)</td>
<td>0.035</td>
</tr>
<tr>
<td>Changing residence two times or more</td>
<td>2.7 (1.2-6.1)</td>
<td>0.019</td>
</tr>
<tr>
<td>Inaccurate knowledge of vaccines and diseases</td>
<td>2.3 (1.3-4.1)</td>
<td>0.011</td>
</tr>
<tr>
<td>Lack of knowledge of when to start immunization</td>
<td>2.4 (1.2-4.9)</td>
<td>0.020</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION, SUMMARY, AND CONCLUSIONS

Discussion

This study included a population-based sample of children in Norfolk with a high response rate that was representative of the children 12 to 30 months of age in the city of Norfolk. Sociodemographic characteristics of the study sample were similar to Norfolk 1990 census data. In addition, immunization rates of the children in the study were similar to that obtained from a retrospective school survey (1991-92).

Immunization histories were ascertained from the child’s immunization records obtained from the child’s health providers COMBINED WITH data obtained from the parent-held immunization records. This minimizes the misclassification bias that originates from inaccurate determination of the child’s age-appropriate immunization status. That bias might have affected the findings in studies which relied primarily on parent recall.

The study is limited by inability to establish causal relationships between the psychosocial variables and the compliance with age-appropriate immunizations. The time order relationship can not be established because of the cross sectional design. In addition, interpretation of the relationships between health beliefs and behavior is
difficult. Health beliefs are not constant and might change over time, as experience may influence health beliefs.

Prior studies of risk factors of delayed immunization have focused on up-to-date immunization, a measure of coverage levels based on any vaccine dose administered. Immunization coverage used in this study is age-appropriate immunization based on the number of properly-spaced doses according to the recommendations of the American Academy of Pediatrics (1991), and the Advisory Committee on Immunization Practices (1994).

The results of this study confirm the poor immunization rates of preschool children. Only 38% of the sample of children in Norfolk who were 12-30 months of age at interview had completed an immunization series with properly-spaced vaccine doses (3 DTP and 2 OPV) by their first birthday. This rate falls far short of the targeted national goal.

The sociodemographic variables that were associated with age-appropriate immunizations in this study were family income, maternal education, marital status, number of children in the house, race, participation in AFDC, and several changes of residence. Other research has demonstrated a strong positive association between level of parent education and immunization status (Bobo et al., 1993; Markland et al., 1979; Marks et al., 1979; McCormick et al., 1981). In some studies race was an important factor for predicting immunization status (McCormick et al., 1981), while in others it was not (Marks et al., 1979). The importance of family
income and marital status were reported by Bobo et al. (1993). Research has also shown the negative association between family size and immunization rates (Markland et al., 1979; Marks et al., 1979).

The psychosocial factors addressed in this study included immunization-related knowledge, attitudes, and cues to action which affect compliance with childhood immunization, and how these factors are associated with the usual source of immunizations.

In regard to maternal knowledge of vaccines and diseases prevented, the results showed that not being age appropriately immunized at 12 months of age was significantly associated with low level of knowledge of vaccines and vaccine-preventable diseases, (OR 2.6; CI 1.5-4.5); inaccurate knowledge of vaccines and vaccine-preventable diseases (OR 2.1; CI 1.3-3.6), and lack of knowledge of when to start immunizations (OR 2.2; CI 1.2-4.1). Knowledge variables continued to predict age-appropriate immunizations after controlling for race, family income, maternal education, and usual source of immunizations. Logistic regression analysis suggests that knowledge is an important predictor of age-appropriate immunization. These results support the findings of previous studies. For example, Lewis et al. (1988) have pointed out that knowledge is important for achieving a higher level of immunization coverage. Furthermore, the study conducted by Shah, Sharma, and Vani (1991) revealed that among
urban educated parents in India the proportion of children completely immunized was found to be associated with vaccine related knowledge.

The study design is limited in terms of lack of providing the temporal relationships between the variables and establishing which factor came before the other. Therefore, causal association between maternal immunization-related knowledge and age-appropriate immunizations of children cannot be established. On the other hand, the positive association between mothers' knowledge about immunizations and their compliance with age-appropriate immunizations could be explained reversely, mothers might have gained that knowledge as a result of obtaining immunizations for their children. If this explanation is true, the level of mothers' knowledge is expected to increase by having more experience of immunizations, i.e., by immunizing more children. However, the study results did not support that explanation. The data indicated that the mean knowledge of diseases and vaccines of mothers who had three or more children (5.6, S.D. 3.1) was insignificantly lower than for both mothers having one child (5.7, S.D. 2.5) and those having two children (5.8, S.D. 3.0). Also, there were no significant associations between mothers' knowledge of immunization schedule and the number of children. Seventy-six percent of mothers who had one child were knowledgeable of when to start immunizations compared to 73% of mothers having two children and to 79% of mothers having 99
three or more children (P=0.670). The proportion of mothers having three or more children who were aware of vaccine contraindications (26%) was insignificantly lower than that (31%) among those having one child only or that (31%) having two children (P=0.786).

Additionally, lack of knowledge of diseases and vaccines was associated with delayed initiation of immunizations "age-appropriate immunizations at three months of age". Only 60% of mothers with low knowledge initiated timely immunizations compared to 74% of mothers with moderate to high knowledge (OR 1.9; CI 1.1-3.2; P=0.020). Low level of knowledge of vaccines and diseases also predicted lack of age-appropriate immunizations at 5 months of age (OR 2.1; CI 1.3-3.4; P=0.007).

In this study, the results of stratified analyses suggested that the effect of knowledge on age-appropriate immunization differs by provider of immunization. For example, in infants receiving their immunizations from a private physician, a low level of maternal knowledge about vaccines and vaccine-preventable diseases was associated with 7.1 times greater risk of lacking age-appropriate immunizations. By comparison, that knowledge was associated with 1.5 increase in the risk of lacking age appropriate immunization for infants receiving their immunizations from other providers.

Attitude factors which influence parents in the decision to immunize their children have been described in Becker's
Health Belief Model. These included attitudes toward susceptibility and severity of vaccine preventable diseases and toward safety and efficacy of the vaccines. In this study, these factors are not important in predicting age-appropriate immunizations. The global attitudes of mothers were positive. The majority of them believed that vaccines are safe and effective and that the diseases are serious and communicable. In spite of mothers' positive attitudes, 62% of their infants were not age appropriately immunized. This suggest that reasons other than attitude factors were responsible for under-immunization. The positive attitude towards vaccines reported in this study is congruent with the findings reported in other studies. Freeman and Bass’s study (1992) of maternal tolerance of vaccine related risk showed that most mothers rated vaccine very highly on the benefit scale and low on the risk scale. However, it is contradictory with other which reported significant association between mothers’s attitudes toward immunization and immunization status of their children. For example, perceived efficacy of immunization predicted the number of immunizations in the study conducted by Kviz, Dawkins and Evrin (1985). Markland and Durand (1976) reported that parents of adequately immunized infants were more aware of disease seriousness, risk, and vaccine efficacy. That discrepancy could be explained by the differences in the study design or the target population. Kviz, et al included 61 pregnant mothers using prenatal care services and followed

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them for recording the immunizations. These studies used different definitions of immunization status.

In the present study, these attitude factors seem to be important for the children receiving their immunizations from a private provider. For those children, negative attitudes were associated with more than a two-fold increase in the likelihood of lacking age-appropriate immunizations.

The findings of this study indicate that an obstacle to age-appropriate immunization was the mothers' misunderstanding of contraindications to immunizations. Mothers were confused regarding true vaccine contraindications. Large numbers of children were being deprived of timely immunization because their mothers inappropriately consider certain conditions or circumstances to be contraindications. This misunderstanding of vaccine contraindications is further supported by the different reasons mothers gave for refusing to let the child receive an immunization recommended by a health professional. Confusion regarding vaccine contraindications found in this study is congruent with other studies. For example, Abbotts and Osborn (1993) found that parental perception that minor illness is a reason to delay immunizations is an important factor for postponing immunization for children using a public health immunization clinic.

Factors that may have contributed to maternal confusion regarding vaccine contraindications could not be assessed in this study. However, it has been suggested that parents may be
confused by the different messages they receive from health professionals about immunization. This explanation is supported by data from a recent survey of pediatricians and family physicians in Norfolk. The survey findings showed that a large proportion of those professionals were misinformed regarding vaccine contraindications.

According to the Health Belief Model, maternal perceptions are modified by external influences such as media messages or advice from friends, family or from physicians. It is surprising that 30% of mothers did not cite health professionals as a source of their information about immunization. The results also indicate that receiving information about immunizations from health providers verbally or through health education materials was not associated with age-appropriate immunization. However, exposure to the media was positively associated with age-appropriate immunization. Only 27% of mothers in this study received immunization information from relatives or friends, which indicates a low level of social support. This measure of social support was not found to be related to age-appropriate immunization.

A positive association was found between the child’s immunization record at home and age-appropriate immunization. This finding provides further support to previous research which showed that the patient-held record is important to increase patient knowledge and compliance in the health care process. McCormick, Shapiro, and Starfield (1981) have

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reported higher up-to-date immunization rates for infants for whom immunization records were available than those without such records. However, their data did not determine the association between having these records and parental attitudes and knowledge regarding immunization. In this study, mothers of infants for whom immunization records were available were more knowledgeable of when to begin immunizations, of what vaccines a child should receive and the diseases prevented by immunizations, and of the true vaccine contraindications than mothers of infants without such records. This may indicate that mothers who are more responsible for their own child’s health as evidenced by having records available tend to be more aware of the required immunizations and more likely to have their children immunized on time.

Poor age-appropriate immunization rates in this study were associated with inadequate use of other preventive care. The American Academy of Pediatrics recommends six well-baby visits during the first 12 months and the first visit should be started by one month of age (Committee on Practice and Ambulatory Medicine, 1988). Only 20% of mothers reported that their children completed six visits and 23% of mothers took their children for the first visit by one month of age. In addition, only 41% of children were breast fed.
Conclusions and Recommendations

The findings of this study draw attention to some psychosocial factors that influence whether or not a child is age-appropriately immunized. The findings should be interpreted with caution due to inability to establish causal associations. However, the results of this study could be used as the foundation of the development of experimental health education interventions.

This study identifies specific areas where health education interventions could have a beneficial effect on increasing age-appropriate immunization rates. This study suggests that in order to increase age-appropriate immunization rates it is not enough to educate parents regarding the risk of a given infectious disease, if contracted; the risk of an immunized child contracting the disease; the benefits of receiving the vaccine; and the risks of receiving the vaccine. Health education efforts might be more productive by emphasizing specific knowledge of the vaccines needed, practical knowledge of immunization schedules, e.g., when to begin immunizations, and the true contraindications.

The major conclusions of this study are:
1. Parents need to know about immunization. They have a need for specific information about what vaccines a child should receive and the diseases prevented by such vaccines.
2. Parents need to know when to start immunizations and be knowledgeable about the recommended immunization schedule.
3. Parents should be appropriately informed about true vaccine contraindications.
4. Lack of immunization-related knowledge and negative attitudes of mothers toward immunizations are strong predictors of lacking age-appropriate immunizations among children receiving immunization from a private provider.
5. Socioeconomic factors of education, income, family size, several changes of residence are important predictors of lacking age-appropriate immunizations.
6. Parent-held immunization records influence mothers' compliance with age-appropriate immunizations.

Recommendations for Public Health Policy

Based on the above conclusions, it is suggested that interventions aimed at improving immunization utilization behavior of mothers to increase age-appropriate immunizations of their children should focus on the followings:
1. Health providers of immunization should make certain that specific information about immunization is transmitted to the parents and they are correctly informed about immunization. More efforts are needed to keep parents, especially those utilizing private health services, aware of the current recommendations regarding immunizations.
2. Written guidelines which are clear, straightforward, and accurate should be disseminated to parents to ensure that parents are informed of true contraindications.

3. Multimedia announcements (e.g., television, radio, newspapers, magazines) should be utilized in informing parents of immunizations, their time frame, and location for obtaining them.

4. Providers of immunizations should make use of the socioeconomic predictors of lack of age-appropriate immunizations as screening indicators to identify high risk children. Those children could be enrolled in immunization tracking programs and outreach immunization services to overcome the barriers in the system of vaccine delivery.

5. Standard parent-held immunization records should be given to all parents. These records should contain the ages at which vaccines are due and be used to record the date and type of all vaccination given. This would emphasize the importance of immunizations and remind parents of when immunizations should be given.

**Implications for Future Research**

The results of this study are similar and congruent with other related findings and added to the growing knowledge base of immunizations utilization, there are some contrary findings.
Since immunization utilization behavior varies by population characteristics, there is a need for further studies in the United States in order to achieve the national immunization target.

This study identifies certain variables which influence age-appropriate immunization coverage rate. Future research should be conducted to further test and validate the findings.

Due to the limitation of the study design in terms of its cross sectional nature which made it difficult to establish causal association, there is a need for further research using longitudinal and/or experimental research design to validate the significant factors.

There is also a need for further qualitative research design which may produce other significant factors which affect the decision making process of parents of inadequately immunized children.

In view of the study design which compared areas of private and non-private providers, there is a need for further research to assess the special needs of parents from each provider group.

The results of this study should be used as a foundation for the development of an experimental health education intervention with evaluation of its outcomes and impacts.
Summary

Immunization may be the most powerful and cost-effective method for prevention of morbidity and mortality from the infectious diseases of childhood. One of the National Health Objectives for the Year 2000 is to vaccinate 90% of children with the primary series by their second birthday. Yet, about half of U.S. 2 year old children are at risk of preventable diseases because they are not age-appropriately immunized. The consequences of the decline in the number of children immunized include epidemics of measles, mumps, and an increase in reported pertussis and rubella cases.

Parent education has been identified as a major strategy for increasing immunization rates among 2 year old children in the U.S. There are few studies to indicate what educational messages should be emphasized and what specific areas an educational campaign should address. It is important to better understand parental knowledge, attitudes, and other psychosocial factors that determine immunization seeking behavior.

The aims of this study were to evaluate the association between maternal knowledge and attitudes and age appropriate immunization of infants at 12 months of age.

From April to August, 1993, a household survey of 389 children 12 to 30 months of age was conducted in Norfolk, Virginia using multistage cluster sampling procedures to assess immunization coverage. Data were collected by
interviewing parents or primary care takers using a structured questionnaire. Immunization records were obtained from parents and health care providers.

A randomly selected subset of mothers were interviewed more extensively in order to assess their knowledge of vaccines and vaccine preventable diseases, attitudes about the seriousness of vaccine preventable diseases and the efficacy and safety of childhood immunizations, awareness of contraindications to immunizations, and their preventive behaviors using another standardized, pretested questionnaire. Mothers' knowledge of vaccines and vaccine preventable diseases was summarized by a knowledge score. Attitudinal data were summarized by attitude scores. The reliability of the scales were assessed by calculation of Cronbach's alpha. The dependent variable was defined as being age appropriately vaccinated at 12 months i.e., all vaccines (3 diphtheria, tetanus, and pertussis and 2 oral polio vaccines) were administered at the recommended ages plus a 30 day grace period according to CDC definitions. Factors associated with immunization status were summarized using multiple logistic regression analysis, adjusted odds ratios, and 95% confidence intervals.

Of the 201 mothers included in the study (aged 15 to 42 years with a median age of 27 years), 47% were white and 46% were African-American; 21% lacked high school education; 36% were not married; 70% were homemakers. The median family
income was less than $20,000. Sixty-two percent of children were not age-appropriately immunized at 12 months of age. Twenty-four percent of mothers did not know that the child should begin getting his/her immunizations at 2 months of age and 28% did not know a place of free immunizations. Seventy-two percent of mothers believed that a child with minor illness should not be immunized. Mothers' attitudes to preventable diseases and vaccines were strongly positive: 99% considered vaccines to be safe, and effective; 86% indicated that an unimmunized child is susceptible to vaccine preventable diseases; and 96% considered preventable diseases to be serious. Not being age appropriately immunized at 12 months was significantly (p<=0.05) associated with low level of knowledge of vaccines and vaccine-preventable diseases, (odds ratio [OR] 2.6, 95% confidence interval [CI] 1.5-4.5); inaccurate knowledge of vaccines and vaccine-preventable diseases (OR 2.1; CI 1.3-3.6), lack of knowledge of when to start immunizations (OR 2.2; CI 1.2-4.0); misunderstanding that a child with minor illness (slight fever, diarrhea, ear infection, teething, or runny nose) should not be immunized (OR 1.9; CI 1.1-3.2), unavailability of immunization records at home (OR 1.9,; CI: 1.1-3.1), and not receiving immunization information from the media (OR 2.8; CI: 1.0-7.3). Maternal attitudes regarding safety and effectiveness of vaccines and the seriousness of the diseases prevented did not predict age appropriate immunizations at 12 months.
The sociodemographic variables that were significantly associated with not being age-appropriately immunized at 12 months included maternal education of 12 years or less (OR 2.6; CI 1.4-4.7); having more than two children in the household (OR 2.8; CI 1.5-5.1); having unmarried mother (OR 3.2; CI 1.7-6.2); being nonwhite (OR 1.9; CI 1.1-3.4); family income of less than $10,000 (OR 4.8; CI 2.0-11.3), being AFDC recipient (OR 3.0; CI:1.4-6.4), changes of residence two or more times since the child’s birth (OR 2.2; CI 1.1-4.6), and receiving immunizations from a public or a military health provider (OR 1.8; CI 1.0-3.3). Behavioral variables that predicted lacking of age-appropriate immunizations included lack of breast feeding (OR 2.2; CI 1.4-3.6), late start of wellbaby care (OR 2.9; CI 1.4-5.8), and having less than five wellbaby visits in the first year (OR 3.1; CI 1.8-5.1).

Knowledge of vaccines and vaccine-preventable diseases and knowledge of when to start immunization remained significant determinants of not being age appropriately immunized at 12 months after use of multiple logistic regression analysis to control for the significant sociodemographic predictors of age-appropriate immunization.

This study draws attention to specific areas where health education could beneficially affect immunization coverage. Mothers who lacked knowledge of vaccines, vaccine-preventable-diseases, and when to begin immunization were more likely to have an infant who was not age-appropriately immunized.
However, because nearly all mothers in our study believed that vaccines are important, safe, and effective, these global attitudes were not found to affect immunization rates. The data suggest that in U.S. populations similar to ours, immunization coverage may be promoted by parent education strategies which should emphasize specific knowledge, such as vaccines and the diseases they prevent; when to begin immunization; and that immunizations can be given during minor illness.
REFERENCES


### APPENDIX A
### ADDITIONAL STATISTICAL RESULTS

#### Table A-1
Percent Distribution of Mothers' Attitudes About Immunizable Diseases and Immunizations.

<table>
<thead>
<tr>
<th></th>
<th>AAI</th>
<th>Not-AAI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Likelihood to get</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measles</td>
<td>51 46 3 72</td>
<td>55 38 7 120</td>
<td>54 41 5 192</td>
</tr>
<tr>
<td>pertussis</td>
<td>39 46 15 67</td>
<td>35 46 19 112</td>
<td>36 47 17 179</td>
</tr>
<tr>
<td>polio</td>
<td>32 43 25 69</td>
<td>40 42 18 114</td>
<td>36 43 21 183</td>
</tr>
<tr>
<td><strong>Severity of</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measles</td>
<td>43 48 9 75</td>
<td>54 39 7 120</td>
<td>50 42 8 195</td>
</tr>
<tr>
<td>pertussis</td>
<td>56 41 3 68</td>
<td>69 28 3 115</td>
<td>64 33 3 183</td>
</tr>
<tr>
<td>polio</td>
<td>78 20 2 74</td>
<td>83 17 * 119</td>
<td>81 18 1 193</td>
</tr>
<tr>
<td><strong>Efficacy of vaccine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measles</td>
<td>73 27 * 77</td>
<td>65 33 2 123</td>
<td>68 31 1 199</td>
</tr>
<tr>
<td>pertussis</td>
<td>74 26 * 76</td>
<td>68 31 1 120</td>
<td>70 29 1 196</td>
</tr>
<tr>
<td>polio</td>
<td>78 22 * 77</td>
<td>73 26 1 121</td>
<td>75 25 1 198</td>
</tr>
<tr>
<td><strong>Safety of</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td>48 52 * 77</td>
<td>47 52 1 122</td>
<td>48 51 1 199</td>
</tr>
<tr>
<td>DTP</td>
<td>48 51 1 77</td>
<td>47 50 3 121</td>
<td>47 51 2 198</td>
</tr>
<tr>
<td>Polio</td>
<td>52 48 * 77</td>
<td>52 47 1 122</td>
<td>52 48 * 199</td>
</tr>
</tbody>
</table>

**VL=Very likely, L=Likely, NL=Not likely, VS=Very serious, S=Serious, NS=Not serious, VE=Very effective, E=Effective, NE =Not effective, VSF=Very safe, SF=Safe, NSF=Not safe, no.=total number of mothers who responded to the question, *= <0.5**
Table A-2
Percent Distribution of Mothers' Attitudes about Immunizing a Child with Minor Illness

<table>
<thead>
<tr>
<th>Attitudes to immunizing a child with</th>
<th>AAI-12</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Not-AAI-12</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Dk</td>
<td>no.</td>
<td>Yes</td>
<td>No</td>
<td>Dk</td>
<td>no.</td>
<td>Yes</td>
<td>No</td>
<td>Dk</td>
<td>no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>runny nose</td>
<td>39</td>
<td>57</td>
<td>4</td>
<td>77</td>
<td>32</td>
<td>58</td>
<td>10</td>
<td>121</td>
<td>35</td>
<td>58</td>
<td>8</td>
<td>198</td>
<td></td>
</tr>
<tr>
<td>mild fever</td>
<td>5</td>
<td>91</td>
<td>4</td>
<td>77</td>
<td>6</td>
<td>93</td>
<td>1</td>
<td>123</td>
<td>5</td>
<td>93</td>
<td>2</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>teething</td>
<td>55</td>
<td>35</td>
<td>10</td>
<td>77</td>
<td>47</td>
<td>46</td>
<td>7</td>
<td>123</td>
<td>50</td>
<td>42</td>
<td>8</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>diarrhea</td>
<td>10</td>
<td>73</td>
<td>17</td>
<td>77</td>
<td>8</td>
<td>77</td>
<td>15</td>
<td>123</td>
<td>9</td>
<td>75</td>
<td>16</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>ear infection</td>
<td>5</td>
<td>91</td>
<td>4</td>
<td>77</td>
<td>6</td>
<td>88</td>
<td>6</td>
<td>122</td>
<td>6</td>
<td>89</td>
<td>5</td>
<td>199</td>
<td></td>
</tr>
</tbody>
</table>

AAI-2=Age appropriately immunized at 12 months of age
Dk=Do not know
no.= Number of mothers who responded to the question
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>White</th>
<th>Non-white</th>
<th>OR adjusted for ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>* low level of correct Knowledge of vaccines and diseases</td>
<td>1.5(0.6-3.7)</td>
<td>2.9(1.4-5.9)</td>
<td>2.3(1.3-4.1)</td>
</tr>
<tr>
<td>* incorrect knowledge of vaccine and diseases</td>
<td>1.8(0.9-3.7)</td>
<td>2.4(1.2-5.0)</td>
<td>2.0(1.2-3.4)</td>
</tr>
<tr>
<td>* Lack of knowledge of when to start immunization</td>
<td>1.4(0.6-3.2)</td>
<td>4.3(1.5-12.2)</td>
<td>2.3(1.2-4.2)</td>
</tr>
<tr>
<td>* Lack of awareness of vaccine contraindications</td>
<td>2.6(1.3-5.3)</td>
<td>0.8(0.3-2.0)</td>
<td>1.6(0.9-2.8)</td>
</tr>
<tr>
<td>* Unavailability of the immunization records at home</td>
<td>1.3(0.7-2.7)</td>
<td>2.9(1.3-6.4)</td>
<td>1.9(1.1-3.2)</td>
</tr>
</tbody>
</table>

Table A-3
Odds Ratios (95% CI) of Knowledge, Attitudes, and Cues to Action Risk Factors by Ethnicity
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>OR adjusted for education</th>
</tr>
</thead>
<tbody>
<tr>
<td>* low level of correct Knowledge of vaccines and diseases</td>
<td>2.4(1.4-4.2)</td>
</tr>
<tr>
<td>* Incorrect knowledge of vaccine and diseases</td>
<td>2.2(1.3-3.8)</td>
</tr>
<tr>
<td>* Lack of knowledge of when to start immunization</td>
<td>2.4(1.3-4.5)</td>
</tr>
<tr>
<td>* Lack of awareness of vaccine contraindications</td>
<td>1.6(0.9-2.7)</td>
</tr>
<tr>
<td>* Unavailability of the immunization records at home</td>
<td>2.0(1.2-3.5)</td>
</tr>
</tbody>
</table>

Mothers having <=12 years of education

Mothers having >12 years of education

OR adjusted for education

* low level of correct Knowledge of vaccines and diseases 1.7(0.9-3.3) 4.7(1.8-12.3) 2.4(1.4-4.2)
* incorrect knowledge of vaccine and diseases 2.6(1.2-5.2) 1.8(0.8-4.1) 2.2(1.3-3.8)
* Lack of knowledge of when to start immunization 2.4(1.1-5.4) 2.4(0.9-6.5) 2.4(1.3-4.5)
* Lack of awareness of vaccine contraindications 1.9(0.9-3.9) 1.3(0.6-2.9) 1.6(0.9-2.7)
* Unavailability of the immunization records at home 2.3(1.1-4.6) 1.7(0.8-4.0) 2.0(1.2-3.5)
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Family income &lt;$10,000</th>
<th>Family income &gt;=$10,000</th>
<th>OR adjusted for family income</th>
</tr>
</thead>
<tbody>
<tr>
<td>* low level of correct Knowledge of vaccines and diseases</td>
<td>1.5(0.4-5.4)</td>
<td>2.4(1.3-4.4)</td>
<td>2.3(1.3-4.0)</td>
</tr>
<tr>
<td>* incorrect knowledge of vaccine and diseases</td>
<td></td>
<td>1.8(1.0-3.1)</td>
<td>2.1(1.2-3.6)</td>
</tr>
<tr>
<td>* Lack of knowledge of when to start immunization</td>
<td>2.9(0.4-18.6)</td>
<td>2.0(1.0-3.9)</td>
<td>2.1(1.1-4.0)</td>
</tr>
<tr>
<td>* Lack of awareness of vaccine contraindications</td>
<td>1.1(0.0-6.4)</td>
<td>1.6(0.9-2.7)</td>
<td>1.5(0.9-2.7)</td>
</tr>
<tr>
<td>* Unavailability of the immunization records at home</td>
<td>0.6(0.2-2.0)</td>
<td>2.2(1.2-3.9)</td>
<td>1.7(1.0-2.9)</td>
</tr>
<tr>
<td>Variable</td>
<td>OR(95% CI)</td>
<td>p</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>--------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>Maternal education of 12 years or less</td>
<td>2.3(1.3-4.1)</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Having three or more children in the household</td>
<td>3.2(1.9-5.5)</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Public/military immunization provider</td>
<td>2.4(1.3-4.3)</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Non-participation in WIC</td>
<td>1.8(1.0-3.4)</td>
<td>0.062</td>
<td></td>
</tr>
<tr>
<td>Being born outside Norfolk</td>
<td>1.8(1.0-3.4)</td>
<td>0.056</td>
<td></td>
</tr>
<tr>
<td>Having less than five well-baby visits in the first year of life</td>
<td>4.9(2.4-10.0)</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Starting well-baby care after two months of age</td>
<td>3.2(1.7-5.9)</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge of vaccine and preventable diseases</td>
<td>1.6(1.0-2.8)</td>
<td>0.059</td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge of when to start immunizations</td>
<td>1.7(1.0-3.0)</td>
<td>0.066</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

INTERVIEW SCHEDULES

1. Schedule A: Household Screening
2. Schedule B: CINCH Project Baseline Immunization Survey
3. Schedule C: CINCH Project Psychosocial Survey
CINCH Project Baseline Survey
Schedule A

HOUSEHOLD SCREENING

1. CITY: Norfolk □ Newport News □
2. CLUSTER NO. □ □ □
3. HOUSEHOLD NO. □ □ □ □ □
4. DATE OF INTERVIEW: _______£93 (mm/dd/yy)
5. INTERVIEWER NAME: ________________________________

INTERVIEWER CODE:

6. (INTRODUCE YOURSELF AND THE CINCH SURVEY.) Are there any children who live in this household who are 12 months to 30 months of age (that is, any child(ren) born sometime between October 1, 1990 and (TODAY'S DATE), 1992)?

□ Yes → CONTINUE TO 7A BELOW
□ No, there are no children in that age range in this household.→ THANK THE RESPONDENT FOR HIS/HER HELP. GO TO THE NEXT HOUSEHOLD.

7a. I would like to speak with someone in the household, a parent, grandparent or guardian who is responsible for the health care of the children. (IDENTIFY ELIGIBLE RESPONDENT. IF ELIGIBLE RESPONDENT IS PRESENT, PROCEED TO 7b. IF NOT PRESENT, RECORD VISIT NOTES ON REVERSE SIDE AND ON FORM S2 AND MAKE ARRANGEMENTS FOR A RETURN VISIT.)

7b. The questions in this survey ask about immunizations or "baby shots" given to young child(ren) and where families go for their children's health care. These questions are being asked in about 900 households in the area this month. The information we obtain from each household will be held strictly confidential, and will not be released to anyone. Your participation is important to the survey but you should know that you have the right to refuse to answer any and all questions or stop the interview at any point. However, it is also important for you to know that the information from this survey will be used to improve the health care of children in the city.

The questions I have to ask will only take about 20 minutes. May I ask you these questions now?

□ Yes → THANK THE RESPONDENT. CONTINUE TO SCHEDULE B
□ Refusal to participate and document reason(s):

Interviewer may come back at a later time. → MAKE NOTES BELOW OR ON REVERSE SIDE.
SCHEDULE B
CINCH Project Baseline Survey
IMMUNIZATION HISTORY

TO BE COMPLETED IN HOUSEHOLDS WITH CHILDREN IN THE TARGET AGE RANGE, 12-30 MONTHS OF AGE.

1. CITY: Norfolk _______ Newport News _______
2. CLUSTER CODE No.: ____________ 3. HOUSEHOLD CODE No.: ____________
4. INTERVIEWER NAME: ____________ INTERVIEWER CODE: ____________
5. DATE OF INTERVIEW: _______/____/93 (mm/dd/yy) 6. TIME OF INTERVIEW: _______ (24 hour clock)

HOUSEHOLD COMPOSITION

First, I would like to begin by asking a few questions concerning this household.

7. What is the total number of people, including children and adults who live in this household? _______ (total)

8. Could you tell me the first name of all the individuals living in this household, their ages, and how they are related to you. Let's start by listing you, children next and other adults in the household after that.


<table>
<thead>
<tr>
<th>Roster No.</th>
<th>First Name</th>
<th>Relationship to respondent</th>
<th>Age (yrs)</th>
<th>Date of birth if &lt; 5 yrs</th>
<th>M/F</th>
<th>Active Military Branch</th>
<th>Occupation of adult</th>
<th>Head of HH &quot;X&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Respondent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
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<td>8</td>
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<tr>
<td>9</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

*ASK: Which person or persons do you consider to be the head of this household?

INTERVIEWER: BE SURE TO COMPLETE ALL ITEMS ABOVE BEFORE PROCEEDING.
THE FOLLOWING IMMUNIZATION HISTORY IS TO BE USED FOR THE FIRST ELIGIBLE CHILD. USE THE SUPPLEMENT TO SCHEDULE B IF THERE IS MORE THAN ONE ELIGIBLE CHILD IN THE HOUSEHOLD.

**IMMUNIZATION HISTORY**

The following questions refer to ____________, and are about immunizations that he/she may have received.

9. Has __________ ever been given any immunizations by mouth or by shot?
   
   Yes □  No □ → Please tell me, what do you think are the reasons that your child has not received any immunizations? (RECORD ALL ANSWERS VERBATIM. ASK: Is there any other reason?) — GO TO Q13
   
   ☐ ☐ ☐ ☐ ☐ ☐

10. Have you ever been given a card or record to keep track of the immunizations or shots that __________ has received?
   
   Yes □  No □ → GO TO Q13
   
   ☐ ☐ ☐ ☐ ☐ ☐

11. I would like to record the dates listed on the card(s). Do you have the immunization card(s) or record(s) available?
   
   Yes □  No □ (can’t find it/don’t have it any longer) — GO TO Q13
   
   ☐ ☐ ☐ ☐ ☐ ☐
   
   Could you show me the card(s) so I can record the dates his/her immunizations were given?

   RECORD DATE OF EACH IMMUNIZATION GIVEN AS MM/DD/YY.

<table>
<thead>
<tr>
<th>Vaccine given</th>
<th>Dose 1</th>
<th>Dose 2</th>
<th>Dose 3</th>
<th>Dose 4</th>
<th>Dose 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTP or DPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPV, IPV or Polio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hib or HbCV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HepB or Hepatitis B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mumps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetanus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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11a. INTERVIEWER: Number of immunization cards shown: _____________

11b. RECORD ANY OTHER IMMUNIZATIONS ON THE CARDS AND THE DATES GIVEN.

<table>
<thead>
<tr>
<th>Date of immunization (mm/dd/yy)</th>
<th>Immunization given</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Are all the immunizations that _____ ever received included on this (these) immunization card(s)?

Yes □  No □  Don't know □
HEALTH CARE PROVIDERS

Now I have some questions to ask about where you usually take ________ for well baby care and/or immunizations.

13. (SHOW RESPONDENT CARD A TO PROMPT RESPONSES.) Please list the names and locations of all the clinics or doctors' offices where __________ has received well baby care and/or immunizations.

   Provider No.

   1. NAME __________________________________________________________________________
      STREET       CITY          STATE

   2. NAME __________________________________________________________________________
      STREET       CITY          STATE

   3. NAME __________________________________________________________________________
      STREET       CITY          STATE

   4. NAME __________________________________________________________________________
      STREET       CITY          STATE

   5. NAME __________________________________________________________________________
      STREET       CITY          STATE

Now we would like to ask your permission for these clinics or doctors to send us a copy of your child's immunization records. This information will be used to make sure the immunization history is complete. OBTAIN A SIGNED AUTHORIZATION FORM FOR EACH PROVIDER LISTED.

14. In general, is there one person or place where you go most of the time to get immunizations or baby shots?

   Yes □  No □  - GO TO Q16

   Please tell me which clinic or doctor's office is where you usually go for ________'s immunizations or shots.

   PROVIDER NO. ________

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15. Why did you choose this location as the usual place for your child's immunizations or baby shots? 
(RECORD VERBATIM. ALL ANSWERS. ASK: Is there any other reason?) → GO TO Q17

__________________________________________________________________________

16. Many people do not go to the same place to have their child’s immunizations. Why has your child not been to the same doctor or place for his/her immunizations? 
(RECORD VERBATIM. ALL ANSWERS. ASK: Is there any other reason?)

__________________________________________________________________________

17. Do you think it is important for children to get immunizations?

Yes □ No □

Why? ________________________________________________________________

__________________________________________________________________________

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HEALTH CARE COVERAGE

Now I would like to ask you a few questions about any health care plans you may have and any costs you have had for your child's immunizations.

18. Look at the health plans listed in CARD B. Is your child covered by any of these plans?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Don't know</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GO TO Q20</td>
</tr>
</tbody>
</table>

18a. Which ones (CHECK ALL THAT APPLY)?

<table>
<thead>
<tr>
<th>Health Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid</td>
</tr>
<tr>
<td>CHAMPUS or Veteran’s</td>
</tr>
<tr>
<td>Blue Cross/Blue Shield</td>
</tr>
<tr>
<td>Aetna</td>
</tr>
<tr>
<td>Other Private Insurance (Specify)</td>
</tr>
<tr>
<td>Workmen’s Compensation</td>
</tr>
<tr>
<td>Other (Specify)</td>
</tr>
<tr>
<td>Don’t know for sure</td>
</tr>
</tbody>
</table>

19. Is ________ covered for immunizations on any of these plans?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
</tr>
</tbody>
</table>

20. Have you ever personally taken _______ or gone with _______ to get his/her immunizations?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>GO TO Q32</td>
</tr>
</tbody>
</table>
BARRIERS TO IMMUNIZATION

(IF THE CHILD HAS NOT RECEIVED ANY IMMUNIZATIONS, GO TO Q32.) The next few questions are concerning the last time you took your child for his/her immunizations.

21. Did you have any problems getting to the doctor or clinic?
   No □  Yes □  → What kind of problems? ________________________

22. Did you have any problems with the office or clinic hours there?
   No □  Yes □  → What kind of problems? ________________________

23. Did you or someone else have to take time off from work to go to the office or clinic for shots?
   No □  Yes □  → Was it a problem? Yes □  No □

24. Did you need an appointment to take ______ to the office or clinic to receive his/her baby shots?
   Yes □  → Was this a problem? Yes □  No □
   No □
   Don't know □  What kind of problem? ________________________

25. Did you have any problems getting your child his/her shots once you were there?
   No □  Yes □  → What kind of problems? ________________________

26. How long did you wait before your child was seen by a doctor or nurse? ________________________
   (IF LESS THAN 1 HOUR, RECORD NUMBER OF MINUTES, IF 1 OR MORE HOURS, RECORD THE NEAREST HALF HOUR.)

27. Did the amount of time you waited cause any problems for you?
   No □  Yes □  → What kind of problems? ________________________
28. Which of the following statements best describes how much you paid for your child's last immunizations alone, not including other well baby visit charges? (ANY INSURANCE REIMBURSEMENT MEANS THE RESPONDENT DID NOT PAY THAT PART.)

I paid all of it □  How much was that? $__________
I paid part of it □  How much was that? $__________
I paid none of it □

Why?
Dept of Public Health/Clinic

Insurance □
Other □
Specify: ____________________________________________
29. When you last took your child to get his/her immunizations, did you

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>About how much was that?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Have to pay for a babysitter?</td>
<td>□</td>
<td>□</td>
<td>$ ________</td>
</tr>
<tr>
<td>b) Have to pay for transportation?</td>
<td>□</td>
<td>□</td>
<td>$ ________</td>
</tr>
<tr>
<td>c) Did you or someone else lose income because you had to miss work?</td>
<td>□</td>
<td>□</td>
<td>$ ________</td>
</tr>
<tr>
<td>d) Did you pay other doctor/clinic charges?</td>
<td>□</td>
<td>□</td>
<td>$ ________</td>
</tr>
<tr>
<td>e) Did you have any other costs that have not been mentioned?</td>
<td>□</td>
<td>□</td>
<td>$ ________</td>
</tr>
</tbody>
</table>

Please specify: ________________________________________________

30. Was the amount you spent for your child to receive his/her last immunization a financial problem for you?

Yes □ No □

31. Did you have any problems in getting your child's last immunizations that we have not already asked about?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>What kind of problems?</th>
</tr>
</thead>
</table>
|   |     |    | _______________________
|   |     |    | _______________________

32. Do you know when it is time for ________ to go for his/her shots?

Yes □ No □

How do you know? ____________________________________________

33. Are you aware of any place(s) where your child can receive his/her immunizations free of charge?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Where?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>______</td>
</tr>
</tbody>
</table>
Finally, I would like to ask a few more questions about you and your family. Your responses are confidential and are only used for group reporting purposes.

34. How long have you lived in this city? ________________________ (RECORD IN YEARS OR IF LESS THAN 1 YEAR, RECORD IN MONTHS.)

35. Would you describe yourself as

- White
- African-American
- Asian-American
- Hispanic
- or Other Please specify:

36. What is the highest grade you completed in school or the highest degree you have obtained?

37. Are there any children in this household currently enrolled in the WIC program?

- Yes □  No □

38. Are there any children in this household currently enrolled in the AFDC or ADC program?

- Yes □  No □

39. Are any of the eligible children in this household (12-30 months of age) currently enrolled in day care?

- Yes □  No □

Which child(ren) (first name) 

Where does he/she go? (NAME CARE PROVIDER, INDICATE AS CENTER OR HOME)

__________________________________________

__________________________________________
40. Could you tell me what your family’s total combined income from all family members was during the past 12 months. This includes income from all sources, such as wages, salaries, social security or retirement benefits, interest or dividends, rent, food stamps, and so forth. (PLEASE TRY TO DETERMINE DOLLAR AMOUNT FIRST. IF RESPONDENT IS UNABLE TO ANSWER, PLEASE READ THE LIST IN 40a.)

$ __________ Don’t know □ Refused □

OR

40a. (SHOW RESPONDENT CARD C.) Can you show me if it was (CHECK ONE).

Under $6,000 □
or $6,000 to $9,999 □
or $10,000 to $19,999 □
or $20,000 to $29,999 □
or $30,000 to $39,999 □
or $40,000 to $49,999 □
or $50,000 to $59,999 □
or over $60,000 □
don’t know □ refused □

41. Is there anything you can think of that would make it easier for you and others to get their baby’s shots in any of the places you have visited or seen (do you have any suggestions or ideas)?

No □ Yes □ — Comments: __________________________________________

INTERVIEWER: IF THERE IS MORE THAN 1 ELIGIBLE CHILD, INTRODUCE SUPPLEMENT B. IF THERE IS ONLY ONE ELIGIBLE CHILD, SAY:

The questionnaire is now complete. Thank you very much for your time and help with this survey.

42. INTERVIEW IS: COMPLETE □ INCOMPLETE □
SCHEDULE C

CINCH BASELINE SURVEY

PARENT KNOWLEDGE AND ATTITUDES ABOUT IMMUNIZATIONS

1. CITY: Norfolk □

2. CLUSTER CODE NO: __________ 3. HOUSEHOLD CODE NO.: __________

4. INTERVIEWER NAME: ___________ INTERVIEWER CODE: _______

5. DATE OF INTERVIEW: ___/___/93 (mm/dd/yy)

RESPONDENT/CHILD DATA (TRANSCRIBED FROM SCHEDULE B)

6. FIRST NAME OF YOUNGEST ELIGIBLE CHILD: _______________________________

7. FIRST NAME OF RESPONDENT: ___________________

8. RELATIONSHIP OF RESPONDENT TO ELIGIBLE CHILD: _________________

9. REFUSAL FOR INTERVIEW:

☐ Refusal to participate. Document reason(s): ______________________________

☐ Interviewer may come back. Note appointment: ___________________________

10. Who in the family is responsible for seeing that _______ receives his/her shots or immunizations? (CHECK ALL THAT APPLY)

Mother □
Father □
Grandparent □
Legal guardian □
Other □
Specify: ______________________
### INFORMATION SOURCE

I have a few questions regarding where you have received information about shots or immunizations.

11. (SHOW CARD D, READ EACH OPTION) How have you gotten your information about immunizations for children? (CHECK ALL THAT APPLY)

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician/nurse talked with me</td>
<td></td>
</tr>
<tr>
<td>Pamphlets/written materials</td>
<td></td>
</tr>
<tr>
<td>Newspapers/magazines</td>
<td></td>
</tr>
<tr>
<td>Television/radio</td>
<td></td>
</tr>
<tr>
<td>Friends/neighbors</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Specify: __________________________</td>
<td></td>
</tr>
</tbody>
</table>

12. Where was _______ (child) born?

- DePaul Hospital
- Sentara Norfolk General Hospital
- Sentara Leigh Hospital
- Norfolk Community Hospital
- Other hospital in Virginia
- Other hospital outside Virginia
- Not in a hospital

   - which? ____________________ (hospital/city)
   - where? ____________________

13. After your baby was born, did someone in the hospital talk with you about getting shots for the baby during his/her first year?

   - Yes [ ]
   - No [ ]
   - Don’t remember [ ]

14. Since ________ was born, has any clinic or doctor’s office sent you reminders when your child’s shots were due?

   - Yes [ ]
   - No [ ]
15. Please tell me all of the diseases you can think of that can be prevented by getting children their shots or immunizations. (AFTER RESPONDENT ANSWERS, ASK: Can you think of any more?)

1. 
2. 
3. 
4. 
5. 
6. 

16. What are the names of the shots or immunizations that infants and young children are supposed to get? (AFTER RESPONDENT ANSWERS, ASK: Can you think of any more?)

1. 
2. 
3. 
4. 

17. What is the best age (in months) for a child to begin his/her shots or immunizations? 

_______
SAFETY AND REASONS NOT TO IMMUNIZE

Now, I would like to know your feelings and attitudes regarding some children's diseases and the safety of shots or immunizations.

18. In your opinion, if a child did not get his/her immunizations how likely would it be for him/her to get (READ ALL OPTIONS)...

<table>
<thead>
<tr>
<th></th>
<th>Very likely</th>
<th>Likely</th>
<th>Not likely</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) measles?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) whooping cough</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or pertussis?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) polio?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. In your opinion, how serious would it be if a child (READ ALL OPTIONS)...

<table>
<thead>
<tr>
<th></th>
<th>Very serious</th>
<th>Serious</th>
<th>Not serious</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. got measles?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. got whooping cough</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or pertussis?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. got polio?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. In your opinion, how effective are shots to prevent a child from getting (READ ALL OPTIONS)...

<table>
<thead>
<tr>
<th></th>
<th>Very effective</th>
<th>Not effective</th>
<th>Effective</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) measles?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) whooping cough</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or pertussis?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) polio?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
21. In your opinion, how safe is it for a child to get (READ ALL OPTIONS)...

   a) an MMR shot (measles-mumps-rubella)?
      Very safe  Safe  Not safe
      □  □  □  → Why? ____________
   
   b) a DPT shot (diphtheria, pertussis, tetanus)?
      Very safe  Safe  Not safe
      □  □  □  → Why? ____________
   
   c) Polio vaccine?
      Very safe  Safe  Not safe
      □  □  □  → Why? ____________

22. Do you know of any reasons why a child should not get his/her shots or immunizations?
    Yes □  No □
    What reasons? __________________________________________________________

23. Please answer YES, NO or DON'T KNOW to the following questions. Is it all right for a child to receive an immunization if he or she...

   a) has a runny nose?
      Yes □  No □  Don't know □
   
   b) has a slight fever?
      Yes □  No □  Don't know □
   
   c) has diarrhea?
      Yes □  No □  Don't know □
   
   d) is teething?
      Yes □  No □  Don't know □
   
   e) has an ear infection?
      Yes □  No □  Don't know □

24. Have you ever refused to let your child receive a shot when a doctor or nurse recommended it?

    Yes □  No □
    Why did you refuse? ___________________________________________________
HEALTH BACKGROUND

Finally, I have a few questions regarding your child's health background.

25. When you became pregnant with _____, when did you begin your prenatal care? (Show respondent Card G)
   First three months  
   Second three months  
   Third three months  
   Never received prenatal care  
   Don't remember  

26. Was _______ born full term or premature?
   Full term  
   Premature  by how many weeks? ____
   Don't know  

27. How much did _______ weigh at birth? ___/____ OR __________ (lbs) (ozs) (grams)

28. How many times since birth has your child gone to the doctor or nurse for well-baby care, that is, when he/she was not sick or injured? (THIS ALSO SHOULD INCLUDE VISITS JUST FOR SHOTS) ____ times
   (PLEASE LIST _______'S AGE IN MONTHS AT EACH VISIT, STARTING WITH THE FIRST VISIT)
   1. ________
   2. ________
   3. ________
   4. ________
   5. ________
   6. ________
29. Was _______ ever breastfed?

Yes [ ] No [ ]

For how many weeks or months was he/she breastfed?

______ weeks OR ______ months

30. Does your child have any serious health problem, handicap or disability?

Yes [ ] No [ ]

What is his/her health problem or disability? ________________________________

31. Have you worked at a regular full-time or part-time job?

Yes [ ] No [ ] — Go to Question 32

a) Which of the following best describes your current employment status?

Full time [ ]
Part time [ ] — For how long? ________
Seasonal labor [ ]
Unemployed [ ]

b) What was your most recent job? (IF CURRENTLY EMPLOYED, CURRENT JOB)

______________________________

32. Has _____ lived at this address since birth?

No [ ] Yes [ ]

How many times has he/she moved? _____ times