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PARENTS' KNOWLEDGE AND ATTITUDES ABOUT IMMUNIZATION IN INDIA

by

Anne George

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Family, Consumer, and Human Development

UTAH STATE UNIVERSITY
Logan, Utah

2004

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ABSTRACT

Parents' Knowledge and Attitudes About Immunization in India

by

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Utah State University, 2004

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Department: Family, Consumer, and Human Development

Childhood immunization is acknowledged as being a crucial health intervention for children. Immunization rates of children may vary depending on their parents' knowledge and attitudes about the issue. The focus of this study is on parents' knowledge and attitudes about immunization, and employs Urie Bronfenbrenner's ecological systems theory. A questionnaire was administered to 233 parents in India to explore the issues of parental immunization knowledge and attitudes. Correlates of parental knowledge and attitudes that were explored included gender, education, respondents' immunization status, and children's immunization status. Sources of parental knowledge about immunization were also examined. Overall, parents in this sample had a high level of awareness and positive attitudes about immunization. Parents' knowledge about immunization was correlated with their attitudes on immunization. Gender was correlated with parents' knowledge about immunization, but not their attitudes, with females having greater awareness about immunization than males.

Parental education, parental immunization status, and children's immunization status were positively correlated with both knowledge and attitudes about immunization.

Doctors and health care settings were the major sources of information about immunization for parents in this sample. Implications for research, policy, and education are discussed.

(144 pages)

ACKNOWLEDGMENTS

I would like to express my deep appreciation and gratitude to Dr. Shelley L. Knudsen Lindauer for her guidance and support throughout my graduate career. She has been a challenging and very inspiring mentor. I am also grateful to my committee members, Drs. Randall M. Jones, Kathleen W. Piercy, Thomas R. Lee, and Scott DeBerard, for their support and astute recommendations. I am grateful for the many hours of advice on statistical analyses given to me by Dr. Jones and Ms. Roxane Pfister. I would also like to thank Ms. Teresa Bodrero for her help in formatting and editing this manuscript.

I am especially indebted to my mother, Mary Thomas, my husband, David, and my sister, Elizabeth, for their moral support, guidance, and prayers. Without them I could not have accomplished my goals.

Anne George

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CHAPTER I

INTRODUCTION

The goal of this study was to understand parents' knowledge about and attitudes toward children's immunization. The immunization of young children is a major public health concern for governments across the world. Caregivers, as facilitators of children's development, play a crucial role in their health and well-being. Accordingly, parents' and other caregivers' understanding about and attitudes toward immunization, along with a host of other factors (e.g., available of adequate finances) determine whether or not their charges are immunized adequately against disease. Understanding parents' and caregivers' attitudes toward immunization can be useful for policymakers who are interested in seeing maximal immunization coverage in their nations. This study relied on a contextual framework that examines the various systems of relationships in the environment of a developing individual, and the impact of those systems on him or her. Specifically, this study focused on knowledge and attitudes toward immunization. Further, this study examined whether parental perceptions were correlated with children's immunization status and with specific parental characteristics.

Problem Statement

Over the course of the 20th century, humankind has seen tremendous improvements in the quantity and quality of human life. The explosion in the use of various technologies has improved living conditions for populations across the world. Some of the greatest improvements in the quality of human life over the course of the 20th century have resulted from the improvements in human health and the reduction of

childhood mortality and morbidity (Christensen, 1994). Public health interventions have played a major role in these developments. The discovery of, as well as the improvements in, life-saving technologies has led to a tremendous reduction in disease and early mortality in many nations. The average life expectancy in the United States, for example, rose from just under 50 years in 1900 to 76.5 in 1997 (U.S. Bureau of the Census, 1960; U.S. Bureau of the Census, 1999). A steady decline in infant and child mortality is reported to be a major reason for the increased life expectancy enjoyed in developed nations of the world today. This decline in childhood mortality is thought to be the result of widespread immunization of young children against preventable but often fatal diseases. The effects of immunization are far more visible in developed nations of the world than in developing nations. Immunizations against infections and deadly diseases have been credited with saving a tremendous number of lives across the world. The eradication of smallpox is credited to immunization against the disease (Christensen). Polio has been eradicated from the Western hemisphere through immunization against the disease. In addition, this region has seen dramatic declines in the incidence of diseases like whooping cough, measles, diphtheria, and Haemophilus influenza type B infections, due to immunization against these diseases (Bedford & Elliman, 2000).

The story of vaccinations has been a successful one in most nations of the world, resulting in a high rate of prevention, if not total eradication, of fatal infectious diseases. However, many developing nations have been slow to reap the fruits of immunization against deadly disease. The underimmunization of children in many developing nations

is seen to result in a higher rate of childhood mortality in developing nations.

Approximately 20% of children across the globe are un-immunized or inadequately immunized; 6-8 million children die each year from preventable diseases due to nonimmunization (Christensen, 1994).

The World Health Organization (WHO) has focused a tremendous amount of research and funding on reducing childhood mortality through promoting the Expanded Programme on Immunization (EPI), which seeks to increase immunization coverage of underimmunized nations of the world. A major focus of the program is to reduce the prevalence of vaccine-preventable diseases on the continents of Africa and Asia. A major explanation for the underimmunization of children in developing nations is that most of these children live in the tropical and subtropical climates where the vaccines require refrigeration. The lack of adequate cold storage systems in remote parts of the world leads to children's limited access to safe and effective vaccination (Christensen, 1994). In addition, a host of other factors such as access to vaccination providers, cost of vaccines, as well as parental/caregivers' knowledge and attitudes toward immunization are also commonly thought of as explanations for the inadequacy of immunization coverage for children in different developing nations (Christensen).

Another cause of concern for the WHO is that immunization rates have been declining in developed nations. This has been occurring despite the effectiveness of immunization in reducing childhood morbidity and mortality due to preventable infectious diseases in these nations. The reason for this decline is that the very success of the EPI seems to be rebounding against it (Bedford & Elliman, 2000; Christensen, 1994).

Specifically, because of dramatic declines in the rate of infectious diseases due to immunizations, parents and caregivers are less concerned about protecting children from once-deadly diseases. Additionally, because the suffering due to diseases has declined, new problems have become visible. These include vaccine failures, and vaccine side effects. Parents and caregivers in many developed nations such as the United States and the United Kingdom are now, ironically, beginning to question the value of vaccinations as life-saving interventions. Consequently, some nations have seen declines in immunization rates. These nations are also seeing outbreaks of previously eradicated diseases (Daniel, 1996).

For the WHO and other United Nations (UN) agencies focused on eradication of childhood mortality due to preventable diseases, the problem of underimmunization has many facets. At the most basic level, barriers to immunization include inadequate funding, or parents' and caregivers' inability to afford vaccines. At another level, barriers to adequate immunization include problems of vaccine access to underimmunized populations in remote, rural areas. Yet another dimension involves caregivers' hesitations about immunizing their children due to lack of information about the efficacy of immunization (Christensen, 1994). Problems of funding and access are tangible issues that are addressed more easily than the often indefinable issues of caregivers' perceptions and attitudes toward immunization.

Understanding parents' and caregivers' knowledge and attitudes about immunization is vital for public health officials interested in combating the spread of preventable diseases. Children and their parents/caregivers do not exist in a vacuum, but

are affected by a host of environmental contexts. A useful theoretical framework for understanding parental perceptions and attitudes as major contexts for children's development is Urie Bronfenbrenner's ecological systems theory.

Conceptual Framework

The conceptual framework underlying this study is Bronfenbrenner's ecological systems theory. In its broadest sense, this theory examines the environmental contexts of development. However, the ecological systems theory also takes into account the biological inheritance of the developing child. In addition, this theory is characterized by a more inclusive definition of the environment than most other theories that focus on environmental contributions to development. The environment is seen as being more than an unchanging force that uniformly affects all individuals. Instead, the environment is seen as a dynamic, ever changing force that affects the individuals that develop within it, and is in turn shaped and altered by their activities, pursuits, and relationships (Berk, 2001).

Bronfenbrenner's conceptualization of the environment describes it as a series of nested structures that include and go beyond all of the contexts in which people spend their lives. These contexts include the home, school, neighborhood, and larger community to which the developing person belongs (Bronfenbrenner, 1993). Different contexts are visualized as different layers of the environment, depending on their proximity to developing individual. The layers of the environment that are the closest to the developing individual have the greatest and most direct impact on shaping their

developmental trajectory. In addition, each layer of the environment is thought to interact with other layers so that the course of an individual's development occurs in the context of a web of contextual interconnectedness (Bronfenbrenner, 1995). In recognition of the role of developing individuals' inherent biological traits and their interaction with the environment, Bronfenbrenner's model has recently been termed as the "bioecological model" (Bronfenbrenner & Morris, 1998). The ecological systems theory views the environment as consisting of four major layers that are nested within each other. In addition, Bronfenbrenner also focused on the temporal dimension of the environment. The nested layers of the environment are discussed below.

The Microsystem

The microsystem refers to the layer of the environment that is closest to the developing individual and contains individuals and relationships that immediately surround the individual (Bronfenbrenner, 1993). The family is generally thought of as the best example of the microsystem. Childrearing practices and parent-child relationships form the foundation for early development. It is in the context of the home that physical, cognitive, social, and emotional development occurs. The beliefs and attitudes of parents and caregivers shape their childrearing practices and affect child outcomes (Berk, 2001). An example of this influence can be seen in parents' and caregivers' attitudes toward childhood immunizations. Parents who have a positive attitude toward immunization are more likely to immunize their children against infectious diseases; conversely parents with negative perceptions of immunization are likely to avoid immunizing or to inadequately immunize their children (Gellin, Maibach,

& Marcuse, 2000). As a consequence, children may experience illnesses in childhood, which can affect their overall physical and cognitive functioning (Berk).

It is important to note that in the ecological systems framework, each layer of development is a system, in which each component is connected with other components of the system; together, the entire system affects the developing individual. The significance of this interconnectedness is that relationships among individuals in the microsystem can be bi-directional (Bronfenbrenner, 1989). Thus, parents' and caregivers' childrearing practices can affect child outcomes; simultaneously, children's outcomes and behaviors can affect parents' and caregivers' childrearing practices. For instance, while parents' attitudes toward immunization may determine whether or not their children are ever immunized, children's reactions to the process may affect parents' attitudes toward immunizations. Children who suffer from vaccine-related side-effects or who simply experience a lot of pain during injections may react very negatively to the immunization process, thereby affecting parents' attitudes and subsequently, their decisions about whether or not to continue with succeeding elements of immunization schedules.

The Mesosystem

The second layer of environmental influences is the mesosystem. The mesosystem refers to the series of connections between the microsystems that affect individual outcomes (Bronfenbrenner, 1995). A common example of a mesosystem would be the interaction between the child's parents or caregivers and their neighbors. It may be argued that individuals who have positive relationships with others in their

neighborhood foster their children's social development by facilitating positive peer relationships for their children. Another example of a mesosystem would be the interactions between parents/caregivers and health care delivery personnel. When parents and caregivers have positive experiences with the health care providers in their community, children's health outcomes are likely to be more positive. Often, the impact of environmental layers on development is indirect, where the interactions between members of microsystems can affect their childrearing values and practices, and thus have an indirect effect on child outcomes (Bronfenbrenner).

The Exosystem

The third layer of environmental influences on development is the exosystem. The exosystem represents the layers of the environment that do not physically contain the developing individual, but which nevertheless impact their development. The exosystem can impact the child's developmental outcomes by affecting the contexts and layers closest to the child (Bronfenbrenner, 1995). An example of the exosystem could be the health care system in the society in which the developing child lives (Berk, 2001). Another example of the exosystem would be policies of the workplace. Parents who can obtain leave to avail themselves of well-child visit opportunities are more likely to immunize their children than those who do not have such opportunities (Abbotts & Osborn, 1993). Further, the development and operationalization of immunization programs by the health care system affects the decisions of parents to immunize their children.

In addition to formal social settings, the exosystem can also constitute informal systems such as the extended family network (Bronfenbrenner, 1995). Parents and caregivers who have access to informal networks are likely to experience less strain in their parenting roles, thereby fostering optimal child development.

The Macrosystem

The outermost layer of the environment is referred to as the macrosystem. The macrosystem is the most intangible component of the environment and contributes the resources, values, and practices of a culture (Berk, 2001; Bronfenbrenner, 1989, 1995). For instance, the emphasis placed on the eradication of infectious diseases in a nation affects the funding devoted to immunization research, and ultimately, child health outcomes. Parents and caregivers are likely to have greater access to and knowledge of immunization when high priority is placed nationally on immunization of young children. Conversely, nations that have scarce resources are likely to place a lower emphasis on immunization programs, thereby creating greater barriers for immunization in terms of access to and affordability of vaccines.

The Chronosystem

The temporal dimension of Bronfenbrenner's conceptualization of development is the chronosystem. A diversity of contexts may be produced in the developing individual's life by forces both internal and external to the individual (Bronfenbrenner, 1995). The internal forces might be the adaptations that individuals make in the face of new roles, opportunities, and challenges across a lifetime; development is a dynamic

process, where the individual may take on new roles and let go of existing ones (Berk, 2001). On the other hand, the forces of development may be externally triggered, where new social and environmental contexts may affect the developing individual in diverse ways. Changing times and contexts can prompt new developments for the individual (Berk).

In the context of children's immunization, this might be understood in terms of the changes in parents' knowledge and attitudes about immunization based on the context of changing times. In the past, when mortality due to infectious diseases was high, attitudes toward immunization were generally positive, even as vaccine failures or adverse reactions were negligible in relation to the toll taken on human life by epidemics like small pox and the plague. However, once immunization campaigns successfully eradicated these dreaded diseases, parents began to be aware of vaccine failures and vaccine-related side-effects. Attitudes toward immunization began to become slightly negative as parents no longer dealt with childhood mortality due to infectious diseases, resulting in a decline in immunization rates (Christensen, 1994). Concomitantly, the 20th century witnessed the dramatic increase in the role of the mass media in shaping opinions and attitudes; the explosion of information on immunization in the mass media, and the publicity accorded to incidents of vaccine failure and vaccine-related side-effects further strengthened some parents' misgivings about immunization (Bedford & Elliman, 2000), corresponding with a decline in immunization rates in many countries of the world. This trend illustrates the ways in which attitudes and opinions vary in the context of changing times and social movements. Currently, many modern societies are dealing with the

surfacing threats of biological warfare, where infectious diseases have the potential to become the modern weapons of war. As a result, interest in immunization against preventable diseases is once again increasing and attitudes toward immunization might well become more positive among larger groups of individuals in the future.

The ecological systems theory presents a comprehensive picture of the contexts of child development. Understanding the environment as a series of nested structures that are dynamic, constantly interacting with one another, and constantly affecting and being affected by other systems provides a richer and deeper understanding of the contexts that affect the individual's developmental trajectory. The use of ecological systems theory to explore parents' knowledge about and attitudes toward immunization can facilitate a more accurate understanding of the complexities inherent in the formulation of attitudes and perceptions and actions.

Rationale

This study was primarily focused on exploring parents' knowledge of and attitudes toward immunization. The rationale behind this endeavor is the fact that immunization against infectious diseases is a major public concern in most nations of the world. Childhood immunization has been credited with saving millions of lives over the course of the 20th century. However, millions of children all over the world remain unimmunized. Research examining the factors that serve as barriers to immunization has typically focused on the availability of resources that enhance the likelihood of children's immunization, as well as the availability of and access to vaccines. Parents' negative

attitudes toward immunization have also been named as barriers to children's immunization (Bedford & Elliman, 2000; Christensen, 1994). While millions of dollars are spent each year to address the issue of vaccine availability, hardly any attention has been paid to understanding the knowledge and attitudes that parents and caregivers have about immunization. The justification for this study's focus on parents' knowledge about and attitudes toward immunization lies in the fact that there is an urgent need to explore the correlates of parental knowledge and attitudes. Further, this study's use of an ecological framework to understand both parental knowledge and attitudes distinguishes it from the few existing studies of the issue.

This investigation was conducted in the nation of India, where the high prevalence of vaccine-preventable disease is a cause for serious concern for public health officials in that nation and in the WHO. The vast majority of research on parents' knowledge about, and attitudes toward immunization is conducted in developed nations such as the United States, where immunization rates are comparatively high and disease rates comparatively low. Focusing on the correlates of immunization in nations in which the problems of infectious disease are less acute may cause researchers and policymakers to overlook some important environmental and contextual influences that shape, influence, and constrain attitudes and behavior.

This study attempted to address some of these issues. Although it was exploratory in nature, it can form the basis for future research devoted to understanding facilitators and barriers to children's immunization in developing nations.

CHAPTER II

REVIEW OF LITERATURE

The following sections review the literature on parents' knowledge and attitudes about immunization. To begin with, the development of immunization is examined, with a brief discussion about the specific ways in which vaccines work. This is followed by a description of the vaccine schedule employed in the United States. With the understanding of vaccines and their specific function, the literature examining parents' attitudes and ideas about immunization in the United States is discussed, because a vast body of literature on the topic has been generated in this nation. In addition, the literature focusing on the rise of Western medicine in India is also discussed in order to gain an understanding of the contextual factors underlying the practice of medicine in India. The immunization schedule employed in India is examined, followed by a discussion of barriers to immunization in the nation of India.

The Development of Immunization

The use of immunization to combat the spread of fatal infectious diseases became widely prevalent over the course of the 20th century. "Immunization against infectious disease has probably saved more lives than any other public health intervention, apart from the provision of clean water" (Bedford & Elliman, 2000, p. 240). While the role played by immunizations in reducing childhood mortality over the course of the 20th century is widely acknowledged, the practice of immunization is much older, and precedes the 20th century. A rudimentary form of immunization was practiced by the

Chinese as early as the 10th century BC. The Chinese followed the practice of transferring pus from the pustules that developed on the body of someone with smallpox, into lesions or cuts in the body of a healthy person; this induced version of smallpox was as infectious as the original. However, the induced smallpox often proved to be less deadly than the original version of the disease (Christensen, 1994). Although immunization in its earliest form did not serve to prevent the onset of deadly disease, it served to reduce the severity of symptoms.

The first use of immunization, as we know it today, occurred in 1796, when the British physician Edward Jenner discovered the first safe and effective vaccine against smallpox. The discovery was accidental, and stemmed from Jenner's observation that dairymaids who contracted the bovine disease known as cowpox were immune to smallpox (Christensen, 1994). From this discovery, vaccines for smallpox were developed and used, not only to reduce the severity of disease symptoms, but also to prevent their onset entirely.

The dramatic success of vaccinations in eradicating certain infectious diseases became evident over the latter part of the 20th century. The WHO and other UN agencies like the United Nations International Children's Education Fund (UNICEF) began to focus on eradicating infectious disease through universal immunization. The WHO's Expanded Programme on Immunization (EPI) was developed in the 1970s to further this goal. The EPI has been very successful in accomplishing its goals. At the time of its inception, fewer than 5% of the world's children were fully immunized. In just 20 years, this program has achieved tremendous success and, in 1990, announced that

80% of the world's children have been immunized against measles, diphtheria, whooping cough, tetanus, tuberculosis, and the once-ubiquitous polio (Christensen, 1994). Because of the difficulty in obtaining accurate statistics on immunization rates, it is hard to determine the actual rates of nonimmunization of children. Nonimmunization involves a complete lack of any type of immunization of the child, and differs from underimmunization, which implies that a child has received some (but not all) recommended vaccines. The difficulty often lies in the fact that parents may sometimes be unable to document their child's immunization history on paper, and/or might not accurately recall which vaccines their child has received.

The approximately 20% of children worldwide who remain nonimmunized today are a cause of great concern to public health officials worldwide. The nonimmunized populations of the world represent failures in vaccine delivery for the most part. Furthermore, children are often underimmunized due to incomplete vaccination compliance. Public health officials and researchers today are keen on ensuring maximal immunization coverage of children while addressing these issues. Efforts are being made to develop vaccines that will require only one visit to the vaccination provider, thereby reducing noncompliance. Other efforts are focused on increasing the stability of vaccines so that they are no longer reliant on refrigeration, and can be accessible at remote tropical areas. Finally, there is an effort to create vaccines against new and variations of extant diseases (Christensen, 1994).

How Vaccines Work

Vaccines are usually tiny organisms that are replicas of disease causing organisms. Once injected into the human body, vaccines activate the body's immune system by stimulating specialized cells responsible for attacking antigens or foreign particles in the body. These cells are of two types: a) T cells, which attack the virus containing cells in the body directly, and b) B cells, which release antibodies in the blood stream that capture antigens and allow their destruction ("Spiraling to a New Vaccine," 1996). Thus, vaccines work as an alarm system that trigger the body's immune response; some of the T and B cells are transformed into memory cells that expedite future responses to the infection (Christensen 1994).

Vaccines trigger the immune response in three ways. Vaccines against small pox and measles contain the virus in a minute quantity; the virus is genetically altered to ensure that it is weak. Alternately, vaccines for cholera, influenza, and whooping cough contain killed whole organisms; because they do not replicate inside the body, they provide short-term immunity and need to be supplemented. Vaccines can also be developed to combat the toxic byproducts of the organism released. An example is the vaccine for tetanus that is aimed against the toxins released by the bacteria and not against the bacteria themselves (Christensen 1994; "Spiraling to a New Vaccine," 1996).

Administration of Vaccines

Vaccines can be injected into the body, or can be orally ingested. The immunity conferred by some vaccines is short-term, and "boosters" may be required to prolong

immunity. In general, vaccinations are administered in nations across the world according to immunization schedules developed by health departments in each nation, based on the recommendations of the WHO. In the U.S., vaccines are administered following a schedule developed by the Centers for Disease Control (CDC).

Traditionally, vaccines work with the humoral immune system, which relies on antibodies produced in the blood and the lymph. When the immune system encounters the invading diseases contained in a vaccine, it develops a "memory" of the organism, and in the case of future exposure to the disease, it is able to respond to the disease-carrying organism sooner ("Spiraling to a New Vaccine," 1996). On the other hand, once a pathogen or a disease bearing entity enters a cell, it is shielded from the antibodies that destroy it. In this case, the cellular immune system responds by causing the infected cell to signal the T-cells in the body. These cells are also known as killer cells that eventually destroy the infected cells, along with the invading disease-carrying cells.

Immunization Schedule for the United States

Every year, the CDC's Advisory Committee on Immunization Practices (ACIP) reviews and adopts the schedule of childhood and adolescent immunization in conjunction with organizations like the Academy of Pediatrics, and the Academy of Family Physicians (Centers for Disease Control and Prevention, 2003). In the United States, nine vaccines are recommended for children and adolescents. A brief description of recommended vaccines follows:

1. Hepatitis B vaccine (Hep B) is administered in 3-4 doses to children between birth to the age of 18 months.

2. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP) provides immunity from diphtheria, whooping cough, and tetanus, and may be administered in 4 doses between the ages of 2 months and 6 years; additionally, tetanus and diphtheria toxoids (Td) vaccine is recommended for children aged 11-12 years with subsequent boosters every 10 years.
3. The hemophilus influenza type b (Hib) conjugate vaccine provides immunity against bacterial meningitis and may be administered in three doses between the ages of 2 and 15 months.
4. The inactivated polio vaccine (IPV) may be administered in 3 doses between the ages of 2 months and 6 years.
5. The measles, mumps, and rubella vaccine (MMR) may be administered in 2 doses between 12 months and 6 years.
6. The varicella vaccine is recommended after the age of 12 months for children who may susceptible to chickenpox.
7. The pneumococcal conjugate vaccine (PCV), inoculating children against pneumococcal diseases (e.g., pneumonia, bacteremia, sinusitis, and acute otitis media), may be administered to children between the ages of 2 and 23 months.
8. The hepatitis A vaccine may be administered in 2 doses and is recommended for at-risk children and adolescents between the ages of 2 and 18 years.
9. Influenza vaccine is recommended for children aged 6 months and older and for adolescents annually in regions that have a higher prevalence of the disease (Centers for Disease Control and Prevention, 2003; Westrup, 1999).

Based on the recommended schedule of immunization in the United States, children receive approximately 17 shots, and are required to visit the doctor about 6 times during the first 15 months of life (Christensen, 1994). In addition to standard recommendations for immunization of children, the CDC also makes recommendations for the immunization of adolescents, and for catch up immunizations for children who have been underimmunized during childhood (Centers for Disease Control and Prevention, 2003).

Attitudes Toward Immunization

In the United States, attitudes toward immunization are largely positive. Vaccines are credited with saving the lives of large numbers of children by eradicating once fatal diseases (Allen, 1996). Diseases like diphtheria, meningitis, polio, tetanus, whooping cough, measles, mumps, rubella, and small pox were common infectious diseases at the turn of the 20th century. The mortality rate of children aged 5 and under fell from 30% in the early 1900s to about 1.5% today (Daniel, 1996; Westrup, 1999). Improvements in sanitation and childhood immunization against infectious diseases have been credited as being causes for this decline (Westrup). The prevalence of several diseases that proved fatal to children in past decades has declined. For instance, more than 20,000 Americans were infected with bacterial meningitis, and 1000 died from the disease in 1984. By 1997, after the availability of the Hib vaccine, only 150 outbreaks of bacterial meningitis were reported across the country. Similarly, prior to the availability of the measles vaccine, approximately 500,000 cases of measles were reported in 1962 in the United

States; by 1997, only 138 cases were confirmed (Daniel). Approximately 20,000 cases of polio were diagnosed in 1952; by the time of the last outbreak of this disease in 1979, only 10 confirmed cases of polio were diagnosed (Daniel).

Perhaps the most dramatic evidence of the efficacy of immunization in the United States and other nations of the world lies in the eradication of small pox. Small pox is described as having killed more children in the past than all other infectious disease combined; today owing to a world-wide immunization campaign, this disease is completely eradicated (Westrup, 1999). Consequently, in the United States and other nations of the world, the efficacy of the vaccines is seen as a biological "given." Accordingly, the United States has a policy of mandatory vaccinations of all children. Parents are required to provide documented evidence of children's immunization status for school entry. Exemptions for immunization are permitted on religious grounds in all states except Mississippi and West Virginia, and exemptions on philosophical grounds are permitted in 17 states in the United States (Allen, 1996).

Despite the overwhelming evidence of the efficacy of immunizations, not all children are adequately immunized. Research focusing on rates of immunization/nonimmunization has yielded varied data. Some researchers (Mayer, Clark, Konrad, Foreman, & Slifkin, 1999) estimate that approximately 20% of the children in the United States are inadequately immunized or not immunized at all, while others estimate that between 37% and 56% of children in the United States are not immunized (Daniel, 1996). In addition, the United States and other nations of the world have seen a decline in immunization rates over the course of the past few decades (Allen, 1996). These trends

are viewed as alarming, and the underimmunization of children is viewed as a phenomenon that makes nations vulnerable to a weakened immunological status. The underimmunization of children is typically attributed to barriers that prevent children's access to immunization.

Barriers to Immunization

Because of the world-wide emphasis on the immunization of children by the EPI, researchers have begun to focus on the various factors that pose as barriers to the complete and adequate immunization of children (Bedford & Elliman, 2000). Christensen (1994) estimates that 13% of children in the United States are not immunized at the time of school entry, while at the age of 2, about 56% of children do not receive their full course of immunization. The barriers to adequate childhood immunizations are manifest at all levels of the child's environment. Barriers at the level of the microsystem might include parents' attitudes toward immunization. Barriers at the mesosystem typically might involve the attitudes and practices of health care providers. At the exosystem level, access to vaccines and government policies in terms of immunization coverage become relevant, and at the level of the macrosystem, a nation's insufficient focus on immunization, coupled with inadequate funding for immunizations, are potential barriers to children's immunizations. Finally, at the level of the chronosystem, a nation's perception of the importance of immunization vis a vis other policy concerns at a given point of time may serve as barriers to immunization. In general, the most common barriers to immunization of children are rooted in children's access to immunization and

in parents' and health care delivery personnel's attitudes toward immunization (Christensen).

Access to Vaccines

In the United States, a major cause for the inadequate or nonimmunization of children is the fact that many children do not have access to vaccines. The major barrier to children's access to immunization is the cost of vaccines. When differentiated by age and income level, different patterns of nonimmunization emerge. The U.S. Department of Health and Human Services (1999) estimated that approximately 29% of American preschoolers are underimmunized. When differentiated by income level, the rate of underimmunized preschoolers from low-income families rises to about 40%. The structure of the health care system in the United States creates unequal access to health care. Health care access in the U.S. is linked to parents' health insurance, which in turn is directly associated with their employment status. Children of unemployed parents or those with insufficient health care insurance do not have consistent and adequate access to quality health care. About 11.6 million children belonging to low income or moderate-income families lack access to good quality health care (Children's Defense Fund, 1999).

Typically in the United States, immunizations have been accessed in the private sector of the health care system. Because insurance plans seldom cover preventative health care services, parents using private health care providers often have to pay for vaccines out of their own resources (Mayer et al., 1999). To mitigate the situation, the U.S. government in 1994 guaranteed free immunization to all medically uninsured children, resulting in a slight increase in vaccination coverage for children in the U.S.

However, the U.S. continues to lag behind Canada and Western Europe in terms of childhood immunization rates (U.S. Department of Health and Human Services, 1999).

State policies regarding immunization coverage have been found to impact children's immunization rates. The availability of greater Medicaid coverage to the poor has resulted in higher and more up-to-date immunization rates (Mayer et al., 1999). States differ in terms of their policies toward immunization. Some states employ a system of partial purchase vaccine financing, in which the state enables participant health care providers to replace vaccines given to Medicaid covered children by obtaining them from health departments. Because Medicaid is health insurance that is available only to low-income families, poor children are thought to be the primary beneficiaries of this system. Other states employ a universal vaccine purchase system, in which the state guarantees free immunization for all children regardless of household income or insurance status. This system hopes to target all children as recipients of immunization, regardless of socioeconomic status.

While income levels provide the most obvious explanation for children's lack of access to complete immunization coverage, other factors might also be important. For instance, researchers suggest that factors such as maternal education, maternal marital status, parental age, and parent's employment status are associated with children's immunization status (Bobo, Gale, Purshottam, & Wassilak, 1993; Miller, Hoffman, Baron, Marine, & Melinkovich, 1994). In addition, Mayer and colleagues (1999) suggested that Latino and African-American children have lower immunization rates than Caucasians due to factors such as residential segregation and cultural differences in

health care use, in addition to differential access to health care or health insurance. Furthermore, researchers are also concerned that children's immunization status might vary depending on their ethnicity. The association between ethnicity and children's immunization status might involve the family's level of acculturation. Children of recent immigrants with lower levels of acculturation have been found to have higher levels of immunization coverage (Anderson, Wood, & Sherbourne, 1997). Although this finding might seem counterintuitive, Anderson et al. suggest that it may be explained by the fact that recent immigrant families have lower rates of maternal employment. Consequently, mothers in these families have more time to take children for health care visits. The researchers also suggested that access to health care providers with bilingual skills (in this case Spanish and English) might also have an impact on recent immigrants' decisions to immunize their children.

Overall, children's access to adequate immunization seems to be impacted by their access to adequate health care. In addition, parental characteristics such as maternal employment and maternal age also affect children's access to health care in general and vaccines in particular. Funding policies adopted by state agencies further affect children's access to vaccines. A final significant barrier to immunization in the light of the ever-increasing diversity of the American population is parents' level of acculturation.

Health Care Providers' Attitudes Toward Immunization

Among the many barriers to children's immunization, the attitudes of health care

providers toward children's immunization are important because they are regarded as the effector arm of programs of immunization, as they are the ones who translate government recommendations into actual practice (Hall & Margolis, 1993). Pediatrician's agreement with CDC recommendation for immunization is a key factor that determines their level of commitment to CDC requirements. Often, pediatricians and nurses may hesitate to administer many vaccines at a single visit because this involves administering multiple injections to the child. However, time and resource constraints might limit parents' willingness and or ability to make repeated visits to the health care providers, resulting in lower levels of immunization coverage for children (Freed, Bordley, Clark, & Konrad, 1993). Lack of understanding about CDC immunization recommendations may lead to negative attitudes towards immunization on the part of the health care providers (Hall & Margolis).

In addition, the beliefs of health care providers often affect the practice of administering vaccines to children who visit the hospital/health care clinic. A child's visit to the health care setting in the face of a minor illness might be a good opportunity to administer vaccines, especially in the case of low-income, at-risk children who are less likely to make routine visits to the hospital for preventative health care services. A study examining pediatric residents' beliefs and practices about immunization indicated that pediatric residents may fail to avail themselves of patient immunization opportunities due to a lack of awareness about vaccine contraindications (the conditions under which it may be inadvisable to administer vaccines), although inaccurate beliefs were more likely among first year residents than among third year residents (England & Shelton, 1997). In

general, this study reported that only 57% of residents were likely to administer vaccines during the 15-month well visit. The most common misconception about vaccine contraindications is the presence of fever less than 102 degrees Fahrenheit. England and Shelton suggest that the reluctance to immunize a child in the event of a fever was a major cause for missed vaccinations because children are more likely to visit a hospital or health care setting when they are ill than otherwise. In addition, concerns that vaccinating a sick child might increase their discomfort, and worry that families might not return for well-child care were also suggested barriers to immunization of children.

Although health care personnel might be regarded as the most knowledgeable consumers of immunization-related information, it appears that there are gaps in their understanding about vaccines and the contraindications associated with them. Even when residents and pediatricians understand immunization, they might still hesitate to administer vaccines to children due to concerns about increasing the child's discomfort in the face of illness, or concerns about upsetting parents. Often, pediatricians do not seem to understand immunization recommendations made by the CDC and consequently disagree with them (Hall & Margolis, 1993). These trends in the research reviewed are concerning, owing to the fact that the administration of immunization has shifted from being a largely public-sector activity to being an increasingly private sector phenomenon. Researchers reveal that approximately 73% of children in the United States receive some or all vaccines in a "primary care medical home," while 58% were exclusively immunized in private practices (Santoli, Rodewald, Maes, Battaglia, & Coronado, 1999). Consequently, the opinions and attitudes of health care providers are important, and

considerable attention needs to be focused on improving health care providers' knowledge and attitudes about immunization.

*Parents' Attitudes as a Barrier
Toward Immunization*

It must be noted that, while the majority of parents have positive opinions about immunization, when parents do have negative opinions about immunization, these opinions decrease the likelihood that a child will be immunized (Gellin et al., 2000). Researchers focusing on parents' attitudes toward immunization tend to differ in terms of their opinions about the impact that parents' attitudes have on children's immunization status. Negative attitudes of parents and primary caregivers toward immunization have been identified as a barrier to children's immunization (Gellin et al.). For instance, in countries like the United Kingdom, Sweden, Germany, Japan, and the United States, parents' negative attitudes toward vaccines have resulted in a decline in immunization rates, and the resurgence of infectious diseases (Gellin et al.). Typically, however, most parents appear to have relatively positive attitudes toward immunization. Any negative attitudes that parents might have about immunization are not based on concerns about the safety of vaccines or the immunization process itself, but on the limited and inconvenient hours during which vaccines may be administered, difficult access to health care, and the prohibitive costs of vaccines (Gellin et al.; Orenstein, Atkinson, Mason, & Bernier, 1990).

Although pediatricians often hesitate to administer more than two vaccine injections to a child at the same time, research suggests that more than 70% of parents

prefer simultaneous immunizations to repeated visits to the pediatrician's office (Lazorik, 1992). Parents' attitudes toward immunization may also be tied to children's reactions to immunization. Researchers suggest that gender differences exist in children's reactions to immunization. For instance, a study found that girls required more time to calm down following immunization, compared to boys (Schechter, Bernstein, Beck, Hart, & Scherzer, 1991). Consequently, parents may have more concerns about immunizing daughters than sons.

Other research focusing on parental attitudes toward immunization has found only a modest relationship between parents' attitudes toward immunization (whether positive or negative) and their child's immunization status (Taylor et al., 2002), suggesting that parents' attitudes do not affect their decisions to immunize their children. This study found that parents typically were likely to have negative attitudes toward immunization in the face of inconvenient clinic hours, transportation difficulties, and the complexities of the immunization schedule. Parents often found that the hours during which vaccines were administered clashed with their work schedules. Additionally, parents found that they had difficulty in obtaining transportation to the health care clinic where the vaccines were administered. These factors were more likely to affect their decisions to immunize their child than were their attitudes toward immunization.

Research focusing on the causes for parents' negative perceptions about immunization suggests that, for the most part, parents are likely to have negative perceptions about immunization due to concerns about vaccine safety (Gellin et al., 2000). Although vaccines have done much to reduce mortality, the process of

immunization inherently involves a certain amount of risk. Since vaccines sometimes involve the ingestion or injection of tiny particles of pathogenic organisms into the human body, there is a small chance that those who are administered a vaccine dose actually develop the disease they have been immunized against (Westrup, 1999). For instance, the oral polio vaccine has been administered to 2.4 million individuals out of which 200 people (0.00008%) have contracted polio on account of the fact that the vaccine is made from weakened, live polio viruses. Similarly, two children in Japan died of whooping cough in 1972 after being immunized against it (Allen, 1996). Consequently, the rate of immunization against whooping cough fell in that nation from 80% to 10%. As a result, the incidence of whooping cough resurfaced in Japan, infecting 13,000 children and killing 41 in 1979 alone (Westrup).

The success of vaccines, in a sense, has also been a factor that undermines their popularity. In the past, due to the high visibility of infectious diseases like polio, whooping cough, measles, and diphtheria, and the high rates of mortality associated with them, the risk of being infected by vaccines went unnoticed. Today, however, the risks associated with immunization are apparent, due to a sharp decline in infectious diseases and the mortality associated with them. Consequently, some parents in the United States and other nations of the world might see immunization as a risky proposition, and consequently have negative attitudes toward the process (Bedford & Elliman, 2000).

In addition to parents' concerns about the risks associated with immunization, another concern for parents might be the fact that vaccines sometimes fail to provide the immunity they promise. Often parents who are concerned about vaccine risks fail to

immunize their children, banking instead on "herd immunity." The hope is that nonimmunized children are protected from infectious diseases because other children in the population might be immunized against them, and consequently be less likely to contract or pass them on to others (Berger, 1999). However, nonimmunized children have been described as synonymous with the weakest link in a society's immunological status, and in the case of vaccine failure, pose a risk to immunized children as well as to themselves (Allen, 1996). Although cases of vaccine failure are few, books and articles written by those who oppose children's immunization (Moskowitz, 1996) have generated many concerns for parents. Health care professionals have not adequately addressed these concerns, and consequently, a few parents continue to harbor misconceptions about vaccine safety, such that some have begun to opt out of immunizing their children (Bedford & Elliman, 2000).

Parents' attitudes toward immunization also might be affected by the attitudes of health care personnel. When pediatricians have negative opinions and attitudes toward immunization, parents are more likely to harbor negative attitudes themselves (Gellin et al., 2000). Further, the relationship between parents and health care delivery personnel may affect parents' attitudes toward immunization. This might be especially relevant in developing nations. For instance, a study examining parents' attitudes toward immunization in Bushenyi, a district in Uganda, found that many parents had erroneous perceptions about immunization. They believed, for example, that a child immunized against polio should also be immune to malaria. The death of large numbers of children due to an outbreak of malaria in the rainy season, despite being immunized against polio,

seemed to be evidence for the inefficacy of immunization (Mulindwa, Kabwongyera, & Barenzi, 2000). Further, the researchers also found that parents had negative attitudes toward immunization, due to fears that the vaccines were contaminated with HIV/AIDS; a related fear was that the vaccines administered in Africa contained experimental substances that were being tested on the African continent by developed European nations. Significantly, parents also had negative attitudes toward immunization because they were often ill-treated by health care personnel responsible for administering vaccines (Mulindwa et al.).

Parents in developing nations who have a high level of confidence about their access to immunizations and other health care services are likely to have a positive attitude toward immunizations. Additionally, those who live in urban areas might be more likely to have positive attitudes toward immunization, as urban residence might be indicative of greater access to quality health care in these nations. These parents are also more likely to immunize their children (Tuma, Smith, Kirk, Hagman, & Zemel, 2002).

Parents' attitudes toward immunization may also be related to the attitudes of health care professionals toward immunization. Parents are more likely to have positive attitudes toward immunization when they have positive interactions with health care professionals, and interact with health care providers who have positive attitudes toward immunization. Further, parents who have access to factual information about immunization, in addition to a balanced understanding about the benefits and risks associated with immunization, are likely to have more positive attitudes toward the process.

Despite the vast amount of literature focused on parental attitudes toward immunization, some researchers suggest that parents' attitudes do not determine their children's immunization status. For instance, Taylor and colleagues (2002) found that although parents hesitate to immunize their children in the face of an illness or because of concerns about the discomfort and pain caused by immunization, their perceptions were only modestly associated with their children's immunization status. Other studies found that, although parents had negative attitudes toward immunization (due to time constraints), their attitudes appeared unrelated to their children's immunization status (Strobino & Keane, 1996; Taylor & Cufley, 1996).

These observations might be accounted for by the fact that in all of these studies, the vast majority of parents saw immunization as an important health intervention for their children (Strobino & Keane, 1996; Taylor & Cufley, 1996; Taylor et al., 2002). Further, parental characteristics were more likely to be related to children's immunization status, than were their attitudes. Tuma and others (2002) have suggested that urban residence and parental education are likely to be associated with children's immunization, while Taylor and Cufley suggested that parental education might affect child immunization by impacting their attitudes.

Immunization in India

An understanding of parents' knowledge and attitudes toward immunization in India requires a basic understanding of the practice of Western medicine in that nation. It

is also important to recognize that other factors affect parental knowledge of and attitudes toward immunization in addition to those examined above.

Western Medicine in India

The practice of medicine in India dates back to centuries in the past. Typically medicines in the Indian subcontinent have been plant and natural product-based formulations. Plant-based medicines and surgical procedures have come under aegis of Ayurvedic medicine that has been practiced in India for centuries. In addition, Greek based medical practices, known as Yunani, also are employed (Sharma, 2000a). These practices, as well as other alternative medical practices, are organized under India's System of Medicine (ISM).

Western medicine, by comparison, has made a relatively recent debut in India. Western medicine was introduced into India primarily during the British colonization of India, which began in the 17th century. When India became independent from British rule in 1947, a Socialist style of medicine was set up. The Indian Medical Service (IMS) was established in the mid-18th century with the goal of providing medical care to the Indian army under the control of the British crown (Nath et al., 1998). Because of its association with the army, the IMS had a strong bureaucratic approach, with a structured hierarchy of positions and roles. The vast majority of health care initiatives, practices, and research efforts were devoted to serving the needs of the colonists, and not the Indian population. While the British government in India attributed the high rates of mortality due to infectious diseases in India to unhealthy living conditions, the Indian masses resented Western medicine because of a political and cultural resistance against the

colonists (Arnold, 1996). With these factors in mind, during the early stages of its introduction into India, Western medicine was viewed as alien and as employing harsh remedies, with an impersonal style of health care delivery. Further, cultural taboos generated suspicions of hospitals. For instance, hospitals that were whitewashed were viewed with suspicion in rural areas because of the cultural association of the color white with death. Consequently, hospitals were viewed initially as inauspicious places to which to take a sick relative. These perceptions led to a continued reliance on Ayurvedic and Yunani medicine, along with other traditional practices, rather than on Western medicine (Nath et al.).

The IMS, under the leadership of the British, suggested that India was in need of modern, western-style medical services, and focused on that goal. In addition, the colonial government also introduced immunizations in India to combat mortality due to vaccine-preventable diseases. The India-wide Vaccine Act was passed in 1880 to ensure vaccination coverage across the nation (Arnold, 1996). As a result of these initiatives, the incidence and prevalence of infectious diseases was reduced. Mortality due to once-deadly diseases was also gradually brought under control. For instance, small pox, which had caused about 12 million deaths in India in the period between 1896 and 1930, was no longer a threat to the Indian subcontinent by the late 1930s (Arnold).

Despite the successes of Western medicine in India, it continued to be viewed with suspicion because of its association with alien and colonial powers. Traditional systems of medicine continued to be relied upon. The fact that the efforts of the IMS

were targeted primarily to the army, rather than to the masses, widened the gulf between the people of India and Western medicine (Arnold, 1996).

At the time of independence from British colonization in 1947, the Indian government gradually began to focus on modernizing the practice of medicine in the nation. Soviet-style planning was employed, with the goal of providing the Indian people with equitable access to adequate health care (Sharma, 2000a). What India's politicians did not foresee at that time was that the population of India would surpass the available supply of health care, and access to health care in a few decades. Although the field of medicine and research into infectious diseases has made rapid strides in this nation, India's population of 970 million (including 300 million below the poverty line) has led to a major gap between the demand for services and the supply of them (Nath et al., 1998). The Indian subcontinent also encompasses a wide diversity in terms of its topography and demographics. The nation includes urban dwellers, rural dwellers (who comprise the majority), island dwellers, and also members of tribal groups who reside in remote forest areas. Those most likely to be unreached by health and medical services in general, and by immunization initiatives in particular, are those who live in the scattered villages, island, or tribal regions (Nath et al.).

Today, the Indian medical system consists of a highly skilled cadre of health care professionals. India is also witnessing the impact of scientific research in the fields of policy making and administration. Simultaneously, across the nation, privately funded health care and corporate-type hospitals, based on the best health care practices available across the world, are becoming increasingly prevalent. However, the emphasis of the

private sector health care system is primarily on curative medicine, rather than on preventative medicine. Immunization initiatives are, therefore, largely under the purview of the central and state governments of India (Nath et al., 1998).

Vaccine-Preventable Diseases in India

Due to the overwhelming demand for the supply of health care services and the shortage of the supply of these services in India, the health care needs of the Indian population are underserved (Nath et al., 1998). This is especially true for those individuals who fall below the poverty line and have difficulty in accessing health care services from the private sector, where resources may be available. This phenomenon is most pronounced for children's immunization. The rates of nonimmunization of children vary across different states in India. The rates of children's immunization in India are hard to determine because of difficulty in tracking populations, and the difficulty in distinguishing between absolute nonimmunization and underimmunization. In a study conducted recently, researchers found that out of 500 children, only 25% received complete primary immunization recommended by India's National Immunization Schedule ("Reasons for Nonimmunization of Children in North India Identified," 2002).

In addition, immunization rates may be hard to track because of the difficulty in regulating children's immunization (for instance, in the form of mandatory immunization requirements for school entry). In 1985, the Indian government started a program called the Universal Immunization Program (UIP) in an attempt to boost immunization rates across the country (Sokhey, Mathur, & Biellik, 1993). The primary objective of this

program was to ensure that at least 85% of infants in India received complete immunization by 1990 (IIPS, 1995).

Although the Indian government has had a long-standing commitment to enhancing children's immunization coverage, immunization rates continue to be low in India. Additionally, there are several inequalities in children's access to immunization across India. In 1998-99, about 35% of infants in India had received complete immunization; about 48% received partial immunization; and 17% received no immunization at all (IIPS, 2000). A major problem associated with the low rates of immunization in India is the high dropout rates from the immunization schedule in some regions of the country. In some regions of the country, immunization dropout rates have been estimated as being as high as 70% (Anan, 1993).

A related complexity in childhood immunization in India is that of children's unequal access to immunization. Research suggests that girls are less likely to receive immunization than boys and are more likely to be immunized at later ages than boys (Gupta, Jain, & Singh, 1978). Immunization rates have also been found to vary from state to state. A recent study found that states in the southern part of India have higher immunization rates than northern states (Pande & Yazbeck, 2003). The researchers also documented that children from urban areas had higher rates of immunization than children from rural regions in northern and southern states. Similarly, children from high-income homes were more likely to be immunized than children from low-income homes; this difference in immunization rates based on family income was most noticeable in rural areas (Pande & Yazbeck).

Overall, it appears that India has been unsuccessful in ensuring uniform and adequate childhood immunization coverage across the country. Researchers have documented missed immunizations in certain pockets across the nation, and the rates of prevalence of certain infectious diseases. For instance, the UNICEF in India estimated that approximately 86% of children may have missed immunizations during the year 1999-2000; additionally, regions such as Uttar Pradesh, Bihar, West Bengal, and New Delhi, have had poor performance in terms of immunization of children (Sharma, 2000b).

India has received much attention from the WHO's program on immunization (EPI). The WHO estimates that five nations across the world might be described as the reservoirs for polio. These nations are India, Bangladesh, Pakistan, Nigeria, and Ethiopia. Because many individuals in these nations are infected with polio, they pose a threat to other nations, even those in which the disease has been eradicated ("WHO Starts Final Campaign Against Polio," 1999). In 1994, India accounted for 4,791 out of 7,435 world-wide cases of polio; in 1995, 2,170 cases of polio were documented in India between January and October; 2,814 cases of polio were documented in 1999. Up to June, 2000, 70 cases of polio were reported across India (Sharma, 2000b). The decline in the incidence of polio is due to the efforts of the WHO and UNICEF, in concert with the Indian government, to extend the immunization coverage of children across India. Overall, India, Pakistan, and Bangladesh, account for two-thirds of the world's polio cases today, and the WHO is striving to eradicate the disease by 2005 (Key, 1996). In addition to polio, other preventable diseases like diphtheria, measles, mumps,

chickenpox, and hepatitis are prevalent across the nation (Lodha, Dash, Kapil, & Kabra, 2000; Nath et al., 1998).

Immunization Schedule in India

Based on the recommendations made by the Indian Academy of Pediatrics, 6 vaccines are recommended for individuals from birth to age 16. These are:

1. The bacillus Calmette-Guerin (BCG) vaccine, inoculating children against tuberculosis (administered at birth).
2. The OPV, inoculating children against polio is administered in seven doses (from birth to age 5).
3. The HepB vaccine, inoculating children against hepatitis B virus (administered in three doses, from birth to the age of 9 months, followed by a booster dose at age 10).
4. The DPT vaccine, inoculating children against diphtheria, whooping cough, and tetanus (administered in three doses between the ages of 6 and 14 weeks, and is followed by booster doses at the ages of 15-18 months and 5 years).
5. The MMR, inoculating children against measles, mumps, and rubella (administered at the age of 15-18 months, while the measles vaccine may be administered independently of the MMR at the age of 9 months).
6. The tetanus toxoid vaccine (TT), inoculating children against tetanus (administered in the form of two booster doses at the ages of 10 years, and 15-16 years, respectively) (<http://health.indiamart.com/kidshealth/vaccine/kids-immunization-record.html>).

In addition, four vaccines are recommended as optional vaccines. They are: (a)

typhoid fever vaccine; (b) haemophilus influenzae type b vaccine; (c) hepatitis A vaccine; and (d) chickenpox vaccine (<http://health.indiamart.com/kidshealth/vaccine/kids-immunization-record.html>). These vaccines are not mandatory and represent recommendations by the Indian Academy of Pediatrics. While the vaccine schedules employed by the U.S. and India are similar, some differences between the schedules exist. The pneumococcal conjugate vaccine (PCV), inoculating children against pneumococcal diseases is mandatory in the U.S. but not in India. Similarly, the bacillus Calmette-Guerin (BCG) vaccine, inoculating children against tuberculosis is mandatory in India, but not in the U.S. Furthermore, some vaccines (Hepatitis A vaccine, Hib vaccine, and varicella vaccine) that are obligatory in the U.S. but not in India. Instead, these vaccines are recommended and are optional in the Indian immunization schedule. Finally, the U.S. vaccine schedule recommends the administration of the influenza vaccine, while the Indian immunization recommends the typhoid vaccine in its stead.

Barriers to Immunization in India

As discussed, a tremendous amount of national and international attention has been directed toward improving the immunization coverage of children across India. However, despite these attempts, the rates of immunization across the nation continue to be inadequate, and preventable diseases like polio that have been virtually eradicated from Western nations, continue to affect children across India. Researchers attempting to identify barriers to children's immunization in India have explored a number of avenues (Nath et al., 1998).

The most important barrier that has been identified in terms of children's immunization is that of the prohibitive cost of vaccines. The lack of adequate resources to meet the demand for immunizations in the public sector is a major cause for the underimmunization of children in India ("Reasons for Nonimmunization of Children in North India Identified," 2002). On the other hand, the high rate of poverty in India may hinder access to vaccines available in the private sector, and ultimately be responsible for the inadequate immunization coverage of a wide spectrum of children in India.

A second barrier to immunization that has been identified is the lack of access to target populations across the nation. In 2000, northern states in India reported a resurgence of diphtheria in the urban slums in the region (Lodha et al., 2000). The migration of the rural poor to urban areas, and the emergence of urban slums that are greatly overpopulated, have made it increasingly difficult for health care professionals to target at-risk populations; the low socioeconomic status of inhabitants of urban slums results in compromised immunity due to malnutrition and nonimmunization (Lodha et al.).

A third barrier to adequate immunization coverage across India is tied to misconceptions that parents may have about immunization. As in research conducted in Africa (e.g., Mulindwa et al., 2000), studies of immunization barriers in India reveal that parents' misconceptions about immunization prevent them from immunizing their children. For instance, about 16 children died and hundreds fell ill after being given doses of vitamin A to prevent night blindness in November, 2001. In India, vitamin A is administered at the time of OPV administration to allow for better regulation of the

process (Nath et al., 1998). However, the association between vitamin A administration and OPV administration in the minds of parents resulted in parents' negative attitudes toward immunization against polio. Due to this change in parental attitudes, only 47% of the 4.6 million children targeted for a WHO campaign against polio were present to receive subsequent doses of the OPV ("Indian Parents Stay Away from Immunization Campaign," 2002). Due to a high rate of illiteracy in India, lack of awareness about immunization might also generate negative attitudes toward the process. However, limited awareness about immunization is not restricted to illiterate or low income individuals in India. Immunization levels in urban India are also low in comparison with urban areas in developed nations.

A fourth possible barrier to children's immunization might be the process itself. The delivery of vaccines to remote parts of India might be hindered because of inadequate transportation and the inaccessibility of certain parts of India. Although India consumes about 45% of the WHO's resources targeted at eradicating infectious diseases like polio (Mitchell, 1999), these resources might be inadequate to meet health care professionals' needs for transportation (or electricity). It must be noted that the process of delivering vaccines to remote areas might itself be a barrier against immunization. For instance, the OPV requires a "cold chain" for storage, in which the vaccine requires continual refrigeration in order to be effective (Christensen, 1994). This is not always possible in India due to various reasons. While the Indian health ministry denies the presence of defects in the cold chain system, it is a fact that many villages in India do not have electricity; even areas that have access to electricity are subject to hours of power

cuts in order to conserve energy. This is especially true in the summer months, when energy sources decline due to drought (Sharma, 2000b).

A recent study examined reasons for underimmunization of children in India ("Reasons for Nonimmunization of Children in North India Identified," 2002). The findings of this study indicated that about 26.4% of respondents identified migration to a native village as a barrier against immunization; domestic problems were responsible for 9.6% of respondents' decisions not to immunize their child; the distance of the immunization center from the home was cited as a barrier by 9.6% of parents; being ill was identified as a barrier against immunization by 9% of parents; in addition, the lack of awareness about immunization, and concerns about side-effects were identified as barriers by a minority of parents ("Reasons for Nonimmunization of Children in North India Identified"). In addition, research suggests that there may be gender differences in children's immunization levels. Gender bias in access to health care is often visible in areas of the Indian subcontinent, where females are less likely to receive healthcare and prevention. They are also less likely than males to be given medical attention or taken to the hospital when they are sick (Feauveau, Koenig, & Wojtyniak, 1991).

Based on the research reviewed, it is clear that not much attention has focused on understanding parents' knowledge about and attitudes toward immunization in India. This understanding is vital, given the prevalence of preventable diseases in this nation. In addition, researchers suggest that despite having access to sophisticated health care technology, India is unable to meet the health care needs of its population due to a dearth of medical research conducted in this country (Nath et al., 1998). Consequently, there is

an urgent need for research examining the social aspects of the practice of medicine in India.

Further, the research reviewed indicates that most of the attention of health care workers has been directed toward understanding the epidemiology of infectious diseases in urban slums and rural areas of India. Not much attention has been paid to understanding immunization among middle class families in urban areas of the nation. In fact, there are virtually no studies that examine the issues of middle class Indian parents' attitudes about immunization. Such an understanding is vital, considering that this population is typically better educated and has better access to vaccines when compared with the rural or slum population in India. Understanding ideas and beliefs about immunization in this population could be vital for researchers and policymakers in that it would provide them valuable insights on the contexts that form the foundations for parents' knowledge about and attitudes toward immunization. This study focuses on middle class parents' knowledge about and attitudes toward immunization. Based on the research reviewed, the following research questions were generated:

1. What is the level of parents' knowledge about immunization in India?
2. What are the attitudes of parents in India toward the immunization of children?
3. Is there a relationship between parents' knowledge about immunization and their attitudes toward immunization?
4. Is there a relationship between gender and (a) knowledge about immunization and (b) attitudes toward immunization?
5. Is there a relationship between an individual's level of education and (a) their

- knowledge about immunization and (b) their attitudes about immunization?
6. Is there a relationship between a person's immunization status and (a) their knowledge about immunization and (b) their attitudes toward immunization?
 7. Is there a relationship between a child's immunization status and (a) parental knowledge about immunization and (b) parental attitudes toward immunization?
 8. What are the sources of parents' knowledge about immunization?

CHAPTER III

METHODS

Sample

The data for this study were collected in the nation of India. The data were collected between June and August, 2002 in the state of Andhra Pradesh in the southern region of the Indian subcontinent. The data were collected from two schools in the city of Hyderabad, India. Both schools enrolled children aged 3-5. The parents and grandparents of these children constituted the participants in this study. A total of 233 respondents participated in the study. While this was a purely convenience sample, it yielded information about middle-income families, a group largely ignored by immunization studies in India.

The sample ranged in age from 16 to 67 ($M = 32.85$). The median age of the respondents was 32 years. Among the respondents, 220 (94.4%) were parents or grandparents of the children studying in the two schools; specifically, 111 (47.6%) were mothers, 106 (45.5%) were fathers, 3 (1.3%) were grandparents, and 6 (2.6%) were others (i.e., friends, relatives or family representatives of respondents). The proportion of males and females in the sample was equivalent, where 110 (47.2%) respondents were male and 115 (49.3%) were female (8 missing responses). The majority of respondents (70.4%) had some college education or higher. Specifically, 2 (0.9%) had no schooling, 22 (9.4%) had received some schooling, 23 (9.9%) had completed high school, 95 (40.8%) had some college education, 69 (29.6%) had received postgraduate training, and

10 (4.3%) had received other professional/technical education. In the sample, 29 (12.5%) respondents indicated that they had not been immunized and 192 (82.4%) indicated that they had been immunized (12 missing responses). The respondents had between 1 and 6 children per family ($M = 1.78$) and the median number of children per family was two.

Design

The purpose of this study was to examine parents' knowledge about immunization and their attitudes toward the process. The literature reviewed reveals that studies focusing specifically on the topic of parents' knowledge and attitudes about immunization are limited. Consequently, the design of this study is primarily exploratory. In addition, this study may also be described as having a correlational aspect due to the fact that it focuses on the relationships between variables and the independent variables in the study were not manipulated.

Selection

This study employed a nonprobability or a convenience sample. Most of the respondents were residents of middle class neighborhoods. The reason for studying mostly middle class and upper middle class families was that there is virtually no literature that focuses on these parents' knowledge and attitudes toward immunization. This study attempted to focus on a relatively underresearched group, namely middle class Indian families in urban areas. This group needs the attention of researchers because immunization levels of urban Indians are lower than those of urban residents in other

developed nations (Lodha et al., 2000; Nath et al., 1998). Although this group has been exposed to immunization-related media campaigns, no research has been conducted to explore their understanding or actual awareness about immunization. A study of these parents' awareness and attitudes about immunization is vital to fill any gaps that might exist in research on this subject.

Measurement

The measure used for this study was a questionnaire (Appendix A). The instrument contained three parts and was four pages long. Part 1 assessed parents' knowledge about immunization. This section contained 11 items addressing parents' level of factual knowledge about immunization. As the section progressed, the items became increasingly complex. For instance, the first item asked if parents had ever heard of the term immunization, while the last question addressed their knowledge about vaccine-related side effects.

Part 2 of the questionnaire contained nine items measuring parents' attitudes toward immunization. A Likert-type scale accompanied the items, with response options varying from 1 (Strongly Disagree) to 5 (Strongly Agree). Some items were reverse coded to minimize the likelihood of response bias.

Part 3 of the questionnaire measured demographic characteristics of the respondents such as their age, their relationship to the child, their immunization status, and their child's immunization status. Further, this section assessed the sources of parents' knowledge about immunization. In addition, an open-ended question that stated,

"Please feel free to make any comments that you desire," was also included in the questionnaire. This item allowed parents to state their comments about the process of immunization in general.

Reliability and Validity

Because this was an exploratory study, the instrument was developed for the purpose of understanding relatively unexplored concepts. The measure was developed based on the empirical literature concerning parents' knowledge and attitudes about immunization. The questionnaire was revised, in response to feedback from two experts in the field of research methods. It was also pilot tested on 50 respondents in the United States. Most of the items were revised on the basis of feedback received in the United States. A majority of the revisions pertained to wording of items. A major revision focused on minimizing item ambiguity. For several items, respondents suggested rewording phrases to minimize ambiguity and clarify the meaning of the question. These suggestions were incorporated into the instrument to ensure the questions were clear and easy to understand. In addition, some items employed technical terms that were unfamiliar to respondents. These items were reworded to make sure that the respondents were familiar with and could easily understand the meaning of each item. Additionally, some items were dropped if they were deemed unnecessary or out of context. Respondents also made recommendations in terms of usage and vocabulary employed in the questionnaire. However, it was believed that some of the feedback would be irrelevant in the context of the Indian population. India employs British English and,

consequently, the questionnaire was developed with British usage in mind. Therefore, the items were pilot tested a second time in India. Specifically, the questionnaire was administered to 10 parents who had young children. These parents were informed about the goals of the study and asked to answer the questionnaire with the intention of providing feedback on items. No changes had to be made, as the respondents felt that the items on all three sections were clear. Their feedback indicated that they found the items pertinent and easy to understand.

To determine the stability of respondents' scores over time, test-retest reliability was used. Teachers maintained a list of students to whom the questionnaires were sent at both times. In addition, they recorded the names of children after the questionnaires were returned both times to ensure that the questionnaires could be matched with each other. The teachers then gave the researcher a list of names of children. Approximately 50 children were listed and questionnaires were sent to the homes of each one of these respondents three weeks later. However, only 17 were returned due to parents' difficulty in understanding the purpose of repeating the exercise. It must be noted that the Indian populace are unaccustomed to being recruited for research studies, and are consequently sometimes unable to appreciate the relevance of such endeavors. The results of the test-retest reliability analysis revealed that for the vast majority of items, the responses remained relatively stable between times 1 and 2 in measurement. On Part 1, agreement in responses ranged from 73.9% to 100%, while on Part 2 of the instrument, agreement ranged from 49.9% to 100% (see Appendix B).

In addition, the reliability of the instrument was assessed under the category of measures of equivalence. In particular the instrument was assessed for internal consistency using Kuder Richardson 20 (KR 20), a measure for determining the reliability of dichotomous variables, on the knowledge scale (Part 1) and Cronbach's alpha on the attitude scale (Part 2). The knowledge scale (Part 1) was found to have a reliability of .62, while the reliability of the attitude scale (Part 2) in the instrument was .57. In general, a reliability level of .70 is considered acceptable in basic research in the Social Sciences (Nunnally, 1978). Based on this convention, both scales on the instrument were judged to have a moderate level of reliability.

The instrument used in this study does have face validity, as the items appear to measure the concepts of interest. Because of the exploratory nature of this study, it is difficult to determine whether the instrument possesses other forms of validity.

Data Collection Procedures and Ethical Considerations

The Institutional Review Board (IRB) at Utah State University reviewed the data collection procedures for this study. Once IRB approval was documented, the data were collected in the summer months of 2002. Initially, informational letters about the research (Appendix C) were sent to the principals of the two schools involved in the study. Interviews were then scheduled between the researcher and each of the two principals. In both schools, the principals scheduled meetings with teachers and discussed the goals of the study with them. All of the teachers expressed unanimous interest in the study and indicated their willingness to facilitate it.

Once teacher willingness was determined, copies of the questionnaire were handed to the teachers. The teachers believed that it would be less disruptive and less threatening to parents to have questionnaires sent home with children than to have them mailed directly by the researcher, due to the fact that parents were familiar with and shared a rapport with the teachers, while the researcher was a stranger to them. Surveys and other types of research are relatively uncommon in India, and it was thought that direct contact with parents might seem threatening and intrusive to people. Therefore, the questionnaires were handed to the teachers who then marked children's names on them (to facilitate test-retest reliability) when they were returned.

The questionnaire was worded in English since the medium of communication in the two schools and in much of urban India is English. Each questionnaire was accompanied by a cover letter (Appendix C) informing parents about the benefits of participating in the study. The parents were assured that there would be no negative consequences of their participation. They were also informed that their opinions would be strictly confidential. Further, they were informed that they had the right to refuse to participate in this study, and their decision to participate must be purely voluntary. School entry is unrelated to immunization status; further, teachers in India typically concern themselves with purely educational domains of children's lives. Consequently, it was believed that parents' answers would be unaffected by the school's involvement. In fact, since research of any kind is rarely conducted on the general public in India, the involvement of the school would lead parents to believe that this was a nonthreatening and nonintrusive project.

Once the questionnaires were returned, approximately 50 questionnaires were resent to parents after 15 days of receiving completed questionnaires from parents. The purpose of this was to ascertain test-retest reliability of the measure. An explanation for the second round of data collection was given to parents in the cover letter and in a follow-up note. They were reminded again about the goals of the study, and that their participation in it was voluntary. They were also given a follow up note (Appendix C) in which they were informed that the reason they were given the questionnaire a second time was to ascertain whether the questionnaire was a reliable tool for assessing their opinions and ideas. The teachers were given a list of children to give the questionnaires to a second time. Only 17 parents returned the questionnaires. This is best explained by the fact that the Indian population is typically not exposed to research conducted by universities or other agencies apart from census authorities. Some of the parents who returned the questionnaire the second time remarked that they had already completed the questionnaire a couple of weeks ago and felt that it was pointless to repeat themselves.

Data Transformation and Analysis

The responses were coded in order to facilitate entry into a software program. In the Knowledge scale (Part 1) of the questionnaire, coded items were evaluated to determine their accuracy. Correct responses were coded as 1 and incorrect responses as 0. Missing values were coded as 9. In Part 2, items were coded in the form they appeared on the questionnaire (i.e., 1: Strongly Disagree to 5: Strongly Agree). Exceptions were made for items that needed to be reverse coded. Missing values were

coded as 9. In Part 3 of the questionnaire, demographic details were coded in order to ascertain their relationship with knowledge and attitude scores.

The data were entered into Statistical Packages for the Social Sciences (SPSS). Variables were named so as to make them easily identifiable. The data were analyzed using descriptive statistics. Specifically, measures of central tendency, frequency distributions, *t* tests, and correlational analyses were used. The level of statistical significance was set at $p < .05$. The decision to set the level of statistical significance at $p < .05$ was made based on the common practice of doing so in statistical analyses in the Social Sciences (Dooley, 1995).

CHAPTER IV

RESULTS

This chapter focuses on the statistical analyses employed to study the various research questions generated. The analyses will be examined in the sections that follow.

Research Question 1: What is the Level of Parents'

Knowledge About Immunization in India?

Part 1 of the questionnaire contained 11 items that examined respondents' knowledge about immunization. These items were dichotomous with correct responses being scored as 1 and incorrect responses as 0. Item 1 in this section asked the question, "Have you ever heard of the terms immunizations or vaccinations?" This item was eliminated from analyses because it was deemed to be redundant. In general, the items in Part 1 measured general awareness among parents about immunization-related issues such as vaccine dosage, efficacy, composition, safety, failure, and side-effects. To gain an understanding of parents' knowledge about immunization, frequency distributions were generated for each item on the knowledge scale.

Overall, respondents in this sample appeared to be most knowledgeable about vaccine dosage. When asked about whether vaccines can be administered in one or several doses, 93.1% of respondents responded accurately (see Table 1). On the other hand, the respondents in this sample appeared to be less knowledgeable about vaccine-related side-effects and vaccine failures than about issues such as the dosage and

Table 1

Parents' Knowledge About Immunization

Item	% of Accurate Responses	<i>n</i>
1. Vaccines are injections/oral substances designed to protect people from diseases	91.2	226
2. All vaccines are given in one dose only	93.9	231
3. Only children can be immunized	69.5	226
4. Some vaccines require several doses to be effective	89.3	224
5. Vaccines are tiny amounts of disease causing organism	77.8	216
6. Failure to receive <u>all</u> vaccine doses can compromise immunity	85.7	223
7. Rarely, vaccines may cause the diseases they are intended to prevent	57.8	204
8. Children always develop a fever following immunization	63.8	229
9. The majority of those immunized develop the disease symptoms	80.6	206

composition of vaccines. For instance, when asked whether vaccines have the potential to cause the diseases they are intended to prevent, only 57.8% responded correctly.

In addition to the items that examined parents' overall understanding about the general issues pertaining to immunization, 12 items explored parents' knowledge about specific diseases against which it is possible to immunize children. Parents were asked to indicate whether vaccines could protect children from a series of diseases. Again, responses were categorized dichotomously, with correct responses being scored as 1 and incorrect responses as 0. Parents in this sample appeared to be highly knowledgeable about diseases that could not be prevented by immunization (see Table 2).

Table 2

Parents' Knowledge About Specific Vaccine-Preventable Diseases (Item 6, Part 1)

Disease	% of Accurate Responses
Polio	95.7
Cancer	96.1
Chickenpox	90.5
Mumps	72.0
Measles	86.6
AIDS	95.3
Pneumonia	77.6
Influenza	42.2
Cold	90.5
Bronchitis	87.1
Cough	89.2
Diarrhea	81.5

n = 232

For instance, 96.1% responded correctly that vaccines could not protect people from cancer; similarly, 95.3% correctly stated that vaccines could not protect people from AIDS (see Table 2). Among vaccine-preventable diseases, respondents appeared to be the most knowledgeable about polio, where 95.7% of the respondents correctly stated that vaccines can protect people from polio. Similarly, 90.5% correctly indicated that vaccines can protect people from chickenpox. Apparently, respondents replied more accurately to questions about which diseases were not vaccine-preventable than to questions about diseases that were vaccine-preventable (i.e., mumps and influenza). For instance, 42.2% of the respondents believed that influenza was not vaccine preventable.

Part 1 of the instrument had a reliability of .62, which was deemed to be relatively moderate. Consequently, exploratory factor analyses (with principal component extraction and varimax rotation) were conducted to discover whether certain factors

would emerge among the items. The number of factors retained was determined using a method known as principal components analysis. This method involves a linear transformation of a large set of correlated variables into a smaller set of uncorrelated ones. The purpose of this is to simplify analyses by reducing data into controllable units (Vogt, 1993). In addition, all factors that had an eigenvalue greater than 1 were retained.

Specifically, two sets of factor analyses were generated. One explored the presence of underlying factors among the items that focused on general awareness about immunization. The second explored the presence of factors among items focused on specific knowledge about vaccine-preventable diseases.

Factor analyses of parents' awareness of general immunization-related issues yielded a four-factor solution. The first factor contained knowledge about immunization dosage and target population and was labeled "dosage." The second factor contained knowledge about vaccine side-effects and was labeled "side-effects." The third factor contained knowledge about the disease-causing potential of vaccines and was labeled "disease." The fourth factor contained knowledge about vaccine administration and was labeled "administration." Overall, 59% of the total variance in knowledge about general immunization-related issues was explained by the four factors.

Factor analyses of respondents' knowledge about specific, vaccine-preventable diseases yielded a three-factor solution. The first factor contained knowledge about common vaccine-preventable diseases and was labeled, "common vaccine-preventable diseases" (see Table 3).

Table 3

Factor Analysis of Parents' Knowledge About General Immunization-Related Issues

Item	Factor 1	Factor 2	Factor3	Factor 4
One dose only	.74	.08	.03	.04
Several doses required	.69	-.23	.11	-.06
Only children immunized	.59	.41	-.17	-.04
Result in fever	.13	.76	-.21	-.01
Result in disease symptoms	-.10	.68	-.09	-.00
May cause diseases	.09	-.06	.76	-.29
Are disease causing organisms	-.07	.14	.68	.32
Are injections/oral substances	-.11	.06	-.10	.82
Require several doctors' visits	.34	-.28	.31	.54
R^2	18.0%	15.6%	13.3%	12.1%

R^2 total = 59.0%

Factor 1 = Knowledge about dosage and target population for immunization

Factor 2 = Knowledge about side-effects of immunization

Factor 3 = Knowledge about disease-causing potential of vaccines

Factor 4 = Knowledge about administration of vaccines

The second factor contained knowledge about common non-vaccine-preventable diseases and was labeled, "common non-vaccine-preventable diseases." The third factor contained knowledge about rare non-vaccine-preventable diseases and was labeled, "uncommon non-vaccine-preventable diseases." Overall, 53.6% of the total variance in knowledge about vaccine-preventable diseases was explained by the three factors (see Table 4).

Table 4

Factor Analysis of Parents' Knowledge About Specific Vaccine-Preventable Diseases

Item	Factor 1	Factor 2	Factor 3
Measles	.79	.01	.02
Chickenpox	.72	-.11	.25
Mumps	.69	.11	-.18
Polio	.63	.10	.21
Diarrhea	.09	.78	-.01
Cough	.38	.65	.18
Bronchitis	.06	.65	.15
Cold	.37	.55	.24
AIDS	.25	.12	.67
Cancer	.22	.35	.61
Influenza	-.49	-.01	.56
Pneumonia	-.12	.46	.47
<i>R</i> ²	22.3%	17.9%	13.5%

*R*² total = 53.7%

Factor 1 = Knowledge about common vaccine-preventable diseases

Factor 2 = Knowledge about common non-vaccine-preventable diseases

Factor 3 = Knowledge about uncommon non-vaccine-preventable diseases

Additionally, 75 respondents provided valid responses to the open-ended item at the end of the questionnaire, which requested parents make any comments they desired. Of these, some responses pertained to parents' knowledge about immunization. While the rest of the comments will be discussed in the sections that follow, a few will be examined in this section. Several respondents stated that the study sensitized them to the issue of immunization and expressed positive attitudes about the study. Specifically, some respondents stated that the study made them more aware of children's

immunization. One father stated, "This survey enabled us to learn more about immunization."

Additionally, some parents stated that they lacked awareness about certain aspects of immunization and made requests for information. For instance, one mother in the sample asked, "I want to know whether my daughter can be immunized against viral fever, cold, and bronchitis."

Further, some parents stated that they found vaccine names confusing and hard to remember. One parent requested, "Please suggest appropriate ages when vaccines are to be given."

In all, many respondents in this sample, despite having a high level of knowledge about vaccines, lacked adequate information about some specific issues such as available vaccines, vaccine names, and recommended ages for immunization.

Research Question 2: What are the Attitudes of Parents in India Toward the Immunization of Children?

Part 2 of the questionnaire examined parents' attitudes about immunization. This section contained eight items that were scored in a Likert-type scale, with response scores ranging from 1 to 5. As with the analyses of parents' knowledge about immunization, three approaches were employed to study parents' attitudes toward immunization. First, descriptive statistics were generated for each question in Part 2. Second, exploratory analyses were utilized to explore the presence of underlying factors in this section of the

instrument. Third, open-ended responses were studied to gain an in-depth understanding of parents' beliefs and attitudes.

Overall, parents in this sample had overwhelmingly positive attitudes about immunization. On a scale of 0 to 5 points, respondents' mean scores ranged from 3.48 to 4.64 (see Table 5). Respondents were most likely to strongly agree that immunization should be made compulsory for all children ($M = 4.64$); they expressed less strong agreement with the view that the benefits of immunization outweigh the risks associated with them ($M = 3.48$).

Table 5

Parents' Attitudes About Immunization

Item	<i>M</i>	<i>SD</i>	% Strongly Agreeing	% Strongly Disagreeing	<i>n</i>
1. In general, immunizations are beneficial	4.63	.72	69.5	1.3	227
2. Immunizations should be made compulsory for all children	4.64	.78	74.7	1.7	229
3. Immunizing children ensures they remain healthy throughout childhood	3.83	1.03	24.9	3.4	224
4. Vaccines are one of modern science's greatest discoveries	4.32	.90	51.1	1.3	227
5. All vaccines are expensive	3.74	1.00	20.2	2.1	229
6. The government should provide universal free immunization	4.33	.98	56.7	2.6	227
7. Vaccines are harmful to children	4.53	.81	64.4	2.1	227
8. Free vaccines would ensure universal immunization	3.96	1.18	41.6	3.9	227
9. Benefits of immunizations outweigh risks	3.48	.99	13.3	3.4	216

Because the reliability of the attitude scale was moderate (.57), exploratory factor analyses were conducted to explore the presence of underlying factors in this part of the questionnaire. Factor analyses of parents' attitudes about immunization yielded a three-factor solution. The first factor contained attitudes about universal immunization and was labeled "belief in universal immunization." This factor contained parents' attitudes that immunizations were beneficial for children in general. It also contained opinions favoring universal immunization for children and the attitude that the government carried the responsibility to ensure/facilitate universal immunization (see Table 6).

Table 6

Factor Analyses of Parents' Attitudes About Immunization

Item	Factor 1	Factor 2	Factor 3
1. Free vaccines would ensure complete immunization	.78	-.04	-.20
2. Immunization is beneficial	.67	.16	.39
3. Immunization should be made compulsory	.66	.15	.27
4. Immunizations should be free	.59	-.04	.10
5. Immunizations ensure a healthy childhood	.01	.77	.03
6. The benefits of immunizations outweigh the risks	.02	.78	.09
7. Immunization is expensive	-.01	.22	.76
8. Immunization is harmful	.18	-.13	.74
R^2	26.5%	14.9%	12.3%
R^2 total = 53.7%			

Factor 1 = Belief in universal immunization

Factor 2 = Positive opinions about immunization

Factor 3 = Negative opinions about immunization

The second factor contained negative attitudes about vaccines and was labeled "negative opinions about immunization." Typically, the idea that immunizations could be harmful to children and the idea that vaccines are expensive appeared to cluster together. The third factor contained attitudes about the overall usefulness of immunization and was labeled "positive opinions about immunization." This factor contained parents' positive attitudes toward immunization. The opinions that immunization ensures a healthy childhood appeared to cluster with the opinion that the benefits of immunization outweigh the risks associated with them.

Item 4 on the attitude scale (Part 2) of the questionnaire, which expressed the opinion that vaccines were one of modern science's greatest discoveries, was excluded from analyses because it did not load on to any of the three factors that emerged in this scale. Overall, close to 54% of the original variance was explained by the three factors.

Reliability analyses were conducted to determine the reliability of items on each of the factors. Reliability appeared to be low for some factors. However, this was not unexpected, because there were few items in each factor (see Table 7).

An exploration of parents' comments about immunization revealed that the vast majority of parents had highly positive attitudes about immunization. Parents expressed strongly positive opinions about the overall usefulness of vaccines. The most common idea they expressed was that immunization protects children from preventable diseases that cause suffering in childhood.

For instance, one father in the sample stated, "Parents should see to it that their children are given vaccines at the right age to prevent them from contracting diseases."

Table 7

Reliability Analyses for Items in Factor Analyses

Factor	Alpha	KR20	Number of items
General Knowledge			
1. Knowledge about dosage and target population for immunization	.40		3
2. Knowledge about side-effects of immunization	.37		2
3. Knowledge about disease causing potential of vaccines	.28		2
4. Knowledge about administration of vaccines	.10		2
Specific Knowledge			
5. Knowledge about common vaccine preventable diseases	.70		4
6. Knowledge about common <u>non</u> -vaccine preventable diseases	.66		4
7. Knowledge about uncommon <u>non</u> -vaccine preventable diseases	.45		4
Attitudes			
8. Belief in universal immunization		.65	4
9. Negative opinions about immunization		.37	2
10. Positive opinions about immunization		.46	2

Another father expressed the opinion, "Immunizations are the best way to control diseases." Similarly, one mother expressed the idea, "Vaccines save the lives of children."

Parents also expressed positive opinions about universal mandatory immunizations. Many parents expressed the opinion that all children across India as well as in other parts of the world should be immunized. A mother echoed a recurring comment, and stated, "Immunization for children should be made compulsory. It should

be given free to all children." A related opinion was one in which a large number of parents believed that free vaccines should be made available to children from low-income homes.

Along with expressing the opinion that immunization should be universal and mandatory, parents also expressed opinions about the responsibility of the government to achieve these goals. Respondents appeared to believe that governmental initiatives would go a long way in increasing the immunization coverage of children. They also believed that the provision of free vaccines would improve immunization rates. For instance, one father said, "The government and voluntary organizations should set up immunization programs free of cost to all children."

Several parents in the sample also made recommendations to improve immunization coverage of children in India. These recommendations primarily involved the provision of immunization in schools or in people's homes. Some parents suggested making immunization a prerequisite for preschool and kindergarten entry. Additionally, parents suggested door-to-door visits on the part of health care personnel to households with young children to ensure complete immunization coverage. A parent suggested:

Vaccination should be made available to all children irrespective of their economic level. Expensive vaccines should be placed within the reach of all families. Apart from the government, voluntary, social and religious organizations should take an initiative to promote children's immunization. The commercialization of medicine should be held in check by the government. More publicity should be directed towards illiterate persons to ensure that consciousness and awareness are developed among the masses. Scientists and researchers in developed nations need to work to develop new vaccines especially for diseases like AIDS.

The majority of parent recommendations revolved around government involvement in the form of policy. For instance, some parents suggested that the

government should make the corporate sector responsible for the provision of free vaccines to all children.

A few parents in this sample expressed negative attitudes about immunization in their comments. These opinions were based on parents' reservations about the cost and side-effects of vaccines, and vaccine failure. Parents expressed concern that some of the vaccine names were confusing, resulting in some vaccines not being administered to children. Parents were also concerned that there appeared to be a dichotomous system of vaccine administration in which, some vaccines were recommended in public health care settings while private health care settings made additional, costlier vaccines available. Parents reported that this caused them to have negative feelings about immunizing their children, and to question whether any immunizations would be necessary at all.

Parents were also concerned that vaccines were too expensive. They expressed the opinion that the high cost of some vaccines makes it hard to administer them to children. As one parent stated, "I consider vaccination essential for my children's good health. But some of the vaccines like varicella and hepatitis A are very expensive. All parents cannot afford these."

Additionally, parents also seemed to have negative opinions about immunization due to reports of vaccine side effects. Some were even concerned about reports of vaccine failure. Despite these concerns, the majority of those who expressed their opinions about immunization in this sample appeared to have largely positive attitudes toward immunization, and to believe that the process had benefits for child health and well being.

Research Question 3: Is There a Relationship Between Parents' Knowledge
About Immunization and Their Attitudes Toward Immunization?

To determine whether parents' knowledge about immunization was related to their attitudes about the process, Pearson bivariate correlations were generated. Specifically, the seven factors that emerged on the knowledge scale (Part 1) were correlated with the three factors that emerged on the attitude scale (Part 2). Knowledge about dosage and the target population for immunization was positively correlated with positive attitudes about the overall usefulness of immunization, $r(200) = .17, p < .05$. The awareness that immunizations are given in more than one dose and are given to both children and adults was related to the belief that vaccines ensure a healthy childhood and that the benefits of immunization outweigh the costs. Knowledge about the side-effects of immunization was positively correlated with negative opinions about immunization, $r(202) = .16, p < .05$. Knowledge that immunization sometimes results in a fever and could result in children developing disease symptoms, was related to the belief that vaccines are harmful and expensive (see Table 8).

Knowledge about the disease-causing potential of vaccines was positively correlated with beliefs about the necessity of universal immunization, $r(188) = .18, p < .05$. Comprehension that vaccines may cause diseases they are intended to prevent and are composed of minute quantities of disease causing organisms still was related to the belief that immunization is highly beneficial, and that governmental provision of free vaccines would ensure universal immunization.

Table 8

Pearson Correlations for the Factors on the Knowledge Scale (Part 1) and the Factors on the Attitude Scale (Part 2)

Part 1 Factors (Knowledge)	Part 2 Factors (Attitudes)		
	Factor 1	Factor 2	Factor 3
General Knowledge			
1. Dosage and target population for immunization	-.11	.04	.17*
2. Side-effects of immunization	-.00	.16*	.13
3. Disease-causing potential of vaccines	.18*	-.07	.12
4. Administration of vaccines	-.04	-.02	-.02
Specific Knowledge			
5. Common vaccine-preventable diseases	.13	.22**	.15*
6. Common <u>non</u> -vaccine-preventable diseases	-.02	.11	.01
7. Uncommon <u>non</u> -vaccine-preventable diseases	.01	.15*	.17*

Factor 1 = Belief in universal immunization

Factor 2 = Negative opinions about immunization

Factor 3 = Positive opinions about immunization

* $p < .05$, ** $p < .01$ (2-tailed)

Knowledge about common vaccine-preventable diseases was positively correlated with negative opinions about vaccines, $r(205) = .22, p < .01$. On the other hand, this knowledge was also related to positive opinions about immunization, $r(213) = .15, p < .05$. Knowledge about common vaccine-preventable diseases like polio and chickenpox was related to the beliefs, not only that immunizations are harmful and expensive, but also that the benefits associated with them outweigh the risks mentioned.

Knowledge about uncommon non-vaccine-preventable disease was also related to both, negative opinions about immunization, $r(225) = .15, p < .05$, as well as to positive opinions about immunization, $r(213) = .17, p < .05$. In other words, awareness of which

diseases were not vaccine-preventable (e.g., AIDS) was related not only to the attitude that vaccines are harmful and expensive, but also to the attitude that their overall benefits outweigh these costs associated with them.

Research Question 4: Is there a Relationship Between Gender and (a) Knowledge About Immunization and (b) Attitudes Toward Immunization?

Both *t* tests and Pearson bivariate correlational analyses were utilized to explore the relationship between respondents' gender and (a) their knowledge about immunization and (b) their attitudes about immunization. During data analysis, females were coded as 1, while males were coded as 0. Correlational analyses were undertaken for each of the seven factors on the knowledge scale (Part 1) in order to explore the relationship between gender and parents' knowledge about immunization. Statistically significant correlations were found between gender and knowledge about the required dosage and target population for immunization, $r(209) = .19, p < .01$ (see Table 9).

To further explore this relationship, *t* tests were employed. Statistically significant differences were found between males and females in terms of their knowledge about the required dosage and target population for immunization, $t(207) = -2.74, p < .05$. Females ($M = 2.64$) scored statistically significantly higher than males ($M = 2.37$) on their awareness about the number of doses required as well as the target population for immunization. Further, knowledge about common vaccine-preventable diseases was found to be significantly correlated with gender, $r(224) = .17, p < .05$.

Table 9

*Pearson Correlations for Relationship Between Gender and Knowledge and Attitudes
About Immunization*

Factor	Pearson Correlation (<i>r</i>)	<i>n</i>
General Knowledge		
Dosage and target population for immunization	.19**	209
Side-effects of immunization	.10	201
Disease-causing potential of vaccines	.01	190
Administration of vaccines	.03	212
Specific Knowledge		
Common vaccine-preventable diseases	.17*	224
Common <u>non</u> -vaccine-preventable diseases	.13*	224
Uncommon <u>non</u> -vaccine-preventable diseases	.05	224
Attitudes		
Belief in universal immunization	-.03	219
Negative opinions about immunization	-.01	221
Positive opinions about immunization	.00	212

* $p < .05$, ** $p < .01$ (2-tailed)

The *t* tests revealed that there were statistically significant differences between males and females in terms of their knowledge about common vaccine-preventable diseases, $t(222) = -2.56, p < .01$. Females ($M = 3.66$) scored statistically significantly higher than males ($M = 3.37$) in terms of their knowledge about common vaccine-preventable diseases (see Table 10).

Statistically significant correlations were found between gender and knowledge about common non-vaccine-preventable diseases $r(224) = .13, p < .05$. The *t* tests further revealed that males and females differed statistically significantly in terms of their knowledge about common non-vaccine-preventable diseases, $t(222) = -2.04, p < .05$.

Table 10

Gender Differences in Knowledge and Attitudes About Immunization

Factor	Males			Females			<i>t</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>		
General Knowledge								
1. Dosage and target population for immunization	2.37	.76	102	2.64	.68	107	-2.74*	207
2. Side-effects of immunization	1.38	.69	101	1.52	.67	100	-1.49	199
3. Disease-causing potential of vaccines	1.37	.70	95	1.39	.69	95	-0.21	188
4. Administration of vaccines	1.80	.43	104	1.82	.41	108	-0.45	210
Specific Knowledge								
5. Common vaccine preventable diseases	3.37	.98	109	3.66	.72	115	-2.56**	222
6. Common <u>non</u> -vaccine preventable diseases	3.42	.98	109	3.65	.69	115	-2.04*	222
7. Uncommon <u>non</u> -vaccine preventable diseases	3.12	.68	109	3.18	.61	115	-0.73	222
Attitudes								
8. Belief in universal immunization	17.11	3.87	106	16.92	3.35	113	-0.73	116
9. Negative opinions about immunization	7.88	2.32	108	7.84	2.02	113	0.39	219
10. Positive opinions about immunization	11.69	1.85	105	11.70	2.02	107	0.13	210

* $p < .05$, ** $p < .01$ (2-tailed)

Females ($M = 3.65$) scored statistically significantly higher than males ($M = 3.42$) in terms of their knowledge about common diseases that were non-vaccine preventable.

To determine the relationship between gender and attitudes about immunization, correlational analyses and t tests were utilized. No statistically significant correlations were found between gender and any of the factors on the attitude scale. In addition,

males and females in this sample did not differ statistically significantly in terms of any of the factors on the attitude scale.

In addition to the analyses conducted to explore the association between parents' gender and their knowledge and attitudes about immunization, correlational analyses also explored whether the child's gender was associated with his or her immunization status. No statistically significant relationships were found between children's gender and their immunization status.

Research Question 5: Is There a Relationship Between an Individual's Level of Education and (a) Their Knowledge About Immunization and
(b) Their Attitudes Toward Immunization?

Pearson bivariate correlations were utilized to determine whether parents' educational levels were related to their knowledge about immunization, and their attitudes about immunization. To begin with, each of the factors on the knowledge scale was correlated with respondents' educational levels (see Table 11).

Knowledge about the required dosage and target population for immunization was statistically significantly correlated with respondents' educational level, $r(205) = .19, p < .01$. The higher the respondents' level of education, the greater their understanding about the required dosage and target population for immunization. Similarly, knowledge about the side-effects of vaccines was significantly correlated with respondents' educational levels, $r(196) = .23, p < .01$. Higher levels of education were associated with

Table 11

Relationship Between Parents' Education and Their Knowledge and Attitudes About Immunization

Factor	Pearson correlation (<i>r</i>)	<i>n</i>
General Knowledge		
1. Dosage and target population for immunization	.19**	205
2. Side-effects of immunization	.23**	196
3. Disease-causing potential of vaccines	.03	186
4. Administration of vaccines	.07	208
Specific Knowledge		
5. Common vaccine-preventable diseases	.21**	220
6. Common <u>non</u> -vaccine-preventable diseases	.19**	220
7. Uncommon <u>non</u> -vaccine-preventable diseases	.12	220
Attitudes		
8. Belief in universal immunization	.02	214
9. Negative opinions about immunization	-.02	216
10. Positive opinions about immunization	.25**	206

***p* < .01 (2-tailed)

more knowledge about the side-effects of immunization such as fever and disease symptoms.

A related finding was that respondents' educational levels were found to be statistically significantly correlated with their knowledge about common vaccine-preventable diseases, $r(220) = .21, p < .01$. Higher levels of education were related to high levels of knowledge about common vaccine-preventable diseases, such as measles and mumps, while lower levels of education were associated with less accurate responses on items that addressed these issues.

Additionally, statistically significant correlations were found between parents' educational levels and the knowledge about common non-vaccine-preventable diseases, $r(220) = .19, p < .01$. A greater level of education was related to a high level of awareness about which diseases were not vaccine preventable; conversely, a lower the level of education, was related to a lower level of knowledge about the subject.

Correlational analyses also revealed that parents' educational level was statistically significantly correlated with positive opinions about immunization, $r(206) = .25, p < .01$. The more educated respondents were, the more likely they were to believe that immunizations ensure a healthy childhood and that the overall benefits of immunizations outweigh the risks associated with them. No statistically significant correlations were found between respondents' educational levels and either their beliefs in universal immunization or their negative opinions about immunization.

Research Question 6: Is There a Relationship Between a Person's Immunization Status and (a) Their Knowledge About Immunization and
(b) Their Attitudes About Immunization?

To explore the association between respondents' immunization statuses and their knowledge and their attitudes about immunization, Pearson bivariate correlations and t tests were utilized. Respondents' immunization statuses were statistically significantly correlated with their: knowledge about the side-effects of immunization, $r(196) = .19, p < .01$; knowledge about common vaccine-preventable diseases, $r(220) = .25, p < .01$ (see Table 12); and knowledge about uncommon non-vaccine-preventable diseases, $r(220) = .$

Table 12

Relationship Between Parents' Immunization Statuses and Factors on the Knowledge and Attitude Scales

Factor	Pearson correlation	
	(<i>r</i>)	<i>n</i>
General Knowledge		
1. Dosage and target population for immunization	.13	207
2. Side-effects of immunization	.19**	196
3. Disease causing potential of vaccines	-.12	186
4. Administration of vaccines	.07	208
Specific Knowledge		
5. Common vaccine-preventable diseases	.25**	220
6. Common <u>non</u> -vaccine-preventable diseases	.10	220
7. Uncommon <u>non</u> -vaccine-preventable diseases	.13*	220
Attitudes		
8. Belief in universal immunization	.01	213
9. Negative opinions about immunization	.13	216
10. Positive opinions about immunization	.14*	206

* $p < .05$, ** $p < .01$ (2-tailed)

.13, $p < .05$. Respondents who had been immunized themselves were more likely to know that immunizations could result in children developing a fever or the disease symptoms that vaccines are designed to prevent. They were also likely to be aware of not only common vaccine-preventable diseases like polio, chickenpox, and measles, but also of uncommon non-vaccine-preventable diseases (e.g., AIDS and cancer).

As can be seen from Table 12, respondents' immunization statuses were positively correlated with their positive opinions about immunization, $r(206) = .14$, $p < .05$. Respondents who were immunized were likely to believe that immunizations ensure

a healthy childhood and that the benefits of immunization outweigh the risks associated with them.

The *t* tests revealed statistically significant differences between those who were immunized and those who were not in terms of their knowledge about the side-effects of vaccines, $t(194) = -2.73, p < .01$. Respondents who had been immunized had a statistically significantly higher level of knowledge about vaccine related side effects ($M = 1.51$) than those who had not been immunized ($M = 1.12$).

Further, *t* tests revealed that there were statistically significant differences between those who were immunized and those who were not in terms of their knowledge about the disease-causing potential of vaccines, $t(184) = 1.61, p < .05$. Respondents who were not immunized ($M = 1.61$), as compared to those who were ($M = 1.36$), were more likely to be aware that vaccines are composed of minute quantities of disease-causing organisms and may sometimes cause the diseases they are intended to prevent. The *t* tests also revealed that there were statistically significant differences between those who were immunized and those who were not in terms of their knowledge about common vaccine-preventable diseases, $t(218) = -3.76, p < .05$. Respondents who had been immunized ($M = 3.61$) knew more about which common diseases (e.g., measles, mumps, and chickenpox) were vaccine-preventable than those who were not immunized ($M = 3.00$). Finally, *t* tests also revealed that there were statistically significant differences between respondents who had been immunized and those who had not been in terms of their knowledge about common non-vaccine-preventable diseases, $t(218) = -1.48, p < .05$ (see Table 13).

Table 13

Differences in Parents' Scores on Knowledge and Attitude Factors Based on Parents' Immunization Statuses

	Immunized		Nonimmunized		<i>t</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
General Knowledge						
1. Dosage and target population for immunization	2.57	.71	2.31	.76	-1.83	206
2. Side-effects of immunization	1.51	.65	1.12	.86	-2.74*	195
3. Disease-causing potential of vaccines	1.36	.71	1.61	.50	1.61*	185
4. Administration of vaccines	1.82	.41	1.73	.45	-1.00	207
Specific Knowledge						
5. Common vaccine-preventable diseases	3.61	.77	3.00	1.07	-3.76*	219
6. Common <u>non</u> -vaccine-preventable diseases	3.54	.86	3.28	-1.48*	-1.48*	219
7. Uncommon <u>non</u> -vaccine-preventable diseases	3.17	.67	2.90	.82	-2.01	219
Attitudes						
8. Belief in universal immunization	17.02	3.48	16.93	4.41	-0.12	212
9. Negative opinions about immunization	7.93	2.15	7.11	2.42	-2.04	215
10. Positive opinions about immunization	11.87	1.89	11.07	1.90	-1.86	211

**p* < .05 (2-tailed)

Respondents who had been immunized ($M = 3.54$) had more knowledge about which common diseases (e.g., cold, and cough) were not vaccine-preventable than those who had not been immunized ($M = 3.28$). No statistically significant differences were found between those who were immunized and those who were not for any of the factors on the attitude scale.

Research Question 7: Is There a Relationship Between a Child's Immunization Status and (a) Parental Knowledge About Immunization and
(b) Parental Attitudes About Immunization?

To determine children's immunization statuses, the immunization scores of the first and second child were summed. The majority of respondents in the sample had two or fewer children (84.2%). Because of the large percentage of parents in the sample having only two children (or fewer), it was expected that focusing on data pertaining to two children would yield a pattern of findings not significantly different from that which might emerge from a focus on subsequent children.

To explore the associations between the variables of interest, Pearson bivariate correlational analyses were utilized. Statistically significant relationships were found between parents' knowledge about immunization and their children's immunization statuses for specific vaccines.

Parents' knowledge about the side-effects of immunization was statistically significantly correlated with whether or not their children had received: the dpt vaccine, $r(118) = .22, p < .05$; the hib vaccine, $r(115) = .30, p < .01$; and the mmr vaccine, $r(110) = .31, p < .01$. Overall, the higher the level of parent's awareness about the side-effects of vaccines, the higher the likelihood of their children being immunized against diphtheria, whooping cough, tetanus, haemophilus influenza type b infections, measles, mumps, and rubella.

Parents' knowledge about the disease-causing potential of vaccines was negatively related to children's receipt of: the varicella vaccine, $r(105) = -.19, p < .05$ and the hepatitis A vaccine, $r(111) = -.22, p < .05$. The higher the level of parents' awareness that vaccines are composed of minute quantities of pathogenic organisms which have the potential to cause the diseases they are intended to prevent, the lower the likelihood of them having immunized their children against chickenpox and hepatitis A.

Parents' knowledge about common vaccine-preventable diseases was positively correlated with their children's receipt of: the bcg vaccine, $r(131) = .36, p < .01$; the dpt vaccine, $r(131) = .36, p < .01$; the opv, $r(132) = .22, p < .01$; the hepatitis B vaccine, $r(129) = .28, p < .01$; and the mmr vaccine, $r(121) = .28, p < .01$. The more parents knew about which common diseases were vaccine preventable, the more likely they were to have immunized their children against tuberculosis, diphtheria, whooping cough, tetanus, polio, hepatitis B, measles, mumps, and rubella.

Parents' awareness about common non-vaccine-preventable diseases was positively correlated with their children's receipt of the bcg vaccine, $r(131) = .22, p < .01$ and the mmr vaccine, $r(121) = .26, p < .01$. The higher the level of parent's knowledge about which common diseases were not vaccine preventable, the greater the likelihood that their children had been immunized against tuberculosis, measles, mumps, and rubella (see Table 14).

The final factor on the knowledge scale (Part 1) that was related to children's immunization statuses was parents' knowledge about uncommon non-vaccine-preventable diseases. Parent's knowledge about uncommon non-vaccine-preventable

Table 14

Relationship Between Children's Immunization Statuses and Parents' Scores on Factors in the Knowledge Scale

Vaccine	Factor 1	<i>n</i>	Factor 2	<i>n</i>	Factor 3	<i>n</i>	Factor 4	<i>n</i>	Factor 5	<i>n</i>	Factor 6	<i>n</i>	Factor 7	<i>n</i>
BCG	.00	125	.06	119	.07	113	-.05	123	.36**	131	.22**	131	.18*	131
DPT	.08	125	.22*	118	.10	113	-.01	123	.36**	131	.04	131	.05	131
OPV	.05	126	.12	119	.12	113	-.10	124	.22*	132	.09	132	.11	132
Hepatitis B	.09	123	.18	118	-.02	112	-.17	121	.28**	129	.11	129	.11	129
Hib	.18	119	.30*	115	-.12	108	-.01	118	.07	125	.09	125	.14	125
Typhoid	-.03	112	.16	107	-.17	102	-.00	111	.09	118	.09	118	.09	118
MMR	.05	115	.31**	110	-.07	105	-.01	113	.28**	121	.26**	121	.19*	121
Varicella	.09	114	.10	111	-.19*	105	.03	115	.11	120	.07	120	.04	120
Hepatitis A	-.02	123	.15	117	-.22*	111	-.07	121	.05	129	-.01	129	-.05	129
Influenza	-.02	123	.10	117	-.16	111	.07	121	-.07	129	-.06	129	-.01	129

Factor1 = Knowledge about dosage and target population for immunization

Factor2 = Knowledge about side-effects of immunization

Factor3 = Knowledge about disease-causing potential of vaccines

Factor4 = Knowledge about administration of vaccines

Factor5 = Knowledge about common vaccine preventable diseases

Factor6 = Knowledge about common non-vaccine preventable diseases

Factor7 = Knowledge about uncommon non-vaccine preventable diseases

* $p < .05$, ** $p < .01$ (2-tailed)

diseases such as AIDS and cancer, was related to their children's receipt of the bcg vaccine, $r(131) = .18, p < .05$ and the mmr vaccine $r(121) = .19, p < .05$. The more parents knew about uncommon non-vaccine-preventable diseases, the higher the likelihood that their children were immunized against tuberculosis, measles, mumps, and rubella.

Parents' attitudes about immunization were also found to be related to their children's immunization statuses. Parents' belief in universal mandatory immunization was positively correlated with their children's receipt of the opv, $r(130) = .21, p < .05$ (see Table 15). Parents who believed that the government should provide free vaccines and require all children to be immunized in order to ensure greater immunization

Table 15

Relationship Between Children's Immunization Statuses and Parents' Scores on Factors in the Attitude Scale

Vaccine	Factor1	<i>n</i>	Factor2	<i>n</i>	Factor3	<i>n</i>
BCG	.10	129	.11	131	.08	126
DPT	.04	129	.03	130	.18*	126
OPV	.21*	130	.12	131	.17	128
Hepatitis B	.11	126	.15	127	.01	123
Hib	-.08	121	.05	122	.20*	121
Typhoid	-.02	114	.14	116	.23*	113
MMR	.02	118	.15	119	.14	116
Varicella	.08	116	.12	118	.22*	115
Hepatitis A	.02	125	.05	126	.06	124
Influenza	-.13*	125	.06	126	.06	124

Factor1 = Belief in universal immunization

Factor2 = Negative opinions about immunization

Factor3 = Positive opinions about immunization

* $p < .05$ (2-tailed)

coverage of children in India, were also likely to have children who were immunized against polio.

Parents' positive opinions about immunization were positively correlated with their children's receipt of the dpt vaccine, $r(126) = .18, p < .05$; the hib vaccine, $r(121) = .20, p < .05$; and the typhoid vaccine, $r(113) = .23, p < .05$. Parents who had the attitude that immunizations ensure a healthy childhood and the benefits of immunization outweigh the risks associated with them were likely to have immunized their children against diphtheria, whooping cough, tetanus, haemophilus influenza type b infections, and typhoid.

Research Question 8: What are the Sources of Parents' Knowledge About Immunization?

Frequency distributions were generated to understand the source of respondents' knowledge about immunization. Respondents indicated a variety of sources from which they had received information about immunization. In all, doctors appeared to be the single largest source of information about immunization with over 27.4% of respondents indicating that they had received immunization-related information from doctors. A related source of immunization-related information was hospitals where 17% of respondents reported receiving information about immunization from a hospital.

Close to 16% of respondents reported receiving information about immunization from family members while over 15% reported hearing immunization-related information on the radio or the television. The news represented a source of immunization-related

information for 12% of the respondents. A small percentage of respondents (5.3%) cited the workplace as a source of immunization information. An even smaller percentage (4.3%) indicated that they received information about immunization from the child's school. Only 2.9% of respondents cited some other unspecified source as an avenue through which they acquired information about immunization.

Additionally, respondents indicated more than one source of knowledge about immunization. When responses that fell into more than one category were taken into account, 71% of respondents indicated that they had heard about immunizations from doctors while more than 47% reported receiving immunization information from a hospital (see Figure 1).

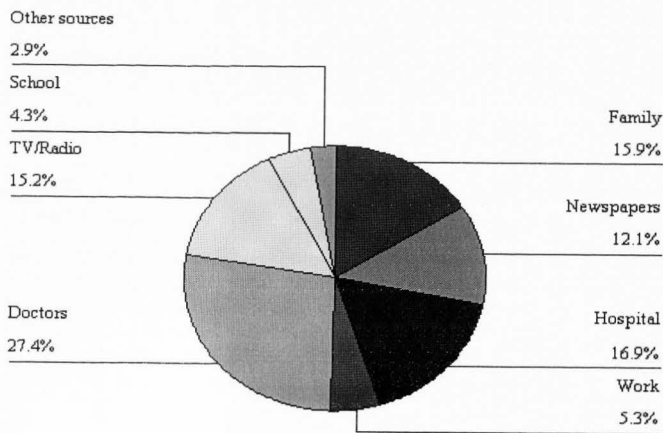


Figure 1. Sources of parents' knowledge about immunization.

Over 45% of respondents reported receiving information about immunization from family members; over 42% reported hearing immunization-related information on the radio or the television. Thirty-four percent of respondents reported learning about immunization from the news media. A few (15.2%) cited the workplace as a source of immunization information. Finally, 12.1% of respondents indicated that they received information about immunization from the child's school, while 8.1% stated that they learnt about immunization from another, unspecified source.

CHAPTER V
DISCUSSION

The goal of this study was to determine parents' knowledge and attitudes about immunization in India. In particular, this study explored the relationship between respondents' knowledge about immunization, attitudes toward immunization, and respondents' gender, educational level, age, child's gender, and child's immunization status. This study also explored the sources of parents' knowledge about immunization. To understand these relationships, the following research questions were generated:

1. What is the level of parents' knowledge about immunization in India?
2. What are the attitudes of parents in India toward the immunization of children?
3. Is there a relationship between parents' knowledge about immunization and their attitudes toward immunization?
4. Is there a relationship between gender and (a) knowledge about immunization and (b) attitudes toward immunization?
5. Is there a relationship between an individual's level of education and (a) their knowledge about immunization and (b) their attitudes about immunization?
6. Is there a relationship between a person's immunization status and (a) their knowledge about immunization and (b) their attitudes toward immunization?
7. Is there a relationship between a child's immunization status and (a) parental knowledge about immunization and (b) parental attitudes toward immunization?
8. What are the sources of parents' knowledge about immunization?

Respondents' Knowledge About Immunization

Parents' knowledge about immunization in this sample was divided into two categories: (a) knowledge about general immunization-related issues and (b) knowledge about specific, vaccine-preventable diseases. In general, parents in this sample had a high level of knowledge about vaccine dosage and vaccine composition. In comparison, their level of awareness about vaccine failures and side-effects was lower. Despite these differences, the overall level of knowledge about general immunization-related issues was relatively high, as the vast majority of respondents responded accurately to most of the questions in the knowledge scale. The differences that emerged might have been attributable to the fact that immunization receives much public attention in India, with a major focus on making parents aware of the benefits of immunization along with the mechanics of the process, such as vaccine dosage, and composition. On the other hand, due to the high level and visibility of vaccine-preventable diseases (Sharma, 2000b), vaccine failures and side-effects are less publicly acknowledged, and few public health services focus on these issues. Consequently, it is not at all surprising that parents were more knowledgeable about some facets of immunization-related issues than others. When underlying dimensions of general vaccine-related awareness were teased out, it appeared that certain levels of awareness about vaccines went together. Typically, as revealed by factor analyses, knowledge about vaccine dosage and target population for vaccination went hand in hand. This is intuitively explained by the fact that publicized versions of the Indian immunization schedule contain clear recommendations for age and

dosage of vaccine administration (<http://health.indiamart.com/kidshealth/vaccine/kids-immunization-record.html>).

Presentation of age specific information along with recommendations for dosage seemed to be responsible for this particular grouping of conceptual knowledge. Consequently, efforts to spread awareness about vaccine related knowledge should incorporate this grouping of concepts in the immunization awareness programs. Recognition that certain concepts group together can help researchers and policy makers who are entrusted with generating immunization awareness to develop more effective models of immunization education. For instance, parent's knowledge about the availability of vaccines for certain common childhood diseases clustered together. Parents' knowledge of the preventability of polio occurred alongside their knowledge of the preventability of measles, both very common childhood diseases in India. Because polio vaccination is strongly incorporated into current systems of healthcare delivery, providing information to parents about newer, lesser known vaccines like the Pneumonia vaccine at the same time as the polio vaccine might prove to be an effective strategy (Key, 1996).

Similarly, respondents' awareness about the accompanying side-effects of vaccines grouped with their awareness of vaccine failure. It is vital to recognize that parents lacked sufficient knowledge about vaccine failures and side-effects while simultaneously being aware that vaccines can sometimes cause the diseases they were intended to prevent. This can be a major hindrance for children's immunization, especially among parents with lower levels of education (Tuma et al., 2002). An

effective immunization education strategy would be to incorporate a recognition of these issues, informing parents that vaccines do have the possibility of failing, while at the same time giving them factual information about the likelihood of such failures and their magnitude. Incorporating parental concerns about immunization as an integral part of immunization education could prove to be highly effective because of its potential to empower parents by increasing their level of factual information about these issues.

The second category of immunization knowledge held by respondents in this sample was related to their understanding of specific vaccine-preventable diseases. The majority of respondents accurately identified vaccine-preventable diseases from a list of common and uncommon diseases. The exception to this was the one where the majority of respondents failed to identify influenza as a vaccine-preventable disease. This finding is clearly attributable to the fact that the influenza vaccine is not mandated or recommended in the Indian immunization schedule (<http://health.indiamart.com/kids/health/vaccine/kids-immunization-record.html>).

Overall, parents' knowledge about common vaccine-preventable diseases clustered together, as did their awareness about common non-vaccine-preventable diseases and uncommon non-vaccine-preventable diseases. Again, the publicity accorded to immunization as well as clear recommendations about vaccine-preventable diseases in the immunization schedule may have accounted for this grouping of knowledge. Whatever the reason, the fact that ideas clustered together is highly relevant for those interested in developing immunization education models in India.

Interestingly, parents in the sample were more likely to identify chicken pox as a vaccine-preventable disease (90.5%) compared to measles (86.6%) and mumps (72%). This finding was surprising owing to the fact that chicken pox vaccine (varicella) has only recently been included in the Indian immunization schedule, while the vaccines against measles and mumps (MMR) have been a part of the Indian immunization schedule for a longer period of time. This might be another clear indication that the publicity accorded to immunization in India is relatively high and the current sample had a high level of awareness about both the specific and general issues pertaining to immunization. This finding somewhat contradicted the idea that parents in developing nations have a lower level of immunization-related knowledge. For instance, unlike parents in the Bushenyi district of Uganda (Mulindwa et al., 2000), parents in Hyderabad, India had a high level of knowledge about immunization. Similarly, in contrast to other research conducted in India ("Indian Parents Stay Away from Immunization Campaign," 2002), the parents in this sample were highly knowledgeable about immunization and had very few misconceptions about both general immunization-related information and specific vaccine-preventable diseases. However, it must be noted that these contrasting findings are probably attributable to differences in the samples employed in these studies.

Parents' Attitudes About Immunization

The findings indicated that respondents in this sample had very positive attitudes toward immunization. Respondents clearly believed that immunization is a vital public health intervention. They believed that immunization coverage should be made universal

and mandatory. Further, they perceived that ensuring such coverage was primarily the responsibility of the government of India. This finding was of special relevance when viewed from the perspective that the Indian Medical System is modeled on a socialist pattern (Sharma, 2000a). The majority of respondents believed that socialist style policies should be enacted to ensure maximal immunization coverage of children in India. Consistent with extant literature (Nath et al., 1998), many of the respondents in this study perceived that immunization initiatives should be under the purview of the central/state governments.

Respondents in this study also had some valid concerns about immunization, and most of the concerns centered on the cost of vaccines. Vaccines like varicella and hepatitis A are not offered free of cost in the public sector but rather at prohibitive prices in the private sector. Several parents expressed negative attitudes toward immunization due to this fact. This finding was similar to findings in the U.S., where parents' negative attitudes toward immunization were rooted in the prohibitive costs of immunization (Gellin et al., 2000; Orenstein et al., 1990).

A related concern was that parents appeared to find the immunizations schedule confusing at times. Some vaccines were recommended only in the private sector and were not offered in public health care settings. The explanation for this might be that immunization recommendations are minimal in public health care settings to ensure maximal immunization coverage, and public health care settings provide immunization free of cost; consequently only the most "basic" vaccines are recommended here. Parents in this sample who visited both settings were faced with parallel forms of the

immunization schedule, perhaps leading to negative attitudes toward immunization on their part. This finding was similar to that in the U.S., where the complexities of the immunization schedule led to negative attitudes among parents toward the process (Taylor et al., 2002).

Additionally, parents' attitudes toward immunization were also impacted by their lack of factual awareness about the issue and their concerns of side effects. A few parents commented that children's immunization could lead to a suppressed immune system and to poorer health. This finding was consistent with research conducted in North India, where parents' expressed concerns about the side-effects associated with immunization ("Reasons for Nonimmunization of Children in North India Identified," 2002). Parents in this sample were also concerned about vaccine failure. Despite the presence of real concerns in the minds of parents, the vast majority of them expressed very positive attitudes toward immunization. They viewed the process as highly beneficial to children's well-being and health. Most of the respondents actively advocated for active governmental initiatives to improve children's immunization coverage. Overall, these findings are consistent with those of the studies reviewed in the literature. This sample of parents from Hyderabad, like parents studied in the U.S., viewed immunizations as a vital health intervention for their children (Strobino & Keane, 1996; Taylor & Cufley, 1996). As suggested by Tuma and colleagues (2002), this finding may be explained by the fact that the sample resided in urban areas with possibly adequate access to health care.

Relationship Between Parents' Knowledge and Attitudes About Immunization

Correlational analyses revealed the existence of a relationship between what respondents in the sample knew about immunization and what their attitudes toward the process were. Comparisons of factors on the knowledge and attitude scales yielded a richer understanding of the facets of this relationship. The more knowledgeable the parents were about general immunization-related issues such as, "vaccines require more than one dose and can be administered to both children and adults," the more likely they were to believe that immunizations ensure a healthy childhood. The finding that parents who were knowledgeable about the side-effects of immunization were also likely to believe that vaccines are potentially harmful is intuitive.

These findings were consistent with other research examining the relationship between parental knowledge and attitudes. Similar to findings that emerged in Uganda (Mulindwa et al., 2000), parental knowledge (or misconceptions) were related to their attitudes toward immunization. Although research on immunization in India has not specifically looked at the relationship between knowledge and attitudes toward immunization, the question is implicitly addressed in past research. Parents who had misconceptions about immunization thought of the process negatively (Nath et al., 1998). The findings of this study therefore seemed consistent with past research in India and other developing nations. Interestingly, while knowledge about the downside of immunization was related to negative attitudes about the process, parents appeared to believe that, overall, the benefits of immunization outweigh the risks. Apparently, more knowledge about the negative facts was not associated with more negative opinions about

immunizations. Rather, it was associated with positive attitudes, despite the perceived risks.

Gender Differences in Knowledge and Attitudes About Immunization

The findings of this study indicated that gender was related to parents' knowledge about immunization, but not to their attitudes. The overall level of awareness of both males and females about general and specific issues pertaining to immunization was quite high. However, females appeared to know more about immunization than males. Additionally, parents in this sample were no less likely to immunize their daughters as compared to their sons. This finding was interesting when viewed in the light of the fact that India is a patriarchal society where males enjoy precedence over females. Females consequently enjoy less access to education and healthcare. Additionally, past research has indicated that sons enjoy precedence over daughters in childhood immunization (Pande & Yazbeck, 2003). The findings of the present study yielded a contrasting view to previous research (Feauveau et al., 1991; Gupta et al., 1978; Pande & Yazbeck), which indicated that females may be less likely to have access to the health care system, implicitly suggesting less knowledge on their part of health care issues.

A contrasting perspective might be the fact that females are primarily entrusted with child rearing and are predominantly responsible for children's health care. Further, mothers are frequently informed about immunization recommendations during pregnancy and immediately after childbirth. Males may lack access to this information because childbirth and childcare are viewed as part of the female experience and occur with less

male involvement. These factors may have cumulatively contributed to the fact that females possessed greater awareness about immunization than males.

In the light of females' greater level of knowledge about immunization, it could be expected that their attitudes about immunization might be more positive than those of males. Surprisingly, the results of this study did not indicate this. Perhaps this is because females typically find themselves responsible for children's health care and often have to cope with the side-effects and discomforts of immunization (e.g., pain and fever) as experienced by their children. Consequently, females may be unlikely to view the process more positively than males, even though they may consider that the overall benefits and outcomes are worthwhile.

The Relationship Between Parents' Education and Their Knowledge and Attitudes About Immunization

The results of this study suggested that parents' education was related to their knowledge and attitudes about immunization. Parents with higher levels of education tended to be more knowledgeable about general immunization-related issues. They also possessed more knowledge about which diseases are vaccine preventable. Parents with more education were also likely to think that vaccines could ensure a healthy childhood for their children. These findings were consistent with previous research, which has suggested that parental education is positively related to their knowledge and attitudes toward immunization (Tuma et al., 2002). The findings of this study were also similar to those of Taylor and Cufley (1996), who suggested that parental education affects

children's immunizations by impacting parents' awareness and attitudes on the subject. In general, parents who were highly educated tended to be better informed about the benefits and risks of immunization. In turn, greater knowledge seemed to be accompanied by more positive attitudes. Interestingly, these relationships appear cross-culturally and seem to be pervasive in diverse contexts. As in developed nations, parents in developing nations with higher levels of education tend to be more likely to view immunization as a vital health intervention for children than parents with lower levels of education.

Further, parents in this sample resided in urban areas and may consequently have had a high sense of self-confidence in terms of their ability to access health immunization. Tuma and colleagues (2002) suggested that parents in developing nations who live in urban areas tend to have more positive attitudes toward immunization, a finding that may explain the patterns that have emerged in this study on respondents' knowledge and attitudes in India.

Parents' Immunization Status and Their Knowledge and Attitudes About Immunization

Parents' knowledge and attitudes about immunization appeared to be related to their immunization status. Parents who were immunized themselves had more knowledge about immunization than parents who had not been immunized. The exception to this was that parents who had not been immunized had more knowledge about the disease-causing potential of vaccines than those who had been immunized.

One speculative explanation for this might be that respondents who were not immunized may have been more sensitized to the issue of the disease-causing potential of vaccines. Concerns about the disease-causing potential of vaccines may have served as a reason for their not having been immunized during childhood. Consequently, these individuals may have had a heightened sense of awareness about the issue. On the other hand, it may also be possible that these parents may use concerns pertaining to the disease-causing potential of vaccines as a rationalization of their decisions not to receive immunization.

Despite this exception, statistically significant differences emerged between those who were immunized and those who were not in terms of their knowledge about immunization. Similarly, those who had been immunized were likely to have a more positive attitude about immunization than those who had not been immunized. While these results may appear intuitive, the converse of them might also be true. Parents who have never been immunized themselves may know less about immunization and have less positive attitudes on the subject. Although immunization is not a novel phenomenon, widespread immunization is definitely a product of the past few decades, owing to the intensification of efforts on the part of the WHO and the Indian government. Consequently, it is highly possible that immunization rates are lower for older generations than for younger generations. Since the findings of the present study indicated that parents who have not been immunized had less knowledge and less positive attitudes about immunization, the possible implications of this are that there are a significant number of parents in India, who have never been immunized themselves, and who have little knowledge about or interest in immunization.

Relationship Between Parents' Knowledge and Attitudes About
Immunization and Children's Immunization Status

Parents' knowledge about immunization was related to their child's immunization status. For the most part in this study (with the exception of hepatitis A and varicella vaccines), the more parents knew about general immunization-related issues and specific vaccine-preventable diseases, the more likely they were to immunize their child. Similarly, attitudes about immunization were found to be related to children's immunization status. The more positive parents' attitudes about immunization, the more likely they were to immunize their children. These findings were consistent with some studies, while they contradicted other findings. The findings of the present study were consistent with those of Tuma and colleagues (2002), who found that parents in developing nations who had a positive attitude toward immunization were more likely to have children who were up to date in terms of their immunization schedule. Parents who knew more about immunization and who had positive attitudes about the process were more likely to immunize their children than parents who had reservations about the process.

A similar finding emerged in Uganda (Mulindwa et al., 2000), where parents who lacked adequate knowledge and who had negative attitudes about immunization were hesitant to immunize their children. A related finding in India was that parents who had erroneous perceptions about immunization and who had negative opinions on the issue were likely to refrain from immunizing their children ("Indian Parents Stay Away from Immunization Campaign," 2002). While these studies appear to point toward the

relationship between parental knowledge and opinions about immunization, other studies suggest the contrary. For instance, past research has suggested that while parents may have negative opinions about immunization, these opinions are only modestly associated with their decisions to immunize their children (Taylor et al., 2002). Other studies have found no relationship between parents' knowledge and attitudes about immunization and their children's actual immunization status.

The findings of the present study and other studies like it, that parents' knowledge and attitudes about immunization were related to their children's immunization statuses, are profound because of their implications for researchers and policymakers. However, it is important to note that correlation does not imply causation. The fact that parents' knowledge and attitudes about immunization were related to children's immunization statuses does not imply that one causes the other. In fact, the reverse may also be true; parents who actually immunized their children may have been more likely to gain more awareness about the issue and or to view the process in a positive light. Furthermore, there is always the possibility that some other unexplained factor may have impacted parents' knowledge and attitudes about immunization as well as their children's immunization statuses. It is also important to bear in mind that the magnitude of relationships observed was relatively small.

Sources of Parents' Knowledge About Immunization

The vast majority of the respondents in this sample indicated that they had heard about immunization from doctors and in hospitals. The print media, television, and the

radio also were sources of information on children's immunization for a significant number of respondents in this sample. The family appeared to be the next major source of information about immunization for the respondents. Interestingly, the child's school and respondent's place of work seemed to be less salient sources of immunization information for parents.

The results of this study indicated that doctors and the health care system represent a major source of information on immunization for parents in India. As mentioned earlier, immunization information is given to women during pregnancy and immediately following childbirth. Hence, it is logical that parents received information about immunization in this setting. The media was another major source of information about immunization for parents in India. This finding indicated that the media is an effective socialization agent and can be a vital channel of immunization information in India. The media can be used to target parents who may not actively interact with health care personnel. Interestingly, the school setting did not appear to be a major source of immunization information for parents. However, the school setting plays a major role in the lives of families with children in India. Apparently, this source is underutilized in that nation.

These findings are consistent with past research in the U.S., where Gellin and colleagues (2000) found that 84.2% of respondents in a study stated that doctors were their primary source of information about immunization. Most of the respondents in this study had reported learning about immunizations in a health care setting. In addition, they also reported learning about immunization from newspapers, magazines, and books.

Theoretical Implications

The findings of the present study provide empirical validation for Urie Bronfenbrenner's (1989) ecological systems theory. Although this study did not focus on any theoretical constructs in particular, its findings shed light on the role played by different layers of the environment on child development. To begin with, at the level of the microsystem, parental beliefs and attitudes appeared to have an impact on the trajectory of child development. Parents who had more knowledge about children's immunization and positive attitudes toward the process were more likely to have immunized their children against specific vaccine-preventable diseases than parents who lacked awareness about immunizations or had negative opinions about the process. Secondly, the influence of forces in the level of the mesosystem was also evident. Children's immunization was related directly to their parents' knowledge and attitudes about immunization. Parents' level of knowledge about immunization and their attitudes about immunization were related to their children's receipt of specific vaccines. Further, parents reported that their experiences with the health care system in India (e.g., in the form of dichotomies in the vaccine schedule) affected their abilities and decisions to immunize their children.

The present study indicated that parents' attitudes may be impacted by their interactions with the health care system. Several parents indicated that they found a dichotomous presentation of the immunization schedule that created confusion in their minds about which vaccines were mandatory and which were not. Concerns about the costs of immunizing their children were also salient in parents' opinion about

immunization, bearing evidence of the impact of forces in the exosystem on child outcomes. Although the Indian government places a heavy emphasis on immunization, some vaccines are expensive and not readily available. At a policy level, many parents believed that providing vaccines free of cost would enhance immunization coverage of children in India. Also, the emphasis placed on immunization in the media and health care system is evidence of the exosystem influences impacting child outcomes, as parents reported that these were their greatest sources of information about immunization. At the level of the macrosystem, it was clear that while emphasis and publicity are directed at immunization in India, on a national level, funding devoted to immunization is inadequate. The limited access and affordability of vaccines presents a clear barrier to widespread immunization in India.

Implications for Research, Policy, and Education

The findings of this study have implications for researchers, educators, and policy makers. This study explored some rarely researched issues. While research in the U.S. has focused on parents' knowledge and attitudes about immunization, insufficient attention has been directed towards understanding what impact these variables have on children's actual immunization coverage. The present study represents a step in this direction. Although causation is not established among the variables in the present study, the relationship between them is examined, representing a step in the right direction. Future research needs to focus on clearly examining these issues.

Additionally, the present study needs to be replicated using more diverse samples across India to yield a clearer picture of parental awareness and attitudes about immunization across that nation. A related suggestion might be to replicate this study in several developing nations to understand whether common or contrasting patterns emerge. While a few studies in Africa (e.g., Mulindwa et al., 2000) examined this issue, the source of parents' knowledge, the relationship between their level of knowledge and their attitudes about immunization, and the relationship between parents' knowledge and attitudes about immunization and their children's immunization statuses remain largely unexplored. It would be interesting to discover whether patterns that emerge in India are similar to those in other nations, both developing and developed.

Another possible direction for future research on the subject of childhood immunization in India might be to explore the issues of gender differences in childhood immunization in India. Past research has documented that females tend to have lower immunization levels than males (Gupta et al., 1978). There is a need for in-depth exploration of the various issues surrounding gender bias in children's immunization in India.

This study also has implications for policy in India. At the fundamental level, policymakers need to address issues of clarity in the immunization schedule and the cost of vaccines in India. Although the Indian Academy of Pediatrics releases clear recommendations for children's immunization on a routine basis, issues of cost and availability appear to have led to a dichotomy in immunization schedules in India. Apparently, middle class parents who frequent both public and private health care

systems are more affected than high income or low-income families who use one or the other system exclusively. Be that as it may, there is an urgent need for the regulation of the immunization schedule to ensure consistent recommendations in public and private sectors. A related suggestion is to regulate the availability of vaccines to ensure that all vaccines are equally available in the public and private sector. It is also vital that the cost of vaccines in the private sector be regulated; regulation of the availability and cost of the vaccines may go a long way in enhancing the immunization coverage of children across India. Another key implication for policymakers is based on the finding that women were more knowledgeable than men on immunization-related issues. Since women are entrusted with the responsibility of child health care, it is vital that policymakers focus on ways to enhance knowledge about immunization among women across India. A related approach might be to enhance knowledge about immunization among fathers as well. Interestingly, with the impact of modernization, more males are beginning to take an active role in childrearing in urban India. Approaches that focus on educating men and women simultaneously might prove to be highly effective.

Door-to-door immunizations have been conducted in some parts of India in the past. Increasing the availability of low cost or free vaccines close to the home might be effective because women may lack the ability and transportation to travel long distances to immunize their children. There is also a need for policymakers to increase educational programs about immunization in health care settings. However the mass media also can be used as a vital tool to target those parents who underutilize the health care system in

India, since a large number of respondents reported hearing about immunization in the news or on the television or radio.

The school system does not appear to be a major source of information about immunization for parents in India. Current policy in India does not mandate that children be immunized to gain entry to preschool or kindergarten. Because the educational system in India is highly respected, it is possible parents might be likely to comply with immunization recommendations made in the context of the school setting. As suggested by respondents in this sample, providing free immunizations to children in schools and requiring mandatory immunization for preschool and kindergarten entry might lead to broader immunization coverage of children in India.

Further, this study has relevance for educators who are interested in developing immunization awareness programs. The understanding that immunization concepts cluster together has implications for the design of immunization education models. At the most fundamental level, there is an urgent need to educate people across India about immunization because parents' knowledge about immunization is related to children's immunization statuses. Immunization programs need to target women specifically to empower them with greater awareness about the issue. Immunization education programs delivered by females are likely to be better received by women, owing to the gendered nature of childrearing in India. Finally, there is an urgent need to direct immunization education toward parents who have never been immunized even as the present study indicates that an individual's immunization status is directly related to

his/her knowledge and attitudes about immunization and indirectly to decisions to immunize his/her children.

Limitations

This study had a number of limitations. To begin with, the sample was a convenience sample. There was very little variability in terms of respondents' education and income level. Most of the respondents belonged to middle class families; all of them resided in a major city in India. Consequently, the findings of this study may not represent parents' understanding and opinions about immunization uniformly across India. This study lacked external validity and can only be said to represent phenomena that pertain to the middle class families in urban India, and perhaps even to upper class families in rural India who may have similar access to health care information and services owing to higher income levels.

A related limitation of this study was the limited reliability of the measure. However, finding statistical significance in the absence of adequate reliability is often unlikely, owing to the high percentage of error in the observed scores. Detecting statistical significance in the event of low reliability is an indication that, despite the high level of error in measurement, relationships do exist among variables. Consequently, it is encouraging to note the presence of statistically significant relationships between the variables, despite the low reliability of the measure employed in this study. On the other hand, it must also be noted that this study generated a high number of statistical tests. The emergence of statistically significant findings in the event of a large number of tests

is also highly likely. Furthermore, the strength of the correlations between variables was quite small. Consequently, the practical relevance of these findings may be limited despite the fact that they are statistically significant.

Another limitation of this study is that the instrument yielded data that could be typically studied for correlations. Causation was impossible to establish owing to the limitations of the type of data that could be collected using the design of this study. Because of its correlational design, this study could not establish that certain variables preceded others consistently, occurred concurrently or were exclusive explanations for observed relationships.

Implications for Researchers and Policymakers

The findings of this study have implications for researchers and policymakers in India who are interested in increasing levels of immunization among children across the nation. The fact that parents who had higher levels of education had greater knowledge and more positive attitudes toward immunization is encouraging. In addition, it can be an indication of the need to target individuals with lower levels of education in order to impress upon them the benefits of immunization. Parents who were more knowledgeable about the issue were also more likely to immunize their children. Policies need to be enforced that foster greater awareness among parents in India about the benefits of immunization.

Most of the parents in this study indicated that the health care setting was their primary source of information about immunization. The implications of this for

researchers and policymakers interested in educating parents about the benefits of immunization are profound. However, the mass media can also be a vital tool to target those parents who underutilize the health care system in India, since a large number of respondents reported hearing about immunization in the news or on the television and radio.

The school system seemed to be a less salient source of information about immunization. However, the educational system is a highly respected setting in India and parents are highly likely to comply with recommendations for immunizations made in this context. Policymakers could enact policies to tie childhood immunization with the educational setting in order to encourage parents to immunize their children. Doing this in government schools that are more likely to be attended by children who come from families belonging to a lower socioeconomic status might be most effective.

Conclusion

The findings of this study indicated that what parents know about immunization is related to their attitudes on the subject. Further, their knowledge and attitudes are related to their educational level, gender, and immunization status. Patterns of parents' knowledge and attitudes about immunization in India do not appear to be very different from those in other nations of the world. However, the WHO and other organizations interested in enhancing immunization coverage of children in India appear to group nations under blanket terms with blanket policies to address their needs. There is a need for effort on the part of researchers in these agencies to recognize unique as well as

similar patterns and develop immunization education and delivery systems that are tailored to the needs of individual nations. Additionally, at a national level, there is a need to eliminate all barriers to immunization that are inherent in the socioeconomic backgrounds from which children hail. Researchers and policymakers can work together to ensure that all children have equal access to immunization that is unrelated to their parents' income or educational status. There is a need for the government to take a more proactive stance in India in ensuring that all children are immunized.

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APPENDICES

Appendix A. Instrument

KNOWLEDGE & ATTITUDES ABOUT IMMUNIZATION

Part 1

Please read the following items and answer them to the best of your ability. If you think an item is true, please circle or tick "YES" or "TRUE." If you think an item is inaccurate, please circle or tick "NO" or "FALSE."

1. Have you ever heard of the terms, "immunizations" or "vaccinations?"
 YES NO

2. Vaccines are injections or substances orally given to people to protect them from diseases.
 TRUE FALSE

3. All vaccines are given in one dose only.
 TRUE FALSE

4. Only children can be immunized against disease.
 TRUE FALSE

5. For certain types of vaccines, it is necessary to visit the doctor several times and to give the child the vaccine several times to protect the child from the diseases associated with them.
 TRUE FALSE

6. Vaccines protect people from the following diseases: (Tick all that apply)

<input type="checkbox"/> Polio	<input type="checkbox"/> Pneumonia
<input type="checkbox"/> Cancer	<input type="checkbox"/> Influenza
<input type="checkbox"/> Chickenpox	<input type="checkbox"/> Cold
<input type="checkbox"/> Mumps	<input type="checkbox"/> Bronchitis
<input type="checkbox"/> Measles	<input type="checkbox"/> Cough
<input type="checkbox"/> AIDS	<input type="checkbox"/> Diarrhea

7. Vaccines are tiny amounts of disease-causing organisms given to children in order to increase their immunity against diseases.
 TRUE FALSE

8. Some vaccines are given several times to prevent diseases. For such vaccines, if children do not receive all their vaccine doses, the vaccine may not work to prevent diseases.
 TRUE FALSE

9. On rare occasions, vaccines may cause the diseases they are intended to prevent.
 TRUE FALSE

10. When children are immunized, they always develop a fever.
_____ TRUE _____ FALSE

11. The majority of people who are immunized develop the disease symptoms they are immunized against.
_____ TRUE _____ FALSE

Please turn over to the next page

Part 2

Now, a few questions about your feelings about immunizations follow. For each of the following, please indicate your position on the issue by circling the number that corresponds to your opinion. The options are: Strongly Disagree = SD (1), Disagree = D (2), No Opinion = N (3), Agree = A (4), and Strongly Agree = SA (5).

	SD	D	N	A	SA
1. In general, immunizations are beneficial for children.	1	2	3	4	5
2. Immunizations should be made compulsory for all children.	1	2	3	4	5
3. Some diseases cannot be prevented by immunizations, and children often suffer from them. Despite this, immunizing children can ensure that they are healthy throughout childhood.	1	2	3	4	5
4. Vaccines are one of modern science's greatest discoveries.	1	2	3	4	5
5. All vaccines are expensive.	1	2	3	4	5
6. The government should provide free vaccines for all children.	1	2	3	4	5
7. Vaccines are harmful to children.	1	2	3	4	5
8. If vaccines were free, all children would be immunized.	1	2	3	4	5
9. The benefits associated with immunization of children far outweigh the potential risks associated with vaccines.	1	2	3	4	5

Please turn over to the next page

Part 3*Please take a moment to tell us about yourself.*1. **Your age at your last birthday :** _____ years2. **Your relationship to the child (Please circle one):**

Mother

Father

Grandmother/grandfather

Other _____

(Specify)

3. **Your highest level of education (Please circle one):**

No schooling

Some schooling (Please circle the highest class attended): 1 2 3 4 5 6 7 8 9 10Intermediate (Please circle highest level attended): 1st year 2nd yearDegree (Please circle year) 1st year 2nd year 3rd year 4th year

Other (Please indicate) _____

Post-graduate work?

Yes

No

List degrees awarded, if any

4. **Have you ever been immunized yourself?**

(Circle one)

Yes

No

5. **Please list all your children's ages, sex and vaccination status in the table that follows. Start with the oldest child and proceed in order, to the youngest child.***Please turn over to the next page*

CHILD NUMBER	AGE	SEX	EVER VACCINATED?									
			Please indicate which of the following vaccines (if any) your child has received by ticking under the appropriate vaccine:									
			BCG Tuberculosis	DPT Diphtheria Polio Tetanus	OPV Polio	Hepatitis B	Hib Hemophilus influenza B	Typhoid	MMR Measles Mumps Rubella	Varicella Chicken Pox A	Hepatitis	Influenza
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												
10.												

6. In column 1 of the table above, please circle the number that corresponds with the child that brought this questionnaire to you.
7. Where did you get information about how to get your child / children immunized? (Tick all that apply)
- | | |
|----------------|-------------------------------|
| Family members | Doctors |
| News Programs | Television and Radio Programs |
| Hospital | Children's School |
| My Work Place | Other _____ |
- (Please Specify)
8. Please feel free to make any comments you desire.

THANK YOU FOR YOUR TIME AND ASSISTANCE !!

Appendix B. Table

Table B1

Test-Retest Reliability on Knowledge and Attitude Scales

Item	Level of Agreement
<u>Items on Knowledge Scale</u>	
1. Vaccines are injections/oral substances designed to protect people from diseases	95.7%
2. All vaccines are given in one dose only	95.7%
3. Only children can be immunized	95.7%
4. Some vaccines require several doses to be effective	76.2%
5. Vaccines are tiny amounts of disease causing organism	86.9%
6. Vaccines protect people from the following diseases:	
Polio	91.3%
Cancer	100.0%
Chickenpox	100.0%
Mumps	82.6%
Measles	91.3%
AIDS	100.0%
Pneumonia	87.0%
Influenza	73.9%
Cold	86.9%
Bronchitis	91.3%
Cough	82.6%
Diarrhea	95.7%
7. Vaccines are tiny amounts of disease causing organisms	91.3%
8. Failure to receive <u>all</u> vaccine doses can compromise immunity	100.0%
9. Rarely, vaccines may cause the diseases they are intended to prevent	76.2%
10. Children always develop a fever following immunization	73.9%
11. The majority of those immunized develop the disease symptoms	89.5%
<u>Items on Attitude Scale</u>	
1. In general, immunizations are beneficial	69.5%
2. Immunizations should be made compulsory for all children	72.6%
3. Immunizing children ensures they remain healthy throughout childhood	56.4%
4. Vaccines are one of modern science's greatest discoveries	65.1%
5. All vaccines are expensive	52.1%
6. The government should provide universal free immunization	62.0%
7. Vaccines are harmful to children	73.8%
8. Free vaccines would ensure universal immunization	60.8%
9. Benefits of immunizations outweigh risks	49.9%

Appendix C. Letters

April 26, 2002

Dear Madam/Sir,

I am a doctoral student in the Department of Family & Human Development at Utah State University, 2905 Old Main Hill, Logan, UT 84322-2905, U.S.A. As part of my doctoral research, I am studying parents' awareness about immunization of children. As part of this study, I would like to administer a questionnaire to the parents whose children are enrolled in your school. Immunization is a really important issue even as various public health officials in India and abroad are concerned about slowing the spread of preventable diseases. Parents' participation in this study is crucial, as their ideas will shed light on this issue.

I request your permission to conduct this study in your school. Your participation in this research will require you to send home a copy of the questionnaire attached to this letter with the children. The questionnaire will be completed by parents / guardians of the children. It contains questions about their ideas and feelings about the immunization of children. The entire procedure will take them no more than 15 to 20 minutes.

Participating in this research will not expose the children, parents, or school to any risks. However, your participation will result in several social benefits. Public health officials in India and abroad will gain a better understanding of the factors that guide parents' decisions to immunize their children. It will also enable policymakers to understand where parents get information about immunization related issues.

Your participation in this study is voluntary; you are free to refuse to participate in this study and may withdraw from it any time. Only I will review responses and any information that parents share will be confidential. I will remove all means of identifying respondents as soon as all the questionnaires are filled out and returned to me. Some parents will also need to be selected to receive a second copy this questionnaire a few weeks later, to ensure that this questionnaire is a reliable means of understanding their ideas and opinions about immunization. I request permission to gather this information a second time from approximately 50 parents

Utah State University's Institutional Review Board has reviewed this research to ensure that the procedures employed follow ethical standards. If you have any questions please do not hesitate to contact me.

Sincerely,

Anne Thomas
Doctoral Candidate
Utah State University

Shelley L. K. Lindauer, Ph.D.
Interim Department Head
Director, Adele and Dale
Young Child Development
Laboratory

April 26, 2002

Dear Parents,

I am a doctoral student in the Department of Family & Human Development at Utah State University, 2905 Old Main Hill, Logan, UT 84322-2905, U.S.A. As part of my doctoral research, I am studying parents' awareness about immunization of children. In addition, I am also interested in understanding your feelings about the issue. This is a really important issue even as various public health officials in India and abroad are concerned about slowing the spread of preventable diseases. Your participation in this study is crucial, as your ideas will shed light on this issue.

I request you to fill out the questionnaire attached to this letter. It contains questions about your ideas and feelings about immunization of children. The entire procedure will take you no more than 15 to 20 minutes.

Participating in this research will not expose you to any risks. However, your participation will result in several social benefits. Public health officials in India and abroad will gain a better understanding of the factors that guide parents' decisions to immunize their children. It will also enable policymakers to understand where parents get information about immunization related issues.

Your participation in this study is voluntary; you are free to refuse to participate in this study and may withdraw from it any time. Only I will review your responses and any information you share is confidential. I will remove all means of identifying you as soon as all the questionnaires are filled out and returned to me. You may be selected to receive a second copy this questionnaire a few weeks later to ensure that this questionnaire is a reliable means of understanding your ideas and opinions about immunization.

Utah State University's Institutional Review Board has reviewed this research to ensure that the procedures employed follow ethical standards.

Anne Thomas
Doctoral Candidate
Utah State University

Shelley L. K. Lindauer, Ph.D.
Interim Department Head
Director, Adele and Dale
Young Child Development
Laboratory

Dear Parents,

A few days ago, you received a questionnaire from your child's school examining your feelings and ideas about children's immunization. Your responses were excellent and helped further the goals of this research.

I am sending you a copy of this questionnaire the second time to ensure that this questionnaire is a valid measure of your feelings and opinions on this issue and that the questions asked are vital and relevant. Please take a few minutes to fill this one out as well and send it with your child to school at the earliest possible instance.

This will be the final step in this research. Thank you for your participation and for the gracious Comments and Suggestions that several of you have made. Your contributions are greatly appreciated!

Sincerely,

Anne Thomas
Department of Family and Human Development
2905 Old Main Hill
Logan, UT 84322
U.S.A

CURRICULUM VITAE

Anne George
 Department of Family, Consumer, and Human Development
 Utah State University
 Logan, UT 84322-2905
 Phone (219) 922-6892
 Email: anne_shamien@yahoo.com

Education:

- Ph.D.: Utah State University, 2003
 Family, Consumer, and Human Development
 Dissertation title: Parents' Attitudes Towards Children's Immunization
- M.S.: Utah State University, 2000
 Family and Human Development
 Thesis title: Children's Awareness, Knowledge, and Understanding of
 AIDS in Bahrain
- B.A.: Nizam College (Osmania University, AP, India), 1997
 Psychology; Sociology; English Literature

Honors and Awards:

College of Education Graduate Teaching Assistant of the Year Award, 2002-2003
 Department of Family, Consumer, and Human Development Graduate Teaching
 Assistant of the Year Award, 2002-2003
 Awarded the President's Ph.D. Fellowship, Utah State University, 2000-2001
 Awarded medal and membership of The Honor Society of Phi Kappa Phi, 2001-2002
 Listed in Dean's Honor Roll, Spring, 2003

Professional Experience:

- 01/03 – present Graduate Instructor, Department of Family, Consumer, and Human
 Development. FHD 1500 (Human Development Across the
 Lifespan); FHD 4240 (Social and Family Gerontology) on Satellite
- 9/02 – 12/02 Graduate Instructor, Department of Family and Human
 Development, Utah State University. FHD 1500 (Human
 Development Across the Lifespan)
- Research Assistant, Department of Family and Human
 Development, Utah State University

- 01/02 – 05/02 Graduate Instructor, Department of Family and Human Development, Utah State University. FHD 1500 (Human Development Across the Lifespan); FHD 3210 (Families and Cultural Diversity) on Satellite
- 09/01 – 12/01 Graduate Instructor, Department of Family and Human Development, Utah State University. FHD 3210 (Families and Cultural Diversity)
Teaching Assistant in Department of Family and Human Development, Utah State University for FHD 4240. Graded assignments, lectured on care-giving in later life, and developed course assignments for students
- 05/01 – 08/01. Research Assistant, coauthored and submitted manuscript for a peer review journal. (Miller, B. C., Park, K., & Thomas, A. (2001) Non marital child bearing. In J. J. Jr. Ponzetti (Ed) International Encyclopedia of Marriage and Family Relationships, New York: Macmillan)

Graduate Instructor, Department of Family and Human Development, Utah State University. FHD 3210 (Families and Cultural Diversity) on satellite
- 08/00 – 05/01. Graduate Instructor, Department of Family and Human Development, Utah State University. FHD 3210 (Families and Cultural Diversity)
- 01/00 – 05/00. Research Assistant, Department of Family and Human Development, Utah State University. Edited manuscripts. Worked as a student teacher in the Adele & Dale Young Child Development Laboratory (CDL) at Utah State University, and administered the Peabody Picture Vocabulary Test (PPVT) to approximately 105 children
- 09/99 – 12/99 Teaching Assistant, Department of Family and Human Development, Utah State University. Graded assignments, lectured on Economic Issues faced by Families

Research Assistant, Department of Family and Human Development, Utah State University. Worked as a student teacher in the Adele & Dale Young CDL at Utah State University, and administered the PPVT to approximately 100 children

- 05/99 – 08/99 Research Assistant, Department of Family and Human Development, Utah State University. Coauthored publishable manuscript
- 01/99 – 05/99 Teaching Assistant, Department of Family and Human Development, Utah State University for a class in Research Methods
- Research Assistant, Department of Family and Human Development, USU. Worked as a student teacher in the Adele & Dale Young CDL at Utah State University
- 08/98 – 12/98 Teaching Assistant, Department of Family and Human Development, USU. Graded assignments and exams; Lectured on assorted topics in Child Development (E.g., Self-Efficacy)
- Research Assistant, Department of Family and Human Development, USU. Worked as a student teacher in the Adele & Dale Young CDL at Utah State University

Professional Publications:

Published Manuscript:

Miller, B. C., Park, K., & Thomas, A. (2001). Non marital child bearing. In J. J. Jr. Ponzetti (Ed.), *International Encyclopedia of Marriage and Family Relationships*, New York: Macmillan

Schramm, D. G., Marshall, J. P., Harris, V. W., & George, A. (2003). *Marriage in Utah: 2003 baseline statewide survey on marriage and divorce*. Salt Lake City, UT: Utah Department of Workforce Services.

Manuscript in Preparation:

George, A., & Lee, T. R. Preventing divorce.

Courses Taught:

On Campus Courses:

FHD 1500 Development across the Lifespan (Course evaluations available upon request)

FHD 3210 Families and Cultural Diversity (Course evaluations available upon request).

Satellite Courses:

FHD 3210 Families and Cultural Diversity: Developed extended syllabus; prepared and delivered power point presentations; employed satellite technology

FHD 4240 Social and Family Gerontology: Developed extended syllabus; prepared and delivered power point presentations; employed satellite technology

Professional Affiliations:

Member of the Society for Research on Child Development

Member of the American Public Health Association