THE BEHAVIORS OF NURSES
WHO IMMUNIZE CHILDREN

By

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A dissertation submitted in partial fulfillment of

the requirements for the degree of

Doctor of Philosophy

(Nursing)

At the

UNIVERSITY OF WISCONSIN-MADISON

2001

Committee's Page. This page is not to be hand-written except for the signatures

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Date of Final Oral Examination: June 12, 2001

Month & Year Degree to be awarded: **December** **May** **August** 2001

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ABSTRACT

This study examined behaviors of nurses immunizing children as a factor affecting immunization coverage for prevention of VPDs. Ajzen's (1985) theory of planned behavior was used to construct an instrument called the Nurses' Childhood Immunization Belief Questionnaire (NCIBQ). A mail survey approach was used to distribute the NCIBQ to 316 randomly selected nurses who immunize children in South Dakota following Dillman's (1978) total design method, yielding an 85% response rate.

Multiple regression analysis showed behavioral intention was a significant determinant of behavior ($p = .000$), perceived behavioral control was positively correlated with behavioral intention ($p = .000$) and a major predictor of immunizing behavior ($p = .001$). A positive correlation was found between respondents' immunizing behavior and age ($p = .042$), education ($p <= .001$), and professional certification ($p < .015$). Nurses in public settings were more able to follow accepted vaccine recommendations than those in private settings ($p < .01$). RNs were also more likely than LPNs to follow recommendations ($p = .043$), as were nurses with five facilitators to immunization present, including audits, standing orders, the AAP "Red Book", the Standards for pediatric immunization practices, and WIC linkage ($p < .05$).

Respondents identified a variety of interventions to relieve discomfort from vaccine injections. Missed opportunities to immunize were evident in responses to each of four case scenarios. Although nurses with more education were more successful at correctly identifying age-appropriate vaccines ($p < .05$), inappropriate vaccine choices were common. Findings have several important implications for nursing practice, education, and research.

ACKNOWLEDGMENTS

Many scholars have remarked that completing requirements for an advanced academic degree is never accomplished without the assistance and support of others. On the occasion of passing this milestone in my life and career, I offer my sincere appreciation to the following individuals who helped to make this personal achievement possible:

Professor Sue Riesch, who took me under her wing and was always available for assistance when it was needed. Her personal interest in me as a person and active involvement in guiding my dissertation research were key to my success;

Professors Linda Baumann, Thomas Broman, Patrick Remington, and Susan Zahner, who gave of their time and expertise to serve on my dissertation committee, and to Professors Roger Brown and Jeffery Henriquez for their special assistance in statistical analysis;

Professor Mitzi Duxbury, who shared her wisdom and mentored me during my first three years of doctoral study;

Doctoral students Weena Chanchong and Norma Jackson, who along with Professor Riesch offered constructive criticism and peer group support as my research progressed;

Fellow doctoral students Celia Wills, Erla Svavarsdottir, Sally Norton, Rana Limbo, Seong-Yi Baik, Carolyn Krause, Mi Kyong Song, Bill Corser, Barb Lutz, and Vicki Von Sadovszky who over the years provided a listening ear or shared ideas for solving problems in moving my research forward;

Gale Barber, Marcia Voss, and Deb Hopke, who over the years diligently attended to the technical details of doctoral education, thus making the process of completing the program a human one;

Dr. Virginia Burggraf at the American Nurses Foundation, who continues to expand my professional connections by making it possible for nurses and others interested in immunization research to tap each others knowledge;

The nurses in South Dakota who participated in my study, and to Lori Koenecke who provided the information I needed to contact them;

Professors Mary Pautz and Joyce Esser-Anderson, both expert educators and committed professionals who are also genuinely nice people, always taking time from their busy schedules to show interest in how and what I was doing;

Kathie Ludwig, for her technical support during my three semesters as course professor for N105;

Tom Dehlinger and the staff at the Isthmus who kept me stimulated and occupied on Thursday mornings;

All the students I lectured and mentored in 10 semesters of involvement in teaching N105, for helping me develop skills as an educator and an appreciation of how much I really do know about health care;

My mentors and many colleagues in nursing and public health, who contributed to my interest in improving the way we deliver immunization services;

The staff and volunteers of the Bush Foundation, the Charles Ekburg Trust, Nurses Educational Funds, and the Presentation College Nursing Honor Society, who over the years provided financial support for my doctoral education;

And lastly, but most importantly, to my loving wife Marianne, and my daughters

Annie, Kari, and Alexa, for their understanding and untiring support for my wish to pursue this educational goal, and their tolerances during my many, many absences when my lack of presence was felt;

To each of you I offer my sincere gratitude and thanks for helping make this possible.

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Introduction

"Most clinicians, public health officers, epidemiologists, and microbiologists felt justified...in proclaiming during the 1950s that the conquest of infectious diseases had finally been achieved."

Rene Dubos (1965, p. 163)

On May 19, 1997, during the opening session of the 31st Annual National Immunization Conference in Detroit, Surgeon General (designee) David Satcher reflected on the remarks of one of his predecessors who prematurely announced in 1969 it was "time to close the book on infectious diseases." Despite this flawed prediction by a respected expert and the euphoria captured in Dubos' satirical remark chiding the scientific community's foolish overconfidence about its capacity to rid humankind of infectious diseases, initiatives to immunize and otherwise protect the public against vaccine-preventable diseases (VPDs) through immunization have now been established as a cornerstone in global and national public health work in efforts spanning several centuries (American Public Health Association [APHA], 1985; Blake, 1985; Hanks & Hanks, 1955).

The rationale for this study is based on the continuing need to prevent VPDs by increasing immunization coverage levels among children in the United States and around the world. Low vaccination coverage levels or underimmunization against diseases preventable by vaccines pose a continuing risk to individuals and the public. Health care providers are major contributors to the problem of underimmunization by sometimes failing to immunize children when they should. The behaviors of nurses as major providers in the delivery of vaccines to children have rarely been studied.

Research is needed to understand how nurses contribute to the outcome of successful vaccine delivery as well as the problem of underimmunization.

The purpose of this study is to explore the behaviors of nurses who participate in the immunization of children as part of society's battle against VPDs. The specific aim is to understand the immunizing behaviors of nurses who immunize children within these overall VPD control efforts. The research design employed a mail survey of a randomized sample of nurses in South Dakota to examine their immunizing behaviors. An instrument titled the Nurses Childhood Immunization Belief Questionnaire (NCIBQ) developed from literature sources and structured using key variables from Ajzen's (1991) theory of planned behavior (TPB) was constructed for this purpose. The study also empirically tests the adequacy of the TPB in explaining immunizing behavioral intentions of nurses who immunize children within the study sample.

The long term goal of the study is to improve immunization coverage levels among children through improved understanding of nurses' immunizing behaviors and how these behaviors are influenced by other factors. It is envisioned that study findings may be useful in devising future strategies to change the behavior of nurses (and potentially other health care providers) who participate in the immunization of children in order for them to become more effective in improving immunization coverage levels, thus achieving society's goals for prevention and control of VPDs.

Immunization or Vaccination?

Throughout this study the terms "immunization" and "vaccination" are used interchangeably when in fact, there are important distinctions. Immunization is an inclusive concept derived from the multidimensional concept of immunity or resistance.

Immunity may be active or passive and acquired through natural exposure or artificially by vaccination. Vaccination is a narrower concept commonly referring to the intentional act of administering a specific immunobiologic agent such as a vaccine, toxoid, immune globulin, or antigenic substance in order to bestow specific immunity (APHA, 1995; CDC, 1994b; McDonnell & Askari, 1997). Active immunization with a vaccine or toxoid induces the host's own immune system to protect against a pathogen, whereas passive immunization with an immune globulin or antitoxin offers temporary protection by introducing specific antibodies to fight a pathogen (McDonnell & Askari).

People are commonly immunized by vaccination, and the goal of vaccination is immunity. The routine immunizations of childhood are intended to bestow long term active immunity. With the exception of live oral polio virus (OPV) vaccine, routine childhood vaccines used around the world are available only in injectable form. Several are commonly available in combination form, notably measles, mumps, and rubella (MMR), and forms of diphtheria, pertussis, and tetanus (DPT) vaccines. The search to develop additional combination vaccines continues (IOM, 2000; Selekman, 1998). While vaccines are a common vehicle for bestowing immunity, this is a dynamic state sometimes achieved through means other than vaccination, including natural exposure. Since no vaccine is completely efficacious, vaccines are not always successful in achieving the goal of immunity. Therefore, levels of immunity are not necessarily the same as vaccination coverage levels (Chen & Orenstein, 1996).

Despite the differences in the concepts of immunization and vaccination, these technical distinctions are not central to this study. Therefore, in order to improve syntax and in keeping with the way both terms are commonly used in the literature, the terms immunization and vaccination and their related verbs, roots, and derivatives are used interchangeably throughout this study to refer to the technical aspects of vaccination unless otherwise noted.

Rationale for the Study Focus

My personal interest in problems associated with health care provider contributions to successful immunization efforts and to missed opportunities in immunizing children began in the late 1970s. As a clinician and subsequently as a manager of regional public health programs in the federal Indian Health Service, I was confronted with the problem of low immunization coverage levels among American Indian children and faced the challenge of organizing programs to facilitate parent and child participation in immunization services and to improve provider performance in immunizing eligible children at every opportunity. Many imaginative interventions have been devised over the years to direct, change, and stimulate improvements in provider immunizing behaviors, often without the systematic evaluation of the effectiveness of the interventions or understanding the dynamics of the immunizing behavior itself.

Although improving provider practices is now recognized as a key element in reducing the number of missed opportunities and in improving vaccination coverage levels overall, most research on related topics to date is non-experimental descriptive research on provider characteristics, knowledge, attitudes, and practice behaviors concerning specific vaccines and in specific situations. Far less research has been conducted to assess the dynamics of varying individual, organizational, or situational factors associated with different immunization practices, decision, and behaviors. Grady (1999) indicates research about behavioral, technological, and organizational innovations in control of infectious diseases is an area of pressing need. Understanding how deficiencies in interpersonal and technical dimensions of care and how variability in health care provider practice patterns affect care outcomes are stressed as part of a growing national policy and research agenda focused on outcomes and quality improvement (Agency for Health Care Policy and Research [AHCPR], 1992; American Nurses Association [ANA], 1995a; Bodenheimer & Grumbach, 1998; Brenzel & Claquin, 1994; Clinton, 1990; DeFriese, 1991; Greco & Eisenberg, 1993; Kindig, 1998; Millenson, 1997; Mitchell, Ferketich, & Jennings, 1998; National Academy of Sciences, 1997; President's Advisory Commission, 1998, Rantz, 1995).

Since optimal vaccination coverage is a focal and ubiquitous concern in all communities where newborn and preschool children are resident, research analyzing provider characteristics, knowledge, attitudes, and practice behaviors as a means to evaluate and improve their practice is recommended as an important strategy in improving primary care services in general and immunization services in particular (Edelson, 1995; Green, Eriksen, & Schor, 1988; Schwartz & Cohen, 1990).The Institute of Medicine (Durch, 1994) and other health policy authorities stress improved understanding of how health care providers contribute and interfere with safe and effective vaccine delivery must receive more emphasis as an area for research (Askew et al., 1995; Durch; Olshansky et al., 1997; Orenstein, 1996a; Orenstein & Bernier, 1994; The Johns Hopkins University, 1993; Thompson, 1997). Thus it is recognized provider practices and behaviors reflect the interplay of multiple factors having important consequences for the public's health.

It is noteworthy most contemporary studies about health care provider characteristics and immunization practices, including the CDC diagnostic studies described in the literature review, have focused primarily on physicians in inner-city and other urban areas to the exclusion of other categories of providers and those practicing in rural areas as noted by Wood and Halfon (1998). Related research focused on nurses is conspicuously lacking. One could easily conclude that nurses have little role and virtually no stake in overall immunization efforts from the paucity of published research about their immunization practices and behaviors. With the bulk of research on health care provider immunization practices focused on physician practices, there are clearly grounds to question how the practices, decisions, and behaviors of other health care providers, especially nurses, factor into the immunization puzzle.

Society clearly expects health care providers to play a role in ensuring that children are appropriately immunized (Breiman & Zanca, 1997; Durch, 1994; Gross & Brown, 1996; Orenstein, 1996a). In response to this expectation and emphasis on additional research in this area, this study is focused on the possible relationships and influences of selected independent variables on nurses' behaviors encompassing their personal and situational circumstances when they vaccinate children.

Given the recognized importance of provider factors and the contradictory and inconsistent influence of client factors on vaccination decisions as described in the literature review, client factors concerning their specific vaccine beliefs and decisions including reasons for vaccine seeking, avoidance, or refusal behavior were removed as a focus of the study. In summary, this focus highlights the importance of understanding the role and behavior of nurses in the delivery of a key preventive service, specifically the vaccination of children for protection against VPDs. With a focus on nurses, the study addresses a void in current research related to understanding health care provider behaviors in safe and effective vaccine delivery within the context of broader preventive services (Leatt & Frank, 1988).

Theoretical Model: The theory of planned behavior

In the early 20th century, social psychologists first endeavored to explain human behavior on the basis of attitudes and behavioral dispositions, but with inconsistent and sometimes contradictory results (Ajzen & Fishbein, 1980). The model used to organize this study is an outgrowth of this earlier work and is based on Ajzen's (1980, 1991) theory of planned behavior (TPB) for analysis of the immunizing behaviors of nurses and variables antecedent to those behaviors. The TPB model is an extension of Fishbein and Ajzen's theory of reasoned action (TRA) which posits behavior as a function of behavioral intention, which in turn is a function of attitudinal and subjective normative factors and their antecedents (Ajzen & Fishbein, 1980; Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975; Madden, Ellen, & Ajzen, 1992; Vallerand, Deshaies, Cuerrier, Pelletier, & Mongeau, 1992). In the TRA, the degree of significance of normative and attitudinal components will vary depending on the specific behavior in question, unique situational factors, and differences among individuals (Ajzen & Fishbein, 1980).

While overlapping with the TRA and incorporating the stated relationship between attitudinal and normative factors and behavioral intention and between behavioral intention and behavior, the TPB adds a component for volitional or perceived behavioral control stemming from a person's beliefs about the possession of opportunities and requisite resources to perform a particular behavior (Madden et al., 1992). Like attitudinal and normative influences, perceived control over a behavior may impact behavioral intention. However, unlike the TRA, the TPB provides for a direct link or effect of perceived behavioral control on the course of behavior (Ajzen, 1985, 1988, 1991; Ajzen & Madden, 1985; Eagly & Chaiken, 1993). Ajzen (1991) justifies the presence of this direct link by postulating the effort leading to a particular course of behavior is likely to increase as perceived behavioral control increases, if behavioral intention is held constant. Further, perceived behavioral control may serve as a proxy measurement for actual control over a particular behavior. Ajzen comments, "To the extent that perceived control is realistic, it can be used to predict the probability of a successful behavioral attempt" (Ajzen, 1991, p. 185). The TPB has been found to be superior to the TRA in accurately predicting variances in intentions and the likelihood of specific goal-directed behaviors, particularly in situations where the individual perceives limited volitional control over the behavior in question (Ajzen, 1985, 1988, 1991; Ajzen & Madden, 1986).

Ajzen (1988, 1991) describes <u>behavioral intention</u>, i.e., the intention to perform a particular behavior, as the mix of motivational factors linked to a particular behavior including beliefs and attitudes, subjective norms, perceived behavioral control, and the relative importance of these factors. <u>Attitude</u> toward a behavior is a hypothetical construct defined as a disposition to respond favorably or unfavorably to a person, object, event, or institution. Behavioral attitude is a function of the individual's salient beliefs about performing the behavior weighted by the evaluation of beliefs about the consequences, referred to as outcome evaluation (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

<u>Subjective norm</u> relates to the individual's perceptions about social pressures to perform or not to perform a particular behavior. Subjective norm is a function of the total set of normative beliefs about expectations of significant others in the environment weighted by the motivation to comply with these behavioral expectations (Ajzen & Fishbein, 1980).

<u>Perceived behavioral control</u> refers to the relative perceived ease or difficulty of performing a particular behavior based on anticipated obstacles, disincentives, impediments, and prior experience. Perception of behavioral control is determined by beliefs about control and perceived power over behavioral performance in a particular situation (Ajzen, 1991).

The TPB maintains that external variables such as sociodemographic attributes or personality traits do not directly affect behavior. Rather, they are related to behaviors only to the extent that they are linked to other theory variables. Thus, these external variables influence intentions and behavior indirectly by their effects on behavioral beliefs, outcome evaluation, normative beliefs, the motivation to comply, control beliefs, and perceived power. They may thus influence intentions and behavior by changing the relative weights of the attitudinal, normative, and control components central to the model (Ajzen, 1985; Ajzen & Fishbein, 1980; Jennings-Dozier, 1999; Madden et al., 1992). For example, nurses' educational level, age, and beliefs, attitudes, or perceptions about specific clients when they immunize children would fall within the external variable domain. A structural model of the TPB appears in Figure 1.

A search of the literature for references to the TPB in the PsychINFO database from January, 1995 to February, 2001 listed 255 citations including many reports of original research using this theory in the United States and abroad. A search of dissertation abstracts listed 87 dissertation references to the TPB in the U.S. from January, 1997 to June, 1999, with 23 of these listed in the social psychology subject category. The TPB has been used extensively to explain and predict individual health behaviors for a variety of health concerns related to areas such as tobacco use, eating and weight control, patterns of risky sexual behavior, and motivation to exercise. Applications outside the domain of health promotion topics are very numerous, with the theory having been applied to diverse research topics including the studying behavior of college students, sales behavior of insurance agents, the teaching of environmental education, and voting patterns of state legislators.

Citations demonstrating applications of either the TRA or the TPB in studying health care provider behaviors are far more limited, with not a single study found in which either theory has been used to examine the behavior of nurses. Concerning other health professionals, only one recent study is identified in which Taylor, Montano, and Koepsell (1994) used the TRA to examine attitudes and other factors associated with mammography screening by physicians. In later work, Millstein (1996) compared the utility of the TRA and the TPB in predicting physician behavior in the delivery of preventive services to adolescents, finding the TPB superior to the TRA in predicting variance in behavioral intention and subsequent behavior. Millstein underscores the paucity of research using the TPB to study health care provider behaviors and encourages more theory applications to examine provider behaviors, particularly where adherence to accepted standards of care is at issue. The TPB therefore provided a respected and convenient framework to study differences in the immunizing behaviors of nurses--and subsequently other health care providers--as a dependent variable while reducing possible independent variables to a relatively small number of complex multidimensional concepts within a concise theoretical model.

Significance of the Study for Immunizations in Nursing

This research examined a particular practice domain of nurses employing literature sources to identify variables potentially affecting their behaviors when they immunize children, thus impacting the effectiveness of nursing care and public health efforts. There are several reasons why immunization activities are of interest and germane to the nursing profession. First, Bernstein (1972), Cady, (1948), Fee and Greene (1989), and Tinkham and Voorhies (1977) assert nurses and women have historically claimed a special interest in public health, including to many of the sanitary reforms and progress in the control of communicable diseases during the first half of this century evolving into community based primary care and public health services available today (de Tornyay, 1980). Secondly, through the application of research findings, nurses in various practice settings are currently addressing the health needs of vulnerable populations, including racial and ethnic minorities and low income and single parent families among whom underimmunization of children may occur (Black et al., 1993; Burgett & Winters, 1996, Grabowsky, 1994; McCracken & Lenihan, 1996; O'Mara & Isaacs, 1993; Salsberry, Nickel, & Mitch, 1993; Stinchfield, 2001). Thirdly, Zahner (1999) identifies the important role of nurses today in public health surveillance efforts, including immunizations. Fourthly, Patricia Grady, Director of the National Institute for Nursing Research calls for nurse researchers to fill knowledge gaps in the prevention and control of infectious diseases, including the evaluation of possible interventions in non-acute health care settings (Grady, 1999).

The programs of the 29th, 30th, and 31st annual National Immunization Conferences substantiate that nurses are intricately involved in a wide range of immunization activities in addition to the singular administration of vaccines (U.S. DHHS, 1995, 1996, 1997), but in the eyes of the public the scope of this activity may be reduced to visions of needles and memories of "shots." Nonetheless, nurses individually and collectively are recognized as stakeholders in immunization efforts, and the success of immunization campaigns will depend in part on clarifying and expanding the role of nurses and nursing (ANA, 1994b; Stenvig, 2000).

The interest of the nursing profession in prevention, providing primary care, and controlling communicable diseases continues today (Marion, 1996; Mawn & Pakkala, 2000; National Association of Pediatric Nurse Associates and Practitioners [NAPNAP], 2000). Through ANA, the profession of nursing is recognized as a leader and nurses are key shareholders in national immunization efforts (ANA, 1993b; CDC, 1993; Satcher, 1997). The significance of large health care membership organizations like ANA in shaping nursing immunization practice through promulgation of standards and advocacy for immunizations as part of national health policy is a familiar feature in the contemporary landscape of the American health care sector.

In their writings about interest groups and interest group theory, a number of health policy scholars and analysts have described the significance and historical importance of political influences wielded by interest groups, large health care membership organizations and trade associations, and other types of organizations in shaping health policy while creating an agenda of attitudes, opinions, and priorities among the ranks of their own members (Kingdon, 1994; Litman & Robins, 1997; Marmor & Dunham, 1983; Weisert & Weisert, 1996). Such institutions are seen as major policy actors in the nation's response to emerging public health issues, including vaccine policy (Foreman, 1994). Further, Brooten, Brown, and Miovech (1998) suggest such political influences are ever present in the work of nurse researchers exploring the domains of providers, patients, and health care delivery systems.

To this end, an important ANA position statement on immunizations for children stresses that the achievement of national goals for the successful immunization of children cannot be realized without the support of all nurses (ANA, 1995b). This position statement further outlines system and provider-driven factors contributing to underimmunization, specifies unique strategies for nurses to improve immunization services, calls for research leading to improved immunization rates, and can be expected to have long term impact on the practice of nursing. The nursing profession recognizes the overall need for additional research in diverse patient care settings to identify quality indicators sensitive to nursing care in community based settings and to identify linkages between nursing care activities and patient outcomes, including immunization levels (ANA, 1996b; Rantz, 1995). As a practice consideration, ANA recently published an special eight page continuing education module on childhood immunizations by West and Kopp (1999) in The American Nurse, its official publication distributed several times a year to over 100,000 nurses nationally.

In cooperation with the Rosalyn Carter and Betty Bumpers non-profit Every Child by Two (ECBT) campaign, ANA has assumed increasing leadership as a sponsor in the national Immunization Action Coalition which began in 1992 (ANA, 1993a). On October

1, 1995, ECBT became a program of the American Nurses Foundation (ANF)(ANA, 1996a, 1996d). Coordinated efforts involving these and other groups have led to targeted initiatives to improve access to immunizations. Grant funding was provided for 21 state nurses associations to sponsor seven urban and fourteen rural projects to improve immunization levels among infants and children (ANF, 1996a, 1996b; Minich, 1996). In early 1997, a new ECBT immunization coalition website was created and a public service announcement about immunizations was released (Arbuckle & Lambert, 1997). ECBT continues to sponsor a variety of programs and activities to educate the public and providers about childhood immunizations (ANF, 1998).

In September of 1998, ECBT made a decision to embark as an independent nonprofit entity. Their global interests and CDC's interest in funding them as a sole entity influenced this decision. Still under the leadership of Rosalynn Carter and Betty Bumpers, ECBT is located in Washington, DC, but retains ANA membership representation on its board of directors (V. Burggraf, personal communication, November 22, 1999).

Assistant Surgeon General Walter Orenstein, Director of CDC's National Immunization Program (NIP) also recently acknowledged the vital and pivotal contributions of the profession of nursing in control of VPDs (Minich, 1998). In 1999, ANA joined the American Academy of Pediatrics and the Infectious Disease Society of America as a partner in the National Network for Immunization Information NNii (Stenvig, 2000). In 2000, ANA resolved to support nursing involvement in NNii (ANA, 2000). In 2000, a new nursing specialty group called the National Network for Immunization Nurses and Associates was formed. ANA also received a CDC grant for a project called Immunization Nursing Network: Provider Outreach Web Education and Resources (INN:POWER) to include an electronic subscriber listserv and website for nurses. It can be expected that the interest of nurses individually and collectively in improving childhood immunizations will expand as VPD control efforts continue.

Significance of the Study to Immunizations in South Dakota

Aside from the urban areas surrounding Rapid City and Sioux Falls, South Dakota is mostly rural and sparsely populated, with 52 of its 67 counties classified as frontier with less than six people per square mile. In contrast to many other states, the penetration of managed care systems has been slow. Between 2.8 and 6% percent of the population reports membership in health maintenance organizations or other managed care systems, and indemnity health insurance and fee for service payment arrangements continue as the dominant health care funding pattern (Hegge, 1998a, 1998b). In 1997, 7.9% of children under age 19 in South Dakota were reported to be uninsured ("Uninsured Children," 1998).

But like other states supporting achievement of national health goals by actively promoting improved immunization levels among children, South Dakota has an active immunization program spearheaded by the South Dakota Department of Health (SDDH). Childhood immunizations are among the key communicable disease prevention and control services for which SDDH has primary responsibility (South Dakota Health 2000, 1995). SDDH provides important statewide immunization support services for vaccine providers and partners. For example, routine mailings to state vaccine providers may include notices about federal vaccine program changes, copies of the most recent recommended childhood immunization schedule, special vaccine information regarding selected vaccines, consumer and provider informational materials, and notices about VPD continuing education opportunities.

The ability of state immunization program staff to interface and communicate effectively with local vaccine providers is enhanced significantly by the state universal vaccine purchase program allowing distribution of childhood vaccines at no cost to providers. There are currently over 300 "free" vaccines sites (i.e., locations where vaccines are purchased through state sources and supplied at no cost to providers) in the state, including a mix of public provider sites such as health department clinics, migrant or rural health clinics, other public sites including Indian Health Service, school, and state facility clinics, and private provider sites (L. Koenecke, personal communication, July 10, 2000). Program penetration is also universal with no providers in the state now purchasing or administering childhood vaccines independently from this system. Purchase of the state supply of vaccines at all free vaccine sites is subsidized in part by the federal Vaccines for Children program proportional to the percentage of children who are eligible for this program. The remainder is purchased through other federal CDC "Section 317" block grant funds plus a state contribution (L. Koenecke, personal communication, February 16, 2000).

In 1991, the department launched the Infant Immunization Initiative (I-3) with the goal of increasing the number of children under the age of two appropriately immunized for their age to 90% by the year 2000. By 1996, 15 I-3 community coalitions were established to overcome immunization barriers, improve access, and improve immunization levels (Infant Immunization Initiative, 1996), and 16 coalitions existed in 1998 (Volmer, 1998). The success of I-3 coalitions has been enhanced by the recent automation of birth certificate registration allowing electronic access to information about newborns for immunization tracking. In 1996, legislation was enacted allowing provider sharing of individual immunization record information toward establishment of a state immunization information repository, now called the South Dakota Immunization Information System (SDIIS) (Thullner, 1996). In addition to eventually consolidating individual immunization information into a single electronic record with access for providers, SDIIS provides a means of easy patient tracking and recall and automates the vaccine utilization reporting system. By 1999, an estimated 90% of children in South Dakota under age six were enrolled in a registry (IOM, 2000, p. 118; CDC, 2001a). Application of data base information was partially responsible for increasing immunization coverage levels of two year olds from 40% to 96% over a three year period in at least one South Dakota County (Christensen, 2000). The impact of these strides is likely to have a positive effect toward improving statewide childhood immunization levels overall.

Despite this evidence of system progress, childhood immunization levels are a continuing priority in the state. State immunization requirements for school children call for mandatory immunization against diphtheria, tetanus, and pertussis (all grades, K-12), measles, mumps, and rubella (grades K-7), hepatitis B and varicella (grades 6-7), and polio (grades K-1). Hepatitis A vaccine is recommended and sometimes required for school entry in selected counties with a high percentage of American Indian children. As in some other states, philosophical, religious, or medical exemptions to immunization may apply (Lumbila, 2000).

The SDDH (1995) retrospective two-year-old immunization level survey for the

1994-1995 school year showed the two-year-old immunization level total to be 62.4%, with counties ranging from 41.1 % to 89.7%. The retrospective survey of 1997 kindergarten entrants showed 70.9% had been appropriately immunized by the time they reached two years of age (Volmer, 1998). The most recent CDC annual report covering calendar year 1999 showed the estimated vaccine coverage of South Dakota children ages 19-35 months having completed the recommended 4:3:1:3 series at 81.7% compared to the national average of 78.4% (+/-1 %) at the 95% confidence interval (CDC, 2000a). South Dakota was identified as achieving national immunization goals for children 19-35 months of age in 1996, with 82% coverage levels for the 4:3:1 series (NIP, 1998). In early 1999, South Dakota Governor Bill Janklow announced an all time high of 74.5% of children entering kindergarten class that year had been immunized appropriately by the time they were two years of age ("Immunization Rates Up," 1999).

A vivid reminder that the risk of preventable contagion continues even with levels in this range occurred in April and May of 1997 when seven measles cases were reported in a central South Dakota ("Measles Likely Over," 1997). More recently, three cases of mumps were reported in the state in October, 1999, with two of these occurring in young adolescents for whom vaccinations were up-to-date ("Mumps are Back," 1999). Such sporadic outbreaks and isolated cases of other VPDs are likely to continue until immunization levels are increased overall and greater herd immunity is achieved.

Licensed registered and practical nurses are clearly important contributors in vaccine delivery in South Dakota, being employed in private physician and group medical practices as well as public health and community health settings under the sponsorship of the state, counties, municipalities, the federal government, and Indian tribes. Roughly 10,000 registered nurses and 3,000 practical nurses hold licenses to practice nursing in the state (Hegge, 1998a). In contrast, fewer than 200 medical assistants hold legal registration needed for practice, and only a fraction of these are employed in the health care field (G. Damgaard, personal communication, May 12, 1998). Although the scopes of practice for medical assistants and pharmacists allow administration of childhood vaccines, this remains primarily a nursing function in South Dakota.

A large portion of nurses in South Dakota are employed in private and group medical practices. At some state and county community health centers and Indian Health Service delivery sites, public health and community health nurses have primary responsibility for the organization and delivery of immunization services with little, if any physician oversight or involvement. Interestingly, several counties where immunization rates are consistently high include those with the fewest physician or other licensed primary care providers. Here immunization services historically have been provided exclusively by local community health nurses (Wilson, 1994). This curious finding strongly suggests nurses are important contributors in immunization efforts in these and perhaps other locales. Similarly, Wilson also reports that immunization coverage rates among populations served by the Indian Health Service where immunization services are organized and monitored by tribal and federal public health nurses tend to be higher than those statewide.

These observations lend credence to the possible importance of the element of volitional or perceived behavioral control in predicting the immunizing behavior of nurses, as children receiving immunization services at other sites where nurses are employed in practice settings with theoretically less decisional autonomy are less well immunized. Of course, whether high or low, immunization rates among children may be influenced by many other factors irrespective of the behavior of nurses in the particular setting where the children receive care. In research using the TPB to organize study variables, Ajzen and Fishbein (1980, p. 29) warn of the importance of distinguishing between behaviors (e.g., the immunizing behavior of nurses who serve a population) and related measures of behavioral outcomes (e.g., immunization coverage levels in that population), cautioning that prediction of outcomes is possible only to the extent that outcomes are actually controlled by specific human behavior.

In conclusion, the immunization delivery system in South Dakota has the infrastructure to improve immunization coverage levels and to monitor progress toward achieving state and national goals, and the population is seemingly accepting of services provided through this system. It was therefore both timely and relevant to select nurses as providers within this immunization delivery system as the sample for the study. Improved understanding of the behaviors of nurses who provide immunization services can only be of benefit in achieving immunization goals and better control of VPDs for local communities, the state, the nation, and the global community.

Review of Literature

The Introduction outlined the general context and organization for this study, including a description of the study purpose, aim, and long-term goal linked to preventing VPDs by improved understanding of the behaviors of nurses who immunize children as a factor possibly affecting immunization coverage levels. The overall rationale and reasoning for the particular study focus on nurses were presented, and the theoretical model was described. The significance of the study was considered from the unique perspectives of nursing practice and the nursing profession. Finally, the status of childhood immunization activities and possible utility of study results in South Dakota were reviewed.

Chapter 2 probes, analyzes, and integrates the core of contemporary literature on topics germane to the study, beginning with an historical review of issues related to VPD control and continuing with a discussion of contemporary issues and means of assessing immunization coverage levels. Factors influencing immunization coverage levels are examined from public or consumer perspectives and then from a health care provider viewpoint, highlighting the crucial role of health care providers in effective vaccine delivery and identifying public opinion and individual client behavioral factors and choices per se as outside the scope of the study.

This review includes synopsized material from pertinent textual and media sources, scientific work, and reports of original research found primarily in the medical and public health literature. This synopsis envelopes factors commonly referred to in the literature as <u>provider immunization practices</u>, defined as an aggregation of repetitive activities that include provider immunizing or vaccinating behaviors. Lastly, study questions and hypotheses are presented.

Historical Perspectives and VPD Control

More than 200 years ago, Dr. Edward Jenner (1798/1996) wrote of his discovery and first experiments in vaccination against smallpox (Orenstein, 1996b). Following a massive international campaign led by the World Health Organization (WHO) during the tense international Cold War period, a conclusive victory was proclaimed when the last case of smallpox in the world acquired through natural viral transmission was reported in 1977 (APHA, 1995, Goodfield, 1985; Henderson, 1998; Hopkins, 1988). The certification of global eradication followed soon after in 1979, and it was posited that other infectious foes could likewise be vanquished (Hopkins, 1983). Thus in 1995, the theme of World Health Day, observed on April 7 by 189 World Health Organization member nations, focused on improving childhood immunization rates and worldwide eradication of polio by the year 2000 (American Association for World Health [AAWH], 1995).

But in a strange and ironic paradox, 1996 was remembered not only as the bicentennial anniversary of the first smallpox vaccination, but also as the beginning of an era in which VPDs once thought to be effectively controlled reemerged at alarming rates. New killer diseases for which no vaccines exist also emerged as serious public health threats (Gunby, 1996; Heymann, 1997, Orenstein, 1996b). So serious is concern for this threat that the theme for World Health Day on April 7, 1997 was "Emerging Infectious Diseases: Reduce the Risk" (AAWH, 1997). After decades of steadily declining rates, deaths from infectious diseases are reported to have increased 22% between 1980 and 1992 in the United States, ("Infectious Disease," 1998). Armstrong, Conn, & Pinner (1999) report infectious disease mortality in the U.S increased from 36 deaths per 100,000 in 1980 to a recent new peak of 63 per 100,000 in 1995. These alarming trends in old and new emerging infectious disease patterns are recognized as a significant public health problem generating opportunities for study in the scientific research community, including the National Institute for Nursing Research (Grady, 1999).

Compounding the fear and uncertainty associated with menacing new killer diseases, familiar parasitic and infectious diseases continue as leading causes of death around the world, with measles alone accounting for two percent of worldwide deaths as recently as 1990 (Olshansky, Carnes, Rogers, & Smith, 1997). According to WHO estimates, over 36 million cases of measles occurred globally in 1996, resulting in roughly a million deaths, greater than the total deaths from all other diseases included in VPD control programs sponsored by WHO combined (Bland & Clemens, 1998; "The World's Top Ten," 1999; Tulchinsky, 1998). Orenstein et al. (2000) also report measles is still responsible for about a million deaths annually, primarily in the developing world. Without a specific vaccine for its prevention, tuberculosis was reported as the cause of 2.9 million deaths in 1997 ("The World's Top Ten,").

Threats of bioterrorism in which anthrax and other infectious agents could be used to wage germ warfare have become a contemporary worry (Binder, Leavitt, & Hughes, 1999). With the collapse of the Soviet Union it has been revealed that millions of doses of infectious smallpox virus were produced, with some now possibly in the hands of terrorist groups (Shepherd & Hotez, 2000). Manufacture of smallpox virus stashes in renegade nations including North Korea and Iraq have also been reported

("Report Warns of Stashes," 1999). Though considered eradicated, this disease remains an international concern with billions of people now susceptible since routine vaccination was suspended 20 years ago. Infectious diseases have no respect for international boundaries, hence no nation of the world can be totally safe from the spread of infectious diseases, including VPDs (Schuchat, 2000). Tomes (2000) suggests public awareness of infectious diseases has been transmuted into a contemporary germ panic in which fear of one infectious agent supercedes fear of another, reporting more than half of Americans believe an epidemic scourge worse than AIDS will be spawned during the new millenium.

Contemporary Issues in VPD Control

Around the world, increases in preventable infectious diseases rates, concerns about new communicable diseases, understanding that some diseases not thought to be infectious may be prevented by vaccines, and the potential of vaccines to prevent diseases continue to be in the news (Arntzen, 1997; Edelson, 1995; Ernst, 1999; Lenon, 2000; Nakajima, 1997; "Nineteen Ninety-seven Progress," 1997; Rosenstein et al., 1998, St. John, 1994; "Thailand Begins an HIV Vaccine Field Trial," 1999; Vaccine Against Diarrhea," 1997). Although vaccines exist for their prevention, Haemophilus influenzae type b (Hib), measles, hepatitis B, tetanus, and pertussis remained as five of the world's ten leading infectious killers in 1997 ("The World's Top Ten," 1999). Anthony Fauci, Director of the federal National Institute of Allergy and Infectious Diseases (NIAID), notes "infectious diseases remain the world's leading cause of death, and the third leading cause of death in the United States" ("Infectious Disease," 1998, p.8). Watts (1998) contends despite progress in control of many infectious diseases, populations living in poverty and lacking access to health care have a tendency for greater risk. Watts notes history has shown that even when emptied, viral niches tend to be promptly refilled.

In the United States, following the development and implementation of systems to achieve national health objectives beginning in the last decade, immunization programming has continued as an important area of public health emphasis (Centers for Disease Control and Prevention [CDC], 1996b; "Clinton Praises," 1997; Lazaro, 1995; U.S. Department of Health and Human Services [DHHS], 1991). Major immunization initiative components are concentrated on children who are expected to be immunized prior to entering school according to a prescribed schedule for the administration of antigens against diptheria, pertussis, tetanus, measles, mumps, rubella, Hib, hepatitis B, and chicken pox (varicella) (Lumbila, 2000).

Cost benefit analysis has been widely used to demonstrate the health value and enduring economic benefits of childhood vaccines when they are accepted and new vaccines before they are adopted for widespread use (Jackson, Schuchat, Gorsky, & Wenger, 1995; Krahn, Guasparini, Herman, & Detsky, 1998; Miller, Sutter, Strebel, & Hadler, 1996; Moore, Laufer, & Conroy, 1998, National Immunization Program [NIP], 1998, p. 1; Rosenstein et al., 1998; Tucker et al., 1998). Brennan (1998) reports every dollar spent on vaccines results in about seven dollars of aggregate savings in reduced lost work time and health care costs.

Leading health policy and public health officials have asserted that unlike many other health services which are of questionable benefit in improving the health of populations, the role of immunizations in successful control of VPDs cannot be overemphasized (Breiman & Zanca, 1997; Eddy, 1997; Ibrahim, 1985; Marmor & Blustein, 1994; Satcher, 1994; Shalala, 1993). A recent report by the Institute of Medicine (IOM) (2000, p. ix) calls the national immunization system "a national treasure." Sharing stature with counseling against tobacco use and screening for six chronic conditions, childhood immunizations are among the only services to receive unequivocal support for their efficacy as clinical preventive services (Bunker, Frazier, & Mosteller, 1995; U.S. Preventive Services Task Force, 1989). In fact, vaccinations, and especially childhood vaccinations, were lauded in 1999 as first of the ten most important public health achievements during the 20th century (CDC, 1999a).

Although changing U.S disease patterns indicate a preponderance of contemporary health problems are now linked to risky behaviors and acquired risks, the potential threat of recurring outbreaks, isolated cases, and possible deaths from measles, pertussis, plague, varicella, and diphtheria has been repeatedly demonstrated (CDC, 1995b, 1996a, 1998b; Hardy, Strebel, Wharton, & Orenstein, 1994; Hersh et al., 1991; Nakajima, 1997; Olshansky et al., 1997; Orenstein et al., 2000; Struewing, Hyams, Tueller, & Gray, 1993; U.S. Department of Health Education, and Welfare [DHEW], 1979). For instance, Orenstein (1998) reports nearly 4 million persons suffer from preventable varicella in the United States annually, resulting in approximately 100 deaths per year.

Recognizing these risks, Breiman and Zanca (1997) suggest experiences in the global community indicate the risk of outbreaks is exacerbated if immunization levels are allowed to fall. Reductions in the incidence of several of these diseases such as the interruption of wild poliomyelitis transmission in the Americas in 1994 may be only temporary unless global control through mass immunization is achieved to prevent the risk of importation into susceptible populations (AAWH, 1995; CDC, 1994a, 1997c; Cochi, Hull, Sutter, Wilfert, & Katz, 1997). Although wild virus polio transmission is now concentrated in sections of the Indian subcontinent and sub-Saharan Africa, the number of polio-infected countries stands at about 30 (U.S. Pharmacopeia, 2000). Global vaccination efforts against polio will need to continue well into the 21st century if eradication is to occur.

Like polio and smallpox, rubella is a virus infecting only humans, suggesting rubella and its sequella of congenital rubella syndrome (CRS) can also be eradicated. However, Plotkin, Katz, and Cordero (1999) contend universal vaccination of infants must be accompanied by universal vaccination of adults over generations before eradication is possible. Although recent reports indicate the transmission of childhood Hib infection can also be successfully controlled and that measles is no longer indigenous in the United States, the need for a continuous emphasis on immunizations and development of new strategies to supplement routine vaccination programs is essential to minimize the risk for sickness and death from these and other VPDs (CDC, 1995c; Edelson, 1995; "Measles Is No Longer Indigenous,", 1999; Quadros et al., 1996; Satcher, 1994; "Vaccine Erases," 1998).

Established in 1974 by WHO to improve global vaccine coverage levels, the Expanded Programme on Immunization (EPI) reports more than half of the world's children are now immunized against measles, poliomyelitis, tetanus, tuberculosis, diphtheria, and pertussis (WHO, 1998). But experiences in the global community also show there are incipient problems and challenges in efforts to control these and other vaccine preventable conditions. With a perpetual reservoir of human carriers who may be asymptomatic, the Hib bacteria is ubiquitous (APHA, 1995). Like prevention of rubella and CRS, the control of Hib infantile pneumonia will necessitate continuing vigilance and vaccination of susceptible children in future generations. In the United States, two distinct populations of children remaining at risk for Hib disease are (a) children with immature or defective immune systems leading to failure of the vaccine to bestow active immunity, and (b) undervaccinated children living in socioeconomically deprived conditions (Jafari, Adams, Robinson, Plikaytis, & Wenger, 1999).

Neither is the absence of circulating measles virus indicative of an absence of risk for measles. Political upheaval, increasing population and crowding, and outbreaks among unvaccinated populations including communities with religious exemption to vaccination have resulted in high attack and case fatality rates and pose a continuing threat (Orenstein et al., 2000; Rogers, Gindler, Atkinson, & Markowitz, 1993). Even in France, a nation with a high standard of living and ready public access to immunization services, Chauvin and Valleron (1999) report 10 to 20% of children ages 2 to 10 years remain susceptible to measles. Given the nature of contemporary human travel and migration, the risk for importation from areas around the world where measles is endemic also continues (CDC, 1998a; "Infectious Disease,"1998), with 26 reported cases of importation to the U.S. in 1998 (Manning, 1999a).

While the Pan American Health Organization (PAHO) and CDC pooled resources to eradicate measles from the Western Hemisphere by the year 2000 ("PAHO and CDC Join Forces," 1999), intensified efforts for global polio eradication in other countries gave rise to subsequent ethical questions, dilemmas, and debate. Vaccination program costs are largely borne by the poorest countries where rates for other VPDs (as well as HIV and malaria infection) are high, thus competing with resources for other needed services, including measles eradication (Hyder, 1998; Lee, Melgaard, Hull, Barakamfitye, & Okwo-Bele, 1998; Orenstein et al., 2000; Stephenson, 1998; Sutter & Cochi, 1997; Taylor, Cutts, & Taylor, 1997; Tulchinsky, 1998). Stephenson suggests if VPD control efforts are joined and coordinated, each target still has unique features effectively addressed from a singular perspective. Similarly, Baker (2000) argues each different vaccine poses unique challenges in basic science, vaccine trials, ethical issues and considerations, and acceptance by the public.

From this perspective, and given the momentum toward polio eradication, Miller, Olivè, and Strebel (1999) criticize the suggestion that priorities should be shifted with additional resources directed at measles eradication, since polio eradication, while elusive, seems achievable. Given finite resources, it is acknowledged that compromises may be required in which only reductions in measles infection rates must be accepted well into the 21st century until polio is eradicated and eradication of measles becomes feasible (Hinman, 1999). Similar ethical questions with competition for resources and the need for international compromise in VPD control targets can be expected in the near future should a vaccine against malaria, now under development (Ernst, 1999) become a reality and readily available, particularly in the poorest nations of the world where malaria is most prevalent and outbreaks of polio and measles continue.

Challenges in Improving Childhood Immunization Coverage Levels

What is the status of childhood immunization coverage in the United States? Although improvements have been noted over time, the United States has lagged historically behind many other nations of the world in immunizing children against measles, mumps, and polio, including some countries with a lower standard of living (GAO, 1993). Nonetheless, progress continues toward meeting national goals for children to have completed the appropriate basic immunizations according to recommendations approved by the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, and the American Academy of Family Physicians, and as promulgated by the CDC and other cooperating professional groups.

CDC annual reports covering calendar year 1995 showed the estimated vaccine coverage of children ages 19-35 months in the United States having received the recommended number of four doses of DPT, three doses of polio, one dose of MMR (4:3:1 series), and three doses of Hib (4:3:1:3 series) vaccine at 74.2% (+/-l%) at the 95% confidence interval (CDC, 2000a). Results of the 1996 National Immunization Survey show that vaccine coverage levels continued to increase toward national goals, and interim national goals for 1996 were achieved (CDC, 1997d; "U.S. Exceeds," 1997; Vanderbilt, 1997). By 1999, coverage rates were virtually unchanged from 1998, with roughly 79.9% and 78.4% of children aged 19-35 months having completed a 4:3:1 and 4:3:1:3 series respectively, and varicella coverage at about 59%.

However, the federal Agency for Health Care Policy and Research (1998) reported nearly a third of toddlers in the United States are not up-to-date for immunizations by the time they reach two years of age. Despite expansion of the Medicaid program in the last decade to reach more uninsured children, a substantial number lacking health insurance as a requisite for access to care are therefore still at risk for not being immunized (Weigers, Weinick, & Cohen, 1998). Short and Lefkowitz

(1992) contend that low income children, including those who have access to Medicaid resources, will continue to lag behind other children in the use of preventive services, potentially interfering with timely immunizations. Lessons in the eradication of smallpox demonstrate that efforts must be intensified to achieve successively higher levels of vaccine protection in given populations (Goodfield, 1985).

This experience, as well as the addition of new vaccines to the recommended vaccine schedule (CDC, 1997a), steady increases in the cost of vaccines (Mitchell, Philipose, & Sanford, 1993), and the birth of roughly four million unvaccinated children per year (Durch, 1994) suggest that resource deployment for optimal vaccine coverage must not only be sustained but increased if national goals are eventually to be achieved. The specific impact of new vaccines placing increased demands on providers is evidenced by changes in the complete preschool series which consisted of only eight separate biologicals in the early 1970s (Preizler, 1973) but grew to as many as 22 recommended vaccines in 1999 (CDC, 1999b). Evolving national vaccine priorities portend additional system stress with the Institute of Medicine reporting no less than 10 of 26 new vaccine candidates targeting infants and small children ("IOM Report," 1999).

Foreboding the danger of slippage which may follow progress, Donald Henderson, a leader in the international smallpox eradication campaign, cautions of the eagerness and tendency of health care providers and national health officials to move on to other challenges when the end of an eradication effort is in sight, but before eradication is realized (Henderson, 1998). Two contemporary examples of such drift are evident in the recent decision to discontinue routine immunization of French schoolchildren against hepatitis B ("No Scientific Justification to Suspend," 1998) and the possible deferral of measles eradication goals by WHO until the year 2020 (Tulchinsky, 1998). Similar concerns have been echoed in 1999 by officials of the U.S. Public Health Service during hearings before Congress and during the 33rd National Immunization Conference (Manning, 1999a, 1999b). Henderson therefore stresses the value of Alexander Solzhenitsyn's "Rule of the Final Inch" in which temptation caused by self-satisfaction, fatigue, and new evolving priorities can contribute to abandonment of an effort prematurely (Henderson, 1998, p. 118). Similar complacency may be found among young parents today who have had no first hand experience with measles, mumps, polio, pertussis, and other once prevalent debilitating infections (Katz, 1998). The underlying message to the health care community is that work must continue undaunted until "the final inch" of eradication is achieved.

Assessment of Childhood Vaccination Coverage Levels

With the relative decline in childhood VPD incidence rates beginning in the mid-20th century, assessment of vaccine coverage has emerged as an increasingly important means of monitoring preventable childhood disease trends (Bolton et al., 1998). Zahner (1999) outlines the important role of nurses (and particularly public health nurses) in assuring information in childhood immunization coverage surveillance systems is timely and reliable. Chen and Orenstein (1996) report vaccination coverage may be assessed directly by measurement of vaccination levels among individuals or indirectly by surveys and reports of vaccine doses distributed or administered. A distinct advantage of direct measurement is that assessment is based on individualized official records or documentation rather than parental or provider recall. Zell, Peak, Rodewald, and Ezzati-Rice (1999) identified a tendency for parents to consider their children up-to-date even when they are not, failing to identify most children needing vaccination. In the same study, parent-held vaccination records were somewhat more reliable than recall, but many completely vaccinated children were misclassified as needing vaccination.

An advantage of direct measurement of vaccination levels through school based surveys is the inclusion of children who have moved, changed providers, or otherwise lack connections to primary care and immunization services. However, such official records may still be inaccurate. Further, direct assessment at school or preschool entry, while reasonably accurate and relatively inexpensive, provides only a retrospective snapshot of vaccination levels several years after vaccination should have occurred (Rodewald et al., 1993). In a study of urban children, Bolton et al. (1998) report up-to-date coverage levels exceed actual age-appropriate coverage by at least 37%. Ball (1995) reports a significant gap in documentation of immunizations among toddlers due to a variety of factors including faulty parental recall, provider recording errors, family mobility, and restrictions on reporting of immunization information by insurance companies. Two recent studies also support the tendency for both parent-held vaccine cards and parental recall to overestimate vaccination coverage (Bolton, Holt, Ross, Hughart, & Guyer, 1998; Zell et al., 1999).

A number of states and other CDC immunization grantees have developed vaccine registries to track children from birth. But Zahner (1999) notes the benefits of having multiple local immunization registries become limited when information cannot be efficiently pooled as aggregate data for effective surveillance. Monitoring by managed care plans also use vaccination coverage levels as an element in monitoring quality of care under the Health Plan Employer Data and Information Set (HEDIS) (IOM,

2000) is beset with its own system problems (Zahner, 1999). Currently, population-based immunization registries include immunization histories of about 21% of U.S. children less under 6 years of age (CDC, 2001a). To the extent nurses at these sites may be immunizing children, they may also be entering and retrieving immunization information on a regular basis. These systems require the investment of substantial human and financial resources and constant and vigilant system maintenance for system information to be accurate and reliable. Further, legal prohibitions protecting and interfering with sharing of confidential medical information across jurisdictional boundaries (coupled with information system incompatibilities) may prohibit the ready exchange of information from one tracking system to another (IOM, 2000). Efforts to implement a national vaccine tracking system introduced in the last decade were abandoned temporarily with the demise of the Clinton health care reform initiative (Robbins & Freeman, 1998). Therefore, indirect methods remain the primary means available to measure vaccine coverage.

In the United States, two primary and coordinated methods are used for ongoing indirect assessment of vaccination coverage levels of preschool children (NIP, 1998). First, the National Health Interview Survey (NHIS) is a door-to-door survey that includes questions about immunizations as part of the National Immunization Provider Check Study (NIPRCS). NHIS has gathered immunization information about approximately 2,500 children ages 19-35 months per year since beginning in 1994. Linked to NHIS, the National Immunization Survey (NIS) of households is conducted by CDC, using a random digit dialing telephone survey approach to estimate vaccination coverage levels of U.S. children ages 19-35 months. NIS incorporates provider validation of immunization histories to enhance reliability (CDC, 1997a; Goldstein & Daum, 1994; Orenstein, Bernier, & Brugliera, 1994). NIS has been implemented in all 50 states and 28 urban areas, with about 440 children in the target age range sampled in each of the areas each year (NIP, 1998; Zell, Ezzati-Rice, Battaglia, & Wright, 2000).

Assessment of immunization coverage may also occur locally, using one or more of several survey methods or computer software packages including Clinic Assessment Software Application (CASA), a public sector program designed by NIP to measure immunization coverage at the provider or clinic level. Assessment findings are also used to suggest ways to improve immunization levels (CDC, 2000a; IOM, 2000; NIP, 1992, 1998). Darden et al. (1996) describe the advantages and relative merits of different methodologies used to assess childhood immunization levels at the clinic level. While of value in improving local practice, these strategies provide incomplete information about overall immunization coverage, since they fail to accurately account for children who are seen by multiple providers, those lost to follow up, and those generally lacking access to primary care services.

The value and utility of indirect survey results as a measure of progress in national efforts to improve immunizations are currently open to question (General Accounting Office [GAO], 1996; IOM, 2000). Sampling techniques employed are beset with a number of potential methodological problems linked to possible sample bias and margin for error despite statistical procedures used to establish reliability and correct for potential error within set confidence intervals. The NHIS/NIS survey relies on random digit telephone dialing for sampling and therefore excludes data from individuals and families without telephones as well as those with telephones who choose not to participate. The impact and magnitude of resulting informational deficiencies is unknown. In summary, information on the immunization status of preschool children who reside in homes without telephones is inferred rather than validated through the NHIS/NIS indirect survey method, with some of these children (plus those from selected racial and ethnic subgroups) persisting at potentially greater risk for delayed immunization than the population as a whole (CDC, 1997a; NIP, 1998).

Current sampling by random digit dialing includes procedures to validate data and improve accuracy by comparing provider immunization information with information from those included in the sample and by weighting to account for nonresponse, ongoing natality, and households without telephones. However, the potential for inaccuracy due to sampling frame bias and lack of robust subgroup statistics, misreporting, changing demography, migration, and flawed records, memory, or recall remains (Chen & Orenstein, 1996; IOM, 2000). Moreover, because roughly 11,000 children are born each day in the U.S. (CDC, 1999a) and population cohort composition changes continuously in relation to the recommended vaccine schedule, data from sample surveys is quickly obsolete and must be updated at regular intervals to be reliable. Assuring accuracy of information will be further challenged as survey database information becomes more complicated when more vaccines are added to the recommended schedule (Chen & Orenstein).

Lastly, Stevens, Freeman, and Konrad (1996) warn of the implicit danger and risk for error in vaccine coverage assessment if aggregate population rate estimates are used to draw inferences about local rates or the status of individuals. NIS information is not intended to identify children in need of immunization (IOM, 2000). This is a prime example of the so-called ecological fallacy, a notion derived from the work of Robinson (1950) describing the risk for error and cross-level bias if information from large health data bases is generalized or correlated to smaller groups or individuals (Connell, Diehr, & Hart, 1987; Feinleib, 1998; King, 1997). Those concerned with the level of current vaccine coverage among U.S. children should remain skeptical about the adequacy of these current indirect assessment strategies, and the need for improved means of timely assessment of vaccine coverage at the local and individual level is evident. Fairbrother, Freed, and Thompson (2000) conclude differences in assessments to determine how well the health system is working versus measures to assure population protection create tension and difficulty in identifying problems and establishing priorities to improve immunization coverage rates.

Factors Affecting Childhood Vaccination Coverage Levels

Public opinion and individual client factors. A plethora of diverse literature sources ranging from lay opinion articles to organized research study reports suggest that individual patient or client factors including demographic characteristics, health beliefs, knowledge, education, language, race, ethnicity, culture, religion, socioeconomic status, doubts about the accuracy of vaccine information, and worries about vaccine side effects and discomfort may have varying degrees of influence on parental attitudes and voluntary public participation in immunization programs, possibly negatively affecting the outcome of any immunization effort (Baum, 1992; CDC, 1996c; Clayton, Hickson, & Miller, 1994; Coulter, 1990; Frank et al., 1995; Gellin, Maibach, & Marcuse, 2000; Goodman, 1996; "Islam Leader," 1995; Krieger, 1995; Levy & Manning, 1996; Manning, 1999b, 1999c; Meszaros et al., 1996; Moore, Fenlon, & Hepworth, 1996; Oeffinger, Roaten, Hitchcock, & Oeffinger, 1992; Suarez, Simpson, & Smith, 1997; The Gallup Organization, 1993; The Johns Hopkins University, 1993; University of Rochester, 1993; Williams, Milton, Farrell, & Graham, 1995; Wood et al., n.d.). The potential individual and social health consequences of persons exempted from immunization laws for personal philosophical or religious reasons are considerable. In a retrospective cohort study of data from 1985 to 1982, exemptors were about 35 times more likely to acquire measles than persons who were vaccinated (Salmon et al., 1999). In another retrospective study of children aged 3 to 18, Feikin et al. (2000) found exemptors were 22.2 times and 5.9 times more likely to contract measles and pertussis respectively. Similarly, in a recent European study where immunization in some countries has been disrupted by anti-vaccine movements, the incidence of pertussis was 10 to 100 times lower in countries where high vaccine coverage was maintained (Gangarosa et al., 1998).

The scientific research base on public opinion and individual factors affecting immunization coverage levels is vast and includes the well known diagnostic immunization studies conducted by CDC in the early 1990's to determine causes of underimmunization in selected urban areas (The Johns Hopkins University, 1993, University of Rochester, 1993; Wood et al., n.d.). More recently, in a national telephone survey of expectant parents and parents with children six years of age and younger ($\underline{n}$ = 1,600), Gellin, Maibach, and Marcuse (2000) identify up to 25% of parents have important misconceptions about immunizations reflective of eroded public confidence in vaccines. Several other studies have revealed how parents or caretakers may disagree with the practices of simultaneous vaccine administration and giving shots to children who are ill, preferring to divide multiple injections between visits and to defer immunizations for children with acute minor illness--views sometimes shared with health care providers (Melman, Chawla, Kaplan, & Anbar, 1994; Taylor & Cufley, 1996; Wood et al., 1998, Woodin et al., 1995). A recent report by Grantmakers in Health (2000) suggests immunization programs may be the victims of their own success, reporting lack of public confidence concerning information on vaccine safety, complacency, misperceptions, and the effects of public policy decisions all contribute to public mistrust in vaccines.

Vaccinations against VPDs can generate both optimistic and pessimistic emotional public responses (Fee & Brown, 2000). While outside the confines of mainstream science, the lay literature also includes the vivid and sensational public expression of negative opinions about immunizations, encompassing accusations of deliberate evil through corrupt suppression of public information about immunization risks and side effects by the government, pharmaceutical industry, and medical community (Collins, 1999). Compulsory vaccination programs have also been portrayed as conspiracies involuntarily subjecting and victimizing children as human guinea pigs (Miller, 1996). Further, leaders of racial, cultural, or religious groups have sometimes engendered fear among group members by suggesting that vaccines are furtively laced with impurities such as human immunodeficiency virus (HIV), thus constituting a genocidal scheme inflicted by the dominant society (Baum, 1992; "Islam Leader," 1995). In a recent reputable study in the mainstream public health literature, distrust in medical professionals was found to be as significant as external system barriers to immunization in influencing perceived parental control over the immunization of their children (Prislin, Dyer, Blakely, & Johnson, 1998). Historically, health professionals providing immunization services (including myself) have sometimes found these negative conceptualizations and distrust to be tenacious to the point of intractability, especially when embedded in mistrust of the dominant society by community members whose attitudes have evolved from acknowledged historical patterns of prior social abuse (Gamble, 1997; Hanks & Hanks, 1955; Read, 1966).

Occasionally, negative public opinion is directed at a specific vaccination and may arise from adverse events anecdotally and erroneously publicized by the media. For example, in late 1994 several major daily newspapers ran feature stories about the newly crowned Miss America who attributed her near total deafness to having received a routine DPT vaccination in childhood. Ironically, in a subsequent release it was announced her deafness was in fact the result of infection with Hib meningitis, a condition now preventable by vaccination! However, this story correcting the misinformation was less prominently featured by the media (Freed, Katz, & Clark, 1996).

In another case, an isolated report by a mother whose daughter lost her hair in 1994 shortly after receiving hepatitis B vaccine became an index case prompting not only publication of case studies of this rare phenomenon (Wise, Kiminyo, & Salive, 1997) and a letter of comment in a prominent medical journal (Sepkowitz, Wise, Salive, & Niu, 1998), but also a story in the San Francisco Chronicle implicating the vaccine (Russell, 1994). While such publicity could lead to improved reporting of adverse events, fear spawned that an unproven side effect such as hair loss might result after vaccination could also convince some parents to defer vaccination of their children indefinitely. The suspension of routine rotavirus vaccine administration in the fall of 1999 following 15-20 reported cases of bowel intussusception in babies receiving the vaccine and the call to phase out vaccines containing minute quantities of the mercurial preservative thimersol have more recently fueled public unrest concerning childhood immunizations ("Childhood Diarrhea Vaccine may be Risky," 1999; Manning, 1999b).

Expressions of public concern about vaccine safety have become increasingly common. Questions about a possible link between MMR vaccine and childhood autism are a contemporary focus of public attention. Appearances by football celebrity Doug Flutie attributing his son's childhood autism to MMR vaccine have recently been featured in the media. However, scientific evidence to support these claims is lacking (Congressional Quarterly, 2000; WHO, 2001). A study of 1.8 million individuals in Finland who received almost 3 million doses of MMR between 1982 and 1996 showed an indeterminate or possible causal relationship between MMR vaccine and serious adverse events at 5.3 per 100,000 vaccinees or 3.2 per 100,000 vaccine doses (Pajta et al, 2000). Febrile seizure was the most frequent of these events.

An article in the women's magazine Redbook with the sensational title "Was it murder or was it a bad vaccine?" (Goodwin, 2000) plants other doubts, suggesting pertussis vaccine may induce cerebral hemorrhaging that could be mistaken for shaken baby syndrome. This association, also lacking scientific justification, has been discredited by vaccine experts as misleading the public (Gellin, 2000). Reports that hepatitis B vaccine may cause multiple sclerosis have been unproven, with data from the Nurses' Health Study and Nurses' Health Study II failing to identify such an association (Ascherio et al., 2001). Gellin (2001) comments on the quandaries in countering unfounded allegations challenging vaccine safety with factual information when even sound epidemiological studies with negative results require years of coordinated planning and monitoring. The most recent assault on vaccine safety stems from a report that some pharmaceutical companies using vaccine ingredients derived from bovine sources are potentially contaminated with agents causing mad cow disease, with experts testifying the risk of contamination as theoretical, at most (Peterson & Winter, 2001).

Compounding public opinion against childhood immunizations in general and live viruses and activated pertussis vaccine in particular, some vocal segments of the chiropractic and homeopathic medical communities contend that widespread use of these vaccines represent the root cause of many contemporary chronic health problems and escalating social decay, blaming the prevalence of depression and suicide, mental retardation, asthma, childhood autism, allergies, epilepsy, predisposition to violent behavior, sociopathic personality, and other chronic conditions on widespread use of vaccines (Coulter, 1990; Krieger, 1995; Miller, 1996). Although scientific evidence to support these claims is lacking, the dissemination and promulgation of such views by licensed medical authorities and other alternative health care providers can potentially intensify negative public attitudes and heighten opposition among consumers already harboring such views. It seems plausible that at least some mainstream licensed physicians and nurses believing in homeopathy or other alternative therapies could hold similar beliefs and attitudes possibly affecting their immunizing decisions and behaviors. Contemporary speculation and research about possible links between childhood vaccinations and increases in childhood autism and juvenile diabetes, asthma, sudden infant death syndrome, multiple sclerosis, and auto-immune diseases (Collins, 1999; Manning, 1999c; Seppa, 1997) may reinforce such suspicions despite the lack of evidence supporting these claims. In summary, with the accelerating pace of public, media, and legislative scrutiny questioning vaccine safety showing no sign of abatement, childhood vaccines are now under constant assault (IOM, 2000; Koch, 2000; Poland & Jacobson, 2000).

Despite the existence of policies and comprehensive programs to continuously monitor vaccine safety at every level, Gellin (2000) found up to 20% of parents were unaware procedures to evaluate vaccine safety and effectiveness even exist. Edwards (2000) asserts perceived benefits in relation to risks have diminished now that adverse events associated with vaccination are more common than the diseases they prevent, adding to public concerns. The IOM (2000) projects the magnitude of concerns about vaccine safety will continue to increase as more vaccines are introduced and VPD rates decline. Mounting unrest has culminated in a number of initiatives to assure childhood vaccines are safe and that information about vaccine safety is scientifically based, including creation of a federal task force on vaccine safety, two separate IOM reports on vaccine safety, convening of an IOM expert committee to review new vaccine safety concerns, and establishment of the National Network for Immunization Information (NNii), an alliance to assure the public, media, public officials, and health care providers have access to accurate vaccine information (IOM, 2000; National Institute of Allergy and Infectious Diseases [NIAID], 1998).

In addition to exploring influences of public opinions, attitudes, and beliefs on immunization decisions, the CDC diagnostic studies attempted to isolate and link a complicated array of client socioeconomic and demographic characteristics to vaccination coverage levels within defined populations (The Johns Hopkins University, 1993; University of Rochester, 1993; Wood et al., n.d.). The Los Angeles study of African American and Latino children identified associations between a number of household and child characteristics and immunization status. Significant differences were found in the strength of particular associations at different age points, and the strongest association at 24 months of age (Wood et al.). In this study, previous immunization status was the most significant predictor of up-to-date status at 24 months. The Rochester study (University of Rochester) found a number of factors associated with delayed immunization failed as reliable predictors of underimmunization in a given child, since factors associated with underimmunization were not found consistently in large numbers of children. The Baltimore study (The Johns Hopkins University) used two theoretical models to identify the profile of children at risk for underimmunization, finding initial immunization delay to be a risk factor for continuing immunization delay and that parental attitudes and beliefs explain relatively little about a child's immunization status.

A recent CDC report (CDC, 1997e) indicates that although vaccination rates across non-white racial and ethnic groups have improved, they lag behind those of whites, with poverty looming as a dominant factor associated with lower immunization rates. Similar findings are reported by Strobino, Keane, Holt, Hughart, and Guyer (1996) who found that among client factors, only poverty, having multiple siblings, young motherhood, and non-participation in supplemental nutrition programs such as the Women, Infant, and Children (WIC) programs were associated with immunization delay.

In a study of children in Texas, Suarez et al. (1997) report African American children and those receiving welfare are far more likely to be underimmunized than those from well educated families and those enrolled in WIC.

In a landmark study also attempting to link socio-demographic characteristics to the immunization status of children in Texas, Prislin et al. (1998) found the predictive value of ethnicity and race, education, and welfare status on immunization levels to be mediated primarily by parental factors including their beliefs, attitudes, and perceived control over immunization decisions. This study suggests the influence of at least some socio-demographic factors on immunization are transformed and manifest through parental beliefs, which in turn determine attitudes and perceived control over a child's immunization.

In comparing the differences in immunization levels of rural and urban children in two large nationally representative surveys, Lowery et al. (1998) found no significant differences, with non-white race, low income, and parental under- or unemployment associated with underimmunization in both groups. A study of immunization coverage among rural preschoolers in 11 Eastern states showed that despite problems associated with greater distances to services, lower Medicaid coverage, higher rates of poverty, and limited physician availability, rates among children cared for through public sector programs were higher than those of their urban counterparts as well as those in rural areas where immunizations are not traditionally a public sector responsibility (Slifkin, Clark, Strandhoy, & Konrad, 1997). Christakis et al. (2000) found greater continuity of care and having a regular source of care positively associated with timely MMR vaccination. In rural Missouri, Wilson (2000) found providers' maintaining strong relationships with clients and assuring easy access to immunization services associated with timely immunizations.

These findings contrast with those in a study by Hueston, Mainous, and Palmer (1994) in which children receiving immunizations through the public care system were more likely to have immunization delays due to missed opportunities than their counterparts served by private sources. Oddly, in a study of children seen in private office settings, Taylor et al. (1997) found children of parents paying for immunization services out of pocket were as likely to be up-to-date as those with little or no out of pocket expenses for vaccines. In a national study of expanded Medicaid and other state programs implemented to buffer the deleterious effects of poverty and to generally enhance access to preschool immunizations, heavy reliance on public resources did not ensure timely receipt of immunizations, suggesting public and private collaboration is necessary for the protection of children from VPDs (Mayer, Clark, Konrad, Freeman, & Slifkin, 1999). Szilagyi et al. (2000) found a marked decline in vaccinations provided at health department clinics but no significant change in immunization levels following financing changes to keep children in a primary medical home where immunizations are integrated with other services.

Cutts, Orenstein, and Bernier (1992), and more recently Suarez et al. (1997) have attempted to summarize findings from varied studies linking this assemblage of personal, social, and economic characteristics to the immunization status of children. However, these authors point out that since many different types of studies and research methods have been used to measure client factors and immunization status in different settings and across different populations, results of studies are inconsistent and sometimes contradictory. Client factors associated with low immunization levels in one study may be linked to successful immunization in another. Similarly, a synopsis of studies by Grabowsky, Dietz, King, and Markowitz (1994) seems to confirm there is no single factor or even aggregate of client factors that account for underimmunization, suggesting that generalizations drawn from one population or group do not necessarily hold true for others, even among those with similar defining characteristics. In summary, attempts to draw inferences about the influences of client factors in successful childhood vaccination are confused by unique situational factors and conditions which make valid and reliable generalization difficult.

Health care provider factors. Individual client factors are recognized as an important facet in understanding successful vaccination and the problem of underimmunization, but their significance may be overshadowed by factors associated with the behavior of health care providers and the dimensions of care within the provider domain and control. As noted previously, research findings suggest parental beliefs do not correlate consistently with obtaining immunizations (Orenstein et al. 1994; The Johns Hopkins University, 1993). Aside from client attitudes about the lack of safety in administering multiple vaccines simultaneously and misconceptions about vaccine timing, Strobino et al. (1996) conclude parental attitudes are poorly associated with incomplete immunization. Since individual members of the public are not free to vaccinate themselves, providers serve as gatekeepers and oversee the provision of vaccines to control VPDs (U.S. DHHS, 1979; Orenstein & Bernier, 1994; Thompson, 1997). Furthermore, Orenstein et al. conclude most parents want their children to be appropriately immunized and trust the judgements of providers in making immunization decisions for them.

Taylor et al. (1997) assert that the behavior of individual providers may be the most influential factor associated with the immunization status of preschool children, at least among those followed by private pediatricians. Several client factors may themselves contribute to this weighting and imbalance between the influence of provider and client factors, including the public's historical deference to medical authority as described by Starr (1982) and a perceived asymmetry of information existing between consumers and providers of health care about appropriate immunization services. While consumers generally value preventive and health maintenance services including well child services (Earle & Burman, 1998), Hughart et al. (1997) conclude immunizations alone do not provide a strong incentive for keeping well child visits. Katz (1998) suggests this may be attributed to the fact that while young parents today may seek preventive services for general health reasons, they have little experience with childhood diseases like measles and mumps which were common in the past. They are also unfamiliar with the devastation caused by polio before effective vaccines against this disease became available.

This evidence emphasizes and underscores the importance of specific provider behaviors in effective vaccine delivery. These specific behaviors may be viewed and examined within the broader context of <u>provider immunization practices</u>, defined as an aggregation of repetitive activities that include provider immunizing or vaccinating behaviors. The Baltimore immunization study concluded "a wide range of provider practices are extremely important in facilitating age appropriate immunizations" (The Johns Hopkins University, 1993, p. 5). Breiman & Zanca (1997, p. 1919) contend "the continued success of childhood immunization programs rests on the public's trust" toward health care providers. The prevalence of underimmunization in geographically dispersed and socioeconomically diverse population groups, including those having health insurance and adequate access to primary care services, suggests that providers should generally be more accountable and motivated to immunize appropriately (Bates, Fitzgerald, Dittus, & Wolinsky, 1994; Lee, McDermott, & Elliott, 1994; Lieu et al., 1994; Orenstein & Bernier, 1994; Salsberry, Nickel, & Mitch, 1994; Zell, Dietz, Stevenson, Cochi, & Bruce, 1994). For example, in a study of 15 private pediatric practices in North Carolina, Bordley, Margolis, and Lannon (1996) found physicians are often unaware of underimmunization rates in their practices.

It has also been repeatedly reported that provider practices and decisions sometimes fail to meet expectations of the public and the provider community itself, creating barriers and generating missed opportunities for immunization and resulting in undesirable levels of vaccine coverage (CDC, 1994c; Farizo, Stehr-Gren, Markowitz, & Patriarca, 1992; Green, 1994; Gross & Brown, 1996; Hutchins, Jansen, Robertson, Evans, & Kim-Farley, 1993; Johnson et al., 1996; Kimmel, Madlon-Kay, Burns, & Admire, 1996; Lochhead, 1991; Mahan & Woodzelle, 1996; Martinkus & Rushing, 1996; Wood, Pereyra, Haflon, Hamlin, & Grabowsky, 1995). Following principles outlined by Holt et al. (1996) and Hutchins, Jansen et al.(1993), a <u>missed opportunity</u> is defined as the failure of a health care provider to take advantage of every opportunity to vaccinate, i.e., failure to administer an age-appropriate vaccine during a clinical encounter without a valid contraindication or client refusal. As a contributing factor in underimmunization, Thompson (1997) contends health care providers bear full responsibility for missed opportunities since by definition they are under provider control. Logically, they are also preventable. In a report from the IOM, Durch (1994) identifies missed opportunities as among the most serious barriers to immunization.

The impact of missed opportunities can be significant. For instance, in a study of inner city children in Baltimore, Holt et al. (1997) found a missed opportunity occurred in over 20% of preventive health visits. Hamlin, Wood, Pereya, and Grabowski (1996) report over 30% of all children seen at both well child and immunization-only public health clinics in a Los Angeles study were given inappropriately timed immunizations. Weese and Krauss (1995) report providers may fail to immunize appropriately even when known barriers are reduced or eliminated, demonstrating the pervasive and sometimes unpredictable nature of missed opportunities as a major contributor to underimmunization.

Major components in underimmunization of preschool children include an initial immunization delay, a paucity of patient and provider contacts, and the effects of missed opportunities (Grabowsky et al., 1994). Children behind ih immunizations are likely to be lacking other preventive services (Szilagyi et al., 2000). Consistent with findings in the University of Rochester CDC diagnostic study (1993), in a study of vaccination rates among 426 children of poor families in the city of Baltimore, Ross et al. (1998) found newborns who did not have a check-up within the first 42 days after birth were twice as likely to have missed being vaccinated as those who did.

These and other studies have noted that the consequences of underimmunization and missed opportunities may become synergistic and cumulative, with missed opportunities themselves becoming a risk factor (Williams et al., 1996) and marker (Bolton et al., 1998) for more missed opportunities. A recent study by Lauderdale, Daum, Blankenburg, and Davis (2001) found delayed receipt of the first DTP vaccine (as a function of either parental or provider factors) to be a strong predictor of later immunization status. Once a child is behind schedule, determination of needed vaccines is more complicated and becomes more difficult for providers. Rodewald et al. (1995) point out that delayed immunizations are a marker for underutilization of other preventive services, i.e., children for whom immunization is delayed may be missing out on other important aspects of comprehensive care. Lasker (1997) and Thompson (1997) indicate providers may exacerbate these problems if they lack incentives to stress clinical preventive services, especially when reimbursement systems favor diagnostic and therapeutic procedures over preventive care.

The snowballing effects of these factors may require an intensification of effort and additional visits for age-appropriate immunization even though appropriate services should have been provided at less risk and cost during previous encounters (Durch, 1994; Frank et al., 1995; Quadros et al., 1996). This situation is one example of a departure from Crosby's (1979) "absolutes of quality," as work carelessly omitted precipitates the need for more work at a later time, having the equivalent impact of costly mistakes and reworking in the manufacturing world today. Moreover, the most effective or successful delivery methods may vary depending on population and provider factors, the extent of an immunization delay, and factors related to individual vaccines, implying there is neither a single cause or a single panacea for the complex problem of missed opportunities (Tannenbaum et al., 1994).

In the following sections, factors related to the behaviors of health care providers when they immunize children are described and organized into sections where they best seem to correspond to the major dependent variables comprising Ajzen's theory of planned behavior (TPB), including attitudes, subjective norms, and volitional or perceived behavioral control concerning immunization of children.

Provider Attitudes Toward Vaccinations

With the bulk of literature concerning provider attitudes toward vaccination appearing in the medical and public health literature, it is noted terms such as acceptance, attitudes, beliefs, reactions, and opinions are commonly used. Semantic and conceptual distinctions between these terms are not clear. In many studies the terms are not defined or used consistently or uniformly, if they are defined at all. Because these terms seem most congruent with the concept of attitude, they are included in this section describing provider attitudes toward vaccination.

The beliefs and attitudes of health care providers concerning immunizations have been the subject of considerable research in recent years, especially among physicians. Provider practices were analyzed as an important element in the Baltimore (The Johns Hopkins University, 1993), Los Angeles (Wood, n.d.) and University of Rochester (1993) CDC diagnostic studies. Thompson (1997) contends provider knowledge, beliefs, and attitudes are among the key predisposing factors for immunization as well as failure to immunize and includes these as a common cause of missed opportunities.

Ajzen (1988, p. 33) acknowledges an individual's salient beliefs underpinning attitudes are generally acquired through a mix of direct, indirect, and inferential processes from informational and other sources. Therefore, obscure and unidentified personal idiosyncrasies may interfere with society's expectation that providers will appropriately immunize children, as suggested by Taylor et al. (1997). Inadequacies in provider information and knowledge may also generate false beliefs and negative attitudes toward vaccinations.

The adequacy of provider knowledge is complicated by ongoing biomedical research for new and improved vaccines, rapid advancement in vaccine development, and changes in vaccine approval and licensing (Altman, 1994; Anderson & Stiehm, 1992; Blennow, Granstrom, & Strandell, 1994; Kimmel et al., 1996; Mitchell et al., 1993; "New Vaccine," 1996; Rubin, 1995; Stix, 1996; Stratton, Howe, & Johnston, 1994). Holmer (2000) reports up to 42 new vaccines are under development. The IOM (2000) reports the number of vaccines available in the next 20 years will triple. As a result, the recommended childhood immunization schedule will continue to change frequently, as it has most recently with the addition of varicella (chickenpox) vaccine, a revised polio vaccine schedule substituting inactivated polio vaccine (IPV) for live oral polio vaccine, and availability of acellular pertussis vaccine in combination DTaP (CDC, 1996d, 1997b; NIP, 1995a, 1995b; Resha, 1997). In 2001, a four-dose series of multivalent pneumococcal conjugate vaccine was added to the recommended immunization schedule (CDC, 2001b). Between 1985 and 2000, the schedule was changed 24 times and as often as three times a year (IOM, 2000). In the last few years, the recommended childhood immunization schedule has changed as often as every six months, challenging providers to stay abreast (Kimmel et al.).

The year 2000 jointly approved recommendations of the Advisory Committee on Immunization Practices (ACIP), The American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AFP) used in this study for childhood immunizations are reproduced in Appendix A (CDC, 2000b). Using this schedule, recommendations call for the administration of a total of 19 vaccines (or 20 if Hepatitis A is included) at specific age intervals in this standardized series by the time a child reaches school age (CDC, 1996d). Given this degree of complexity and the frequency of changes in the recommended vaccine schedule as well as local, regional, and temporal variability in availability of particular vaccine combinations, there is reason for potential confusion among providers concerning the recommended vaccines to be given a child at a particular age (Orenstein, 1997). Some providers commonly administer vaccines more frequently than others do in their day to day work, suggesting a differential or gradient may exist in the knowledge and familiarity of health care providers concerning preschool immunization recommendations and the frequency with which they are actually called upon to administer vaccines. Furthermore, some providers may choose to make local adjustments in the ages that certain vaccines are administered, thus failing to comply with the established recommendations.

Iterations of the approved age-specific immunization schedule, standards for recommended vaccine administration for special cases (e.g., immuno-compromised children and those with a prior immunization delay), and specific preferred immunization practices including valid and invalid (false) contraindications have been developed and widely promulgated in texts and journals for professional education and in plain language that lay people will understand (AAP, 1997; AAWH, 1995; ANA, 1994a, 1994b; Anderson & Stiehm, 1992; CDC, 1993, 1996c; Freeman, 1997; Knollmueller, 1993; NAPNAP, 2000; J. Osborn, personal communication, June 21, 1996; Osguthorpe & Morgan, 1995; Wallace, Ryan, & Oglesby, 1994). The National Network for

Immunization Information (Nnii) has recently embarked on a national campaign for effective communication with patients, providers, the media, and policy makers about vaccine benefits and risks using print and electronic media (NNii, 2000). However, neither providers nor consumers are automatically aware or fully accepting of such authoritative information, updates in the recommended vaccine schedule, or changes recommended for improving immunization coverage levels among children served by a particular health facility. In a survey of public ($\underline{n}$ = 47) and private ($\underline{n}$ = 50) providers in Los Angeles, Wood, Halfon, Pereya, Hamlin, and Grabowsky (1996) identify a serious gap in provider knowledge about the recommended vaccine schedule and contraindications to vaccination, with public health nurses having more correct responses than both private and public physicians in both categories of questions.

Grabowski, Orenstein, and Marcuse (1996) attribute general disinterest and inattention to vaccine recommendations to the tendency of (pediatrician) providers to overestimate immunization coverage levels in their own practice, lending to a tendency to ignore new information or recommendations for practice improvements. Bradford (1999) suggests physicians may not be supportive of changes due to financial considerations, particularly if payments or reimbursements for vaccination services are perceived as insufficient to cover costs. With frequent changes in the recommended vaccine schedule and no foreseeable end in new vaccine development, variations in health care provider beliefs and attitudes concerning individual vaccine efficiency and safety as well as the evaluation of attitudinal shifts when the recommended vaccine schedule is revised will continue to be potentially important factors affecting adherence to vaccine recommendations (Ellenburg & Chen, 1997; Gyorkos & Franco et al., 1994;

Gyorkos & Tannenbaum et al., 1994; Hobson, 1994; Miller et al., 1996; Muhlemann & Weiss, 1997; Orenstein & Bernier, 1994).

A core of research concerning provider attitudes toward vaccination can be categorized as to whether it relates to knowledge, beliefs, and attitudes linked to the behavior of administering specific vaccines, or to behavior in specific situations associated with vaccination under certain conditions, such as the simultaneous administration of one or more vaccines to a child by injection or administration during a bout of minor illness.

Attitudes toward administration of specific vaccines. Diphtheria, pertussis, tetanus, polio, measles, mumps, and rubella are the VPDs for which vaccines have been available for the longest period of time (Selekman, 1998). Among these, a paucity of contemporary literature suggests there has been few recent expressions of controversy or need to even study the attitudes of health care providers concerning these vaccines, with the notable exception of pertussis and MMR vaccines. Until recently, the recommended pertussis vaccine was a killed whole cell suspension containing antigens playing no role in bestowing immunity against pertussis, antigens implicated in occurrences of several rare but potentially serious reactions including convulsions and encephalopathy. Over the last 20 years, concerns and negative attitudes toward pertussis vaccine (and DPT by association) have been repeatedly and widely publicized, with public opposition and negative attitudes leading to an episode of declining immunization coverage and outbreaks of pertussis abroad (Chen, 1994; Miller, 1996; Peter, 1992; U.S. DHHS, 1998). In the U.S., public vengeance against pertussis vaccine was directed at pharmaceutical companies when lawsuits were filed against drug manufacturers over adverse events, thus posing a threat to continued vaccine production (Ellenberg & Chen, 1997). Within the last year, unsubstantiated reports concerning a link between MMR vaccine and childhood autism have generated similar unrest (Gellin, 2000; Koch, 2000; NIAID, 1998).

Although the killed cell pertussis vaccine was still considered safe, catastrophic untoward vaccine events involving pertussis (DPT), MMR, and oral polio vaccines were among the major factors providing the stimulus for creation of the Vaccine Adverse Event Reporting System (VAERS) and authorization for a vaccine-associated injury compensation program injuries under the National Childhood Vaccine Injury Act (Chen et al., 1994; Ellenberg & Chen, 1997; Flamberg, 1995; IOM, 2000; GAO, 1999). Post-marketing surveillance of vaccine adverse event information under VAERS has become a valuable tool in monitoring rare events and the safety of new vaccines (Niu, Salive, & Ellenberg, 1998). Nonetheless, public aversion to DPT vaccine began to spill into the professional domain through the contagion of threatened litigation against not only drug companies but also health care providers who administered any vaccine implicated in cases of vaccine related injuries (Cherry, 1997). In The Johns Hopkins University (1993) CDC diagnostic study in Baltimore, over 60% of providers expressed some concern over liability associated with vaccines. In a study of physician's perceived liability risk associated with vaccines, Freed, Kauf, Freeman, Pathman, and Konrad (1998) found less than 30% of respondents believed state and federal compensation programs were adequate to protect them against vaccine related litigation. However, variables related to perceived liability were not independently associated with other immunization behaviors, suggesting fear of liability may be cited as a reason for deferral when other factors may actually be more important in making decisions about whether or not to immunize.

In another study of 1,236 physicians in office-based practice to assess their beliefs about vaccine safety and litigation, Zimmerman, Schlesselman, Mieczkowski, Medsger, and Raymund (1998) found that 13-32% overestimated specific vaccine risks. A high percentage of these were concerned about potential litigation from adverse vaccine effects. Of those aware of the national vaccine injury compensation program, less than half believed it afforded high protection against litigation. However, most respondents reported they would encourage vaccination even when parents were concerned about possible adverse events. Interestingly, reports of lawsuits against hospitals and physicians for failure to immunize appropriately have also been reported ("Hospitals and Doctors Sued,"1996).

New acellular pertussis vaccines, developed to improve vaccine safety (Orenstein, Hadler, & Wharton, 1997) and available in combination forms with diphtheria and tetanus vaccines as DTaP, became widely available in 1996 and are reported to result in far fewer sequelae and side effects than the whole cell form (Selekman, 1998). Thus, abatement of provider negativity toward this vaccine as well as diminished fear of litigation would be expected and assumed, but confirmatory research has yet to be published in the literature.

Concerning the other older vaccines, live attenuated polio vaccine (OPV) was the standard vaccine for polio for over 40 years. With the last case of wild virus in the Western Hemisphere reported in 1991, the only new cases of paralytic polio were those associated with the vaccine, an exceedingly rare occurrence (Orenstein, Hadler, &

Wharton, 1997; Satcher, 1999). Recently, six confirmed and 26 possible cases of flaccid polio occurring in areas of Haiti and the Dominican Republic with low immunization coverage levels were determined to be caused by oral (live-virus) vaccine ("PAHO Working", 2001). The current recommended immunization schedule in the U.S. calls for four inactivated (IPV) doses and no OPV, thus reducing the risk for vaccine-induced polio (Prevots & Strebel, 1997; Satcher; Selekman, 1998). But this revision is accompanied by a change in the route of vaccine administration by substitution of oral doses to injections, a change with the potential to generate negative attitudes toward the immunizing behavior among some providers. Some providers would seem to be more accepting of a vaccine incapable of causing vaccine-associated paralysis, as reported in a study of parents and nurses in Georgia ("Parents Accept", 1998). However, systematic assessment of changes in the attitudes of health care providers related specifically to the altered polio vaccine recommendations requiring additional injections for infants have yet to be reported in the literature.

Concerning MMR as the other older vaccine, recent studies on health care provider attitudes toward the vaccine are not found in the literature. However, public concerns about a link to childhood autism have been expressed widely, sometimes requiring health care providers to respond to these concerns (Gellin, 2000; Koch, 2000; NIAID, 1998). The Baltimore CDC diagnostic study found participating providers were somewhat more cautious and conservative in their attitude toward administration of MMR than they were in giving other vaccines (The Johns Hopkins University, 1993).

The introduction of new vaccines into the recommended vaccine schedule provide elements similar to a natural experiment for studying changes in the profile of provider attitudes toward the vaccine over time. An example of how negative attitudes and concerns about a new vaccine may vary among different physician groups and also attenuate over time is demonstrated in the case of hepatitis B vaccine, first added to the recommended immunization schedule for all children in 1991.

Two months after the announcement of the new vaccine recommendations, Freed, Bordley, Clark, and Konrad (1993) surveyed a random sample of 300 family physicians in North Carolina, finding 48% of respondents were aware of the new vaccine recommendations. Only 17% agreed the vaccine was warranted for all newborns in their practice. Eight months after the initial recommendations were released, in a study of 700 pediatricians and 300 family physicians conducted by the same investigators (1994), 66% of pediatricians and 33% of family practice physicians were accepting of the recommendations. However, only 53% and 23% of the two groups respectively had incorporated the new recommendations into their practices. This was attributed to perceived lack of necessity for the vaccine and aversion to multiple injections.

Differences in pediatrician and family practice physician attitudes toward hepatitis B vaccine were followed in another study involving several of the same authors. Two years after the hepatitis B vaccine recommendations was made, pediatricians were far more likely than family physicians to claim they were familiar and in agreement with the recommendations and also more likely to have adopted vaccine administration into their practice (Freed, Freeman, Clark, Konrad, & Pathman, 1996). Interestingly, the number of physicians adopting the new vaccine recommendations exceeded the number that agreed with it in both groups. In a study of 522 pediatricians in Illinois, Kraus, Campbell, and Marcinak found the majority had incorporated the new recommendations into their practice by 19 months after the initial release. By 1995, in a national study of 3,681 primary care physicians, 78% rated the importance of the vaccine as high (Zimmerman & Mieczkowski, 1998).

Universal vaccination against varicella or chicken pox was introduced into the recommended vaccine schedule in 1996. Mixed reactions and acceptance in the medical community have also been observed, but given the relative newness of the vaccine, less systematically than in the case of hepatitis B. In a study of 434 pediatricians in the state of Washington, Newman and Taylor (1998) found only 42% reported following the universal varicella immunization policy. Reasons for adoption of the recommendations included the desire to reduce risk for serious complications of the disease and parental lost work time if a child becomes ill. Physicians concerned with the ability of the vaccine to confer long term immunity were less likely to adopt the recommendations.

In a 1996 study of 172 physicians in Rochester, New York, 63% indicated they administered varicella vaccine to children 1-5 years of age. Major reasons cited for deferral included the belief that chicken pox is usually a normal and self limiting experience in childhood, the natural history of the disease could undergo an epidemiological conversion into a more severe disease of adults, children receive enough immunizations already, the cost of universal vaccination is excessive, and that only immuno-compromised individuals and their contacts are candidates for the vaccination (Schaffer & Bruno, 1999).

Heated editorializing and exchange of opinions about the effectiveness, pros and cons, and risks and benefits of varicella vaccine continue to be found in the literature (Arvin, 1997; Gershon & LaRussa, 1998; Hurst, 1996; Niederhauser, 1999; Plotkin, 1996; Seidman & Pont, 1998; Sparks & Russell, 1998). Dominant themes in this ongoing debate include concerns over the duration of immunity, potential risks to adults who acquire the disease later in life (when it tends to be more serious) if the vaccine fails, and overall concern about the cost-effectiveness of universal vaccination (MacFarlane, Sanders, & Cerek, 1997). Lavin (1996, p. 1225) concludes universal vaccination recommendations for both hepatitis B and varicella were resisted because these were problems "the community and physicians did not agree presented a danger sufficient to justify such an intervention." Echoing concern over the prospect of creating a generation of vulnerable adults, one physician (Lallier, 1996) reported hesitation in giving the vaccine to his own four year old son. Clearly, salient beliefs and attitudes of health care providers toward selected vaccines may be a factor in determining whether specific vaccine recommendations are followed.

Attitudes toward vaccinating behaviors under certain conditions. It is frequently cited in the literature that health care providers are reluctant to administer vaccines to children presenting with acute minor illnesses and an assortment of conditions, allergies, signs, and symptoms, even when such manifestations are recognized as invalid or false vaccine contraindications according to accepted standards. A number of studies have shown provider misconceptions about contraindications or beliefs that vaccinations are ineffective or dangerous when a child is mildly ill are important contributors to missed opportunities (Bowman & Schwenk, 1995; Taylor et al., 1997; The Johns Hopkins University, 1993; University of Rochester, 1993; Wood et al., n.d.;

Wood et al., 1998).

In a synopsis of 79 survey studies on missed opportunities in 45 developing and industrialized countries, a median of 19% of missed opportunity occurrences stemmed from false contraindications (Hutchins & Jansen et al., 1993). These claims are supported in findings of a national study of primary care physicians (N = 1,241) in which 90% recognized minor illness with fever as an invalid contraindication, but nearly half (47%) were less likely to administer age-appropriate vaccinations if the child was ill (Zimmerman, Schlesselman, Baird, & Mieczkowski, 1997). As an example of how attitudes may influence behavior, only 4% of respondents who believed the risk of side effects increased in the presence of an upper respiratory infection were likely to immunize. Eight percent of total respondents believed the efficacy of MMR vaccine would decrease during an upper respiratory infection. Major public health concerns may emanate from questionable practices of a relatively small percentage of providers if they provide immunization services to large numbers of children and thus account for a disproportionate share of total missed opportunities.

In a study of missed opportunities to immunize inner city children, Holt et al. (1996) found medical diagnoses of well child, otitis media, upper respiratory infection, skin infection, gastroenteritis, and resolving illness were the conditions most commonly associated with failure to immunize. In a study of 140 primary care physicians who serve children, Szilagyi, Roghmann et al. (1994) found more than half would not immunize a child with a fever or ear infection. In a study of Cincinnati physicians, Siegel and Schubert (1996) found less than half would use an illness visit for immunizations whether the child was due or overdue for a visit, even though 83% of respondents correctly identified illness with fever as a false contraindication. Wood et al. (1998) found more missed opportunities associated with private than public providers and acute illness versus well child visits.

In a study by Campbell et al. (1994) to determine if pediatric (n = 52) and family medicine (n = 23) residents at a large university medical center followed accepted immunization contraindication standards, questionnaires were administered depicting 17 common clinical scenarios that might be encountered in settings where immunizations are provided. Respondents overwhelmingly indicated reluctance to immunize in the presence of fever and neurological conditions even when these were not true contraindications. Pinkowish and Schaffner (1998) conclude many opportunities to vaccinate children are lost because of these and other ungrounded provider worries about inducing or aggravating sickness.

Peter (1992) summarized a list of loosely defined common false contraindications to immunization cited by ACIP. These include prematurity, breast feeding, the presence of acute minor illness or diarrhea, low grade fever, vague antibiotic, egg, or duck allergies, prior localized or minor reaction to a vaccine, family history of SIDS, and maternal pregnancy. This list is not exhaustive, and health care providers may hold other salient but unidentified beliefs about false contraindications.

Another set of circumstances described in the literature in which health care providers demonstrate hesitancy to vaccinate according to accepted standards pertains to simultaneous vaccine administration, i.e., when multiple antigens are administered during the same clinical encounter. Providers and parents may be concerned that simultaneous administration will lead to more side effects and decrease vaccine safety and effectiveness (King & Hadler, 1994). The Standards for Pediatric Immunization Practices (CDC, 1993), described in more detail in a section which follows, recommend simultaneous vaccine administration of age-appropriate vaccines to children as a safe and effective intervention based on findings of a rigorous program of research. Clinicians and researchers indicate that except in unusual cases, simultaneous administration does not reduce the desired immunologic response or pose increased risk to the child, with benefits far outweighing the risk of deferral (Chen, Haber, & Mullen, 1995; King & Hadler, 1994; Peter, 1992). In a national study of children at 21 different provider sites, Dietz et al. (1994) conclude missed opportunities would be reduced and significant improvements in age-appropriate immunization levels could be achieved with greater adherence to recommendations for simultaneous administration.

Orenstein, Atkinson, Mason, and Bernier (1990, p. 321) underscored the importance of simultaneous administration nearly a decade ago, stating "simultaneous administration must be the rule, not the exception." In the international synopsis of studies on missed opportunities in developing and industrialized countries cited previously, a median of 22% of missed opportunity occurrences stemmed from failure to administer vaccines simultaneously (Hutchins, Jansen, et al., 1993).

The value of the recommendation for simultaneous administration as a strategy to raise immunization levels was supported in a Minnesota program where an intervention of rigorous attention to screening and administration of all age appropriate vaccines was employed, resulting in a marked decline in missed opportunities and concomitant improvement in immunization rates (Harper, 1997). Contrary findings were found in a study by Szilagyi et al. (1996) when an intervention to increase immunization status through routinized screening failed to reduce missed opportunities because children simply were not screened by providers despite the planned intervention.

Client socioeconomic status may be among the factors associated with provider failure to administer vaccines simultaneously, although reasons for this association are unclear. In a study of Virginia providers and children, poorer children were far more likely to have missed opportunities due to provider failure to administer vaccines simultaneously (Williams et al., 1995). Dietz et al. (1994) conjecture providers may be reluctant to administer vaccines simultaneously, particularly the fourth dose of DPT with MMR vaccine, because of worries about side effects or a diminished immunological response. It is posited that negative attitudes toward simultaneous administration stem from beliefs about potential adverse interactions of the vaccines, discomfort for the child caused by injections, parental objections, costs, or a mix or combination of these factors as summarized in report sponsored by the Institute of Medicine on immunization barriers (Durch, 1994). However, the literature is frequently unclear in distinguishing which belief or combination or mix of beliefs is at play when negative attitudes toward simultaneous administration are described.

Another important issue surrounding provider attitudes and possible objections to simultaneous vaccine administration is unequivocally related to the fact that vaccines are available only in injectable form, with the exception of OPV, but even this vaccine has been replaced in the recommended vaccine schedule by injectable IPV. This implies that on visits occurring within certain age intervals, even for children who are up-to-date for immunizations, a health care provider who follows recommended guidelines may be required to administer up to four separate injections--and possibly a fifth, intradermal Mantoux (PPD) test for tuberculosis--on the same visit. A child with immunization delay could conceivably be due for an injectable dose of varicella vaccine as well, and injectable vaccine against pneumococcal infection was added to the recommended vaccine schedule for 2000.

How many shots do parents and health care providers consider too many? Following the addition of three doses of hepatitis B vaccine to the recommended childhood series, Madlon-Kay and Harper (1994) studied a group of parents, nurses, and physicians at 32 family practice clinics to assess attitudes toward simultaneous administration of injectable vaccines. Respondents in all three groups overwhelmingly indicated that three shots were too many for a child to receive on one visit, with concern about perceived pain and discomfort contributing to this attitude. The investigators conclude that the issue of discomfort from an injection may significantly contribute to missed opportunities and be a barrier to adoption of immunization recommendations, further stressing the importance of prioritizing biomedical research to develop combination vaccines. In a study of pediatric residents, 25% indicated they would not give four simultaneous injections, with 74% of these citing the multiple injections would be too painful for the child (Szilagyi, Rodewald, & Humiston, 1994). In the same study, parental objections were cited by 29% as the reason for deferral of multiple injections among those who would defer. Brennan et al. (2001) found a curvilinear relationship between the number of antigens due and missed opportunities; missed opportunities were most common when one, two, four, or five antigens were due, and less common when three were due. Providers must also deal with concerns of an increasing number of parents who conclude the total of 30 antigen doses a child is recommended to receive by age 6 is unsafe and unnecessary ("Fewer Children Get Immunizations", 2001).

Expressions of negative parental attitudes toward multiple injections can therefore be seen to have some potential influence on health care provider decisions. In a study of attitudes of 281 caretakers or parents toward multiple injections, 8.5% preferred two visits for two injections, with 42.3% and 58.4% preferring two visits for three and four injections respectively (Melman et al., 1994). But in another study of 215 physicians and medical residents and 197 parents, physicians (80%) showed more concern than parents (60%) over simultaneous administration by injection, with both groups identifying pain for the child as the dominant reason for the concern (Woodin et al., 1995). More than half of the practicing physicians reported their office staff would react negatively to giving multiple injections. It is not clear if office staff included nurses. However, most parents expressed willingness to allow up to four injections if this was recommended by the physician.

It can thus be seen that attitudes of health care providers may be swayed toward immunization deferral unless they accept the value of multiple injections themselves and are prepared to recommend simultaneous administration by injection when confronted with objections from parents, caregivers, coworkers, or subordinates. Nonetheless, the seriousness of parental objections in its relationship to provider behavior as a contributor to missed opportunities is unclear. In the international synopsis of studies on missed opportunities in developing and industrialized countries, a median of only 3% of missed opportunity occurrences stemmed from parental refusal (Hutchins, Jansen, et al., 1993).

The impact of beliefs about both false contraindications and simultaneous administration on immunization decisions and behaviors have been assessed in the same study. Askew et al. (1995) organized a study of 43 private and 25 public pediatric providers (including two nurse practitioners) in New Jersey using a telephone interview survey to assess beliefs and practices concerning simultaneous vaccine administration and knowledge of true vaccine contraindications consistent with accepted standards. Significant findings revealed that private providers were less likely than public providers to consider vaccination during hospitalization and emergency room visits and more likely to defer simultaneous vaccine administration because of perceived psychological or physical trauma to the child. Private providers were also more likely to defer vaccination in the presence of an acute minor illness or low grade fever. The authors conclude private providers are less likely to believe clients are inconvenienced by multiple visits and underscore how more provider education may be needed to reduce the number of missed opportunities. Another plausible reason for higher deferral of vaccines among private providers could be overestimation of their own performance (Bordley et al., 1996) or perceived risk for claims of malpractice resulting from vaccine side effects, as reported by Zimmerman et al. (1998).

Differences in attitudes of physicians toward multiple injections have been observed according to gender and length of career practice as demographic variables. In a study comparing attitudes with immunization levels of 140 physicians who provide primary care services to children, lower immunization levels were associated with female physicians (Szilagyi, Roghmann, et al., 1994). However, using criteria outlined by Ajzen and Fishbein (1980), this finding may be specious and of no relevance if some portion of the chosen outcome measure (differences in immunization coverage rates) is attributable to factors other than physician behavior in the population studied.

In a study of medical residents, Szilagyi, Rodewald, and Humiston (1994) found most of the 171 respondents were reluctant to administer simultaneous injections and to provide immunizations during acute care visits, failing to adhere to true vaccine contraindications. This and a similar study by Campbell et al. (1994) conclude health care providers would benefit from more specific formal provider education about immunization practices as students in order to counter erroneous beliefs about contraindications and lessen resistance to simultaneous administration by injection, thus addressing these contributors to missed opportunities before students begin their careers. But another study assessing physician opinions concerning multiple injections, physicians who graduated from medical school less than 10 years prior were significantly less concerned about giving multiple injections to children under seven months of age than those in practice for over 10 years (Woodin et al., 1995). Similarly, Szilagyi, Rodewald, et al. (1994) found older physicians (and those in solo practice) were less likely to follow immunization guidelines than those who graduated from medical school more recently. Research including demographic information comparing differences in attitudes toward specific vaccines and simultaneous administration by injection between providers who have children of their own and those who do not is not found in the literature.

What interventions do health care providers employ to deal with pain and discomfort associated with injections? In a study of children ages 4-7, French, Painter, and Coury (1994) describes those taught to blow imaginary soap bubbles reported less pain and demonstrated fewer pain behaviors than a control group who were not similarly distracted. French and colleagues conclude only 2% of parents with children have devised any strategy of their own to deal with immediate pain associated with vaccinations. Perhaps health care providers would show less adversity and have more accepting attitudes of children's pain associated with simultaneous administration by injection if they were more prepared to intervene themselves.

A third major theme in which variability in health care provider attitudes and behavior toward vaccine administration under certain conditions has been observed includes an economic component related to cost factors, i.e., if and how the provider is paid for immunization services and whether there is a cost to the client or parent for a vaccine, a clinical encounter or office visit, or both. Whereas many nurses who administer vaccinations may be salaried employees, cost may be a factor of concern to nurse practitioners or other independent or advanced practice nurses reimbursed for services under Medicaid or other insurance.

The cost of providing immunizations in physician's offices may lead some parents to seek immunization services in public clinics and prompt some physicians to refer patients to these clinics (Bordley, Margolis, & Lannon, 1996). Overall, vaccine costs have increased substantially over the last 10 to 15 years (Freed, Clark, Konrad, & Pathman, 1996). Orenstein and Bernier (1994) report the purchase price of vaccines to fully vaccinate a child increased from about $27 in 1983 to $270 in 1994. The cost of four doses of the new pneumococcal conjugate vaccine alone is expected to nearly double the total cost of the recommended childhood vaccines. Concerning immunization service profitability, in a study of 15 private pediatricians in 11 states, 6 indicated provision of immunizations as profitable and 9 reported it was not (Taylor et al., 1997). Logically, some providers would be reluctant to provide immunization services if service costs are insufficiently subsidized or compensated in some way to at least meet provider costs.

Free vaccines were introduced as a partial solution to this problem. Hueston, Mainous, and Farrell (1994) reported that providers in states with access to free vaccines were significantly ($p < .001$) more likely to offer vaccines than providers in states without free vaccines, concluding that availability of free vaccine does increase the likelihood that more children will be appropriately vaccinated. The availability of free vaccine would also seem likely to reduce the fraction of missed opportunities resulting from negative attitudes of health care workers about reluctance to waste vaccine if, for example, a multi-dose vial were to be used for only one child (Hutchins, Jansen, et al., 1993).

Therefore, the Vaccines for Children (VFC) program, described in greater detail in a following section, was implemented in 1994 "to immunize more children and increase vaccine coverage levels nationwide by creating an entitlement to free vaccine for children eligible for VFC and thereby reduce vaccine cost as a barrier to immunization" (GAO, 1995, p. 10). VFC is intended to offer vaccine free to providers of services for eligible children, including uninsured and American Indian children and Medicaid enrollees (Orenstein & Bernier, 1994). The program provides vaccine to enrolled public and private providers at no cost to the provider and allows states to purchase vaccines at contract prices for uninsured children.

Several evaluative reports initially criticized the VFC program by challenging the assumption that the cost of vaccine is a significant barrier to timely immunization (Edelson, 1995; GAO, 1995; Simpson, Biddle, & Rabinovich, 1995). But in a study of 1,769 physicians, Zimmerman, Medsger, et al. (1997) report 44% of those receiving free vaccine from VFC or other sources indicated they would send an uninsured child elsewhere for immunization services compared with 90% of those not receiving free vaccine who would refer. Regression analysis revealed free vaccine accounted for 24% of the variability in the likelihood of referral. In a later study, Zimmerman, Mieczkowski, and Michel (1999) found children followed by providers who do not receive free vaccines were more likely to be underimmunized whether seen directly or referred for immunizations to public clinics. In a 1997 survey of pediatric nurse practitioners, Zimmerman, VanCleve, and Medsger (2000) found those receiving free vaccine supplies through VFC were less likely to refer children to public clinics for vaccination than those who did not.

Free vaccines and the VFC program are not a panacea for underimmunization in what Wood and Halfon (1996, p. 581) refer to as a nationally "fragmented child health financing system." These authors conclude state or national immunization policy is still needed for underinsured children who lack coverage for charges associated with immunization services. Another study of poor urban children showed other client risk factors associated with poverty may factor into underimmunization independently of health care provider immunization practices even when free vaccine is available (Bates et al., 1994). Similar findings are reported in a study of inner-city children in Chicago who participated in a free vaccine program (Kenyon, Matuck, & Stroh, 1998).

The attitudes and immunizing behaviors of some health care providers may not change significantly despite the availability of free vaccines. North Carolina implemented a vaccine replacement program in 1985. In a study of 2,537 pediatricians and family practice physicians several years after implementation, 93% of respondents still indicated they would refer children elsewhere for immunization due to concern regarding a parent's ability to pay for an office visit, another practice identified as contributing to missed opportunities and underimmunization (Bordley, Freed, Garrett, Byrd, & Meriwether, 1994). Several years later, Freed et al. (1997) point out economic barriers to immunization persisted following implementation of a new universal free vaccine program in North Carolina in which physicians could charge an administrative fee of $15, $20, and $25 for administration of one, two, or three or more vaccines respectively. Clark and Freed (1998) found North Carolina physicians often failed to tell parents fees could be waived in hardship cases; as a result, two thirds of children (including two thirds of those enrolled in Medicaid) continued to receive immunizations in public health clinics because of reasons related to cost following implementation of the universal vaccine program. In a study comparing physician charges in Texas, North Carolina, and Massachusetts, Freed, Clark, et al. (1996) conclude physicians may shift costs or overcharge for other services if compensation for vaccination services are believed to be inadequate.

Examining the impact of health insurance availability per se on choice of providers, Lieu et al. (1994) examined a cross section of children in a California county, finding a high percentage of those with insurance would continue to receive immunization services from public sources because of concerns over inadequate insurance coverage for vaccines, associated office visit charges, and long waiting periods in private settings. Rodewald et al. (1997) studied immunization delivery patterns in a group of previously uninsured children included in a large data base in New York after initiation of a statewide insurance program for low income children. Findings showed the number of children receiving immunizations in public health department clinics declined whereas the number who went to primary care provider offices increased, and immunization levels increased overall. Szilagyi et al. (2000) monitored the portion of vaccines delivered in health department clinics in New York since the inception of VFC and other financing changes, concluding fewer children are receiving vaccines in health departments, thereby keeping more children in an established medical home.

These financial considerations can wield considerable force in shaping provider attitudes toward immunization behaviors. In a recent intervention study, Fairbrother, Hanson, Freidman, and Butts (1999) compared the effects on immunization coverage in the practices of physicians assigned to four groups: those who received (a) a cash bonus for immunization level increases in the population served, (b) an enhanced fee for providing immunization services plus feedback on immunization coverage rates, (c) feedback alone, or (d) a control group. Immunization coverage increased rapidly and sharply in the bonus group, with modest increases over time in the all other groups, including the control group, a possible Hawthorne effect. Bonuses have been used successfully as an incentive to improve immunization coverage in the United Kingdom where childhood vaccination coverage rates are reported to be the highest in the world, and continued examination of this strategy in the United States is suggested (Fairbrother et al., 1999; Robbins & Freeman, 1998).

As providers may have attitudes of excessive concern about specific vaccines, so may they harbor attitudes at another extreme--one of indifference toward vaccination. Not offering, thinking about, or screening for immunizations are reported as an important contributor to missed opportunities in a synopsis of international studies (Hutchins, Jansen, et al., 1993). In a retrospective study of 1,165 children in a managed care organization in Arizona, Ball and Serwint (1996) found unacknowledged missed opportunities, i.e., visits when an assessment of a child's immunization status did not occur, to be associated as the primary cause of missed opportunities to vaccinate. Similarly, in a study of 95 children seen in a primary care pediatric clinic for well child or acute illness services, missed opportunities occurred in fully one-third of new patients when records were unavailable and an immunization history was not obtained (Watson et al., 1996). In a study of Los Angeles children, assessment of immunization status by nurses was accurate only 27% of the time (Wood et al., 1995).

Some health care providers may fail to recognize the immunization of children is important. It can be argued that such indifference is both attitudinal and normative, as social pressure to immunize would appear to be lacking if a provider fails to even acknowledge or assess a child's immunization status. Thus, several intervention studies employing protocols for assessment at every visit have been conducted. These studies have had varying degrees of success ranging from a decline in missed opportunities and general improvement in immunization rates overall (Harper, 1997) to no change in the incidence of missed opportunities when providers failed to screen children's immunization status despite the intervention (Szilagyi et al., 1996). Such uncaring attitudes pose an important set of ethical problems for a profession like nursing

(Halldorsdottir, 1999). It behooves nursing and other health professions to address concerns about indifference and uncaring attitudes in relation to underimmunization since the public continues to be dependent on health providers for these services.

Provider Subjective Norms and Immunizing Behavior

Provider subjective norms concerning vaccinations and vaccinating behavior are an end product reflecting influences of normative beliefs about social pressures from salient referents to vaccinate modified by the motivation of the individual to comply with the expectations of these referent norms. Notably fewer research findings have been published concerning subjective norms and immunizing behaviors compared with the relatively extensive research base concerning provider attitudes toward immunizations in the literature. The following section establishes a framework analyzing the possible sources and influences of subjective norms on health care provider immunizing behaviors based on an assortment of trends and findings in the literature related to this theoretical construct.

Provider feedback. Thompson (1997) and Landon, Wilson, and Cleary (1998) have identified that reinforcement, feedback and interactions with professional colleagues may reduce variations and lead to improvements in the behavior of health care providers, including those who deliver clinical preventive services. The retrospective analysis of immunization rates is an important tool with obvious face value when used for the primary purpose of assessing immunization coverage. But providing information about immunization coverage levels as feedback to those responsible for the delivery of vaccination services may also be used as a strategy to change behavior and stimulate improvements in their immunization practices. At first employed as an intervention, regular feedback from one or more sources can be seen to have a normative dimension if it increases a health care provider's awareness of social expectations to vaccinate and motivation to comply with vaccine recommendations.

The most definitive work related to the value of feedback in improving immunization rates is reported in the case of the state of Georgia where state public health officials began a program to provide annual measurement and feedback about immunization coverage using five indexes (vaccination coverage rates, missed opportunities, children having moved, lost contacts, and late starts) to providers in state public health clinics. Public health functions in Georgia are highly decentralized with over 70% of children receiving immunization services at local public health clinics (CDC, 1995a). Termed AFIX (an acronym for assessment, feedback, incentives, and exchange of information) by CDC, the statewide intervention included an aggressive program of vaccine coverage information, a system of incentives such as plaques and public recognition for good performance, and a network for information exchange between provider sites (Dini, Chaney, Moolenaar, & LeBaron, 1996). Outcomes included a steep decline in missed opportunities, improved documentation of immunizations, and a marked increase in vaccination coverage overall between 1988 and 1994 (LeBaron et al., 1997). Thompson (1997) suggests this evidence supports a causal link between the feedback intervention and improved immunization rates. Serendipitous results included development of individualized methods by providers to meet coverage goals, such as reminder and recall systems, increased prenatal and postpartum visits, and structured linkages to supplemental nutritional and food assistance programs.

These investigators suggest similar improvements could result from measurement and feedback to private providers with the potential for improvements further enhanced by fiscal incentives. This suggestion is reconfirmed in the study by Fairbrother et al. (1999) in which provider sites with a feedback only intervention demonstrated a 12% increase in immunization coverage, while feedback with a financial bonus resulted in more than a 25% increase.

Practice models and WIC linkage. Concerning the impact of service delivery models on missed opportunities, Wood, Schuster et al. (1998) found no reduction among providers using a case management model after adjustment for other study covariates. In contrast, Wood, Halfon et al. (1998) found a case management intervention to be effective in increasing immunization levels among inner-city, African-American infants.

Demonstration projects sponsored by CDC in Chicago and New York City in the early 1990's showed significant increases in vaccination coverage levels when WIC and immunization services are linked (NIP, 1998). The New York study compared the impact of a WIC voucher system with a direct escort intervention and found both strategies to be effective (Birkhead et al., 1995). The Chicago WIC linkage project reviewed immunization levels and referred families to accessible immunization clinics and issued a one month supply of WIC food instead of the customary three month supply for children who were not up-to-date (Hoekstra, LeBaron, & Megaloeconomou, 1998; Wood & Halfon, 1998).

The statewide intervention study in Georgia also underscored the potential value of WIC and immunization service linkage in improving immunization coverage levels (Dini, Chaney, et al., 1996). It is suggested this structural change providing a "one stop shopping" approach linking health care and immunization services with different service agency programs may alter social norms by increasing the expectation and perception that health care providers should appropriately immunize children referred to them. For example, the ability of health care providers to maintain a strong relationship with clients was positively associated with higher immunization levels in a study of children in a rural setting (Wilson, 2000). In a study of caregivers of children receiving Medicaid-funded immunization services, Evers (2000) found pediatric clinic staff to be the most important facilitating factor for up-to-date immunization. Christakis, Mell, Wright, Davis, and Connell (2000) found timely MMR vaccination to be positively associated with other measures of continuity of care. The Standards for pediatric immunization practices (CDC, 1993) described elsewhere in this chapter have embodied this principle by stressing the importance of co-scheduling immunization and other child health services.

National childhood vaccine and immunization policy. Public health policy spans a broad process whereby issues and problems catch the public eye, solutions are crafted through regulation, allocation, or other means, and programs are implemented and evaluated in relation to their costs and benefits (Abdellah, 1991; Litman & Robins, 1997; Weisert & Weisert, 1996). With the ultimate goal of solving a problem or addressing a particular concern, health policy provides the blueprint for how operational decisions are made at many levels (Milio, 1984). Carver (1997) identifies how decisions in local organizations are formulated through the blending of perspectives and values of individuals with the political and economic realities and forces in the broader social environment.

The possible connection between national vaccine policy and the behavior of individual health care providers who immunize children may seem obscure. What is the potential mechanism whereby national vaccine policy can be a factor molding their normative beliefs and subjective norms related to immunizations? In fact, national childhood vaccine policy provides an important backdrop for defining society's expectations about vaccine delivery and a starting point for understanding social pressures affecting a health care provider's normative beliefs about their perceived responsibilities and resultant behaviors in vaccinating preschool children. In this instance, the salient referent is not a specific individual, but a societal compass pointing toward the desirability of certain behaviors and manifest through social institutions, especially the government. From an economic viewpoint, the externality of having the costs of VPDs borne by others besides the victims has made it incumbent on society and government to invoke policy to assure widespread immunity through vaccination (Weisert & Weisert, 1996). Hence, immunization services are somewhat unique among clinical preventive health care services to the extent that services to individuals have become a function of broader national policy implementation having implications for specific provider behaviors that contribute to improved population health at the local level (Bernier, 1994).

In defining health service sector ethical responsibilities, some ethicists have reasoned it is society's obligation to assure needed services are provided to community members, asserting that professionals have no particular duty to achieve society's ends. Others find it contradictory to place the onus for the delivery of needed services on society if professionals do not share in this responsibility (Curtin & Flaherty, 1982). According to the latter argument, in the case of vaccine policy implementation, health professionals must share in the responsibility for effective vaccine delivery because they are the ones who customarily (and the only ones who actually) provide this service in the U.S. today.

Is implementation of national vaccine policy a public responsibility, or does it belong in the private sector? Slifkin et al. (1997) note that while direct clinical services including the immunization of children are often viewed as public sector functions in some regions of the country, they are not universally viewed as a public sector responsibility. In fact, involvement of private providers is critical in effecting public vaccine policy in a pluralistic nation like the United States where health care is increasingly dominated by for-profit entities in a free enterprise industry. From the beginning, federal immunization policy and funding in the U.S. have been explicitly structured as a partnership between the federal and state governments and the private sector (Johnson, Sardell, & Richards, 2000). This point is particularly important with the trend of some traditional public health functions now being subsumed by large managed care organizations (Goldberg, 1998). Hueston et al. (1994) describe the added value of private providers who offer immunization services because public sources providing only immunization services may be poorly equipped or otherwise fail to identify other health care needs of children. A contrary view is espoused by Bordley et al. (1996) who, in a study of North Carolina physicians, found private physicians are often poorly prepared to provide immunizations and other preventive services.

A seamless system that fully integrates childhood immunizations into a comprehensive national health care system with universal coverage for all has yet to be realized and is considered by some to be unlikely unless national health reform is enacted (Freed, Bordley, & Defreise, 1993). Bernier (1994) stresses the importance of continued public and private collaboration and cooperation if an effective population based approach to protection against VPDs is to be achieved. Whether by regulatory or distributive means, it is implied that achieving health policy goals for improved immunization coverage levels can only be accomplished with the full cooperation and involvement of health care providers who participate in policy implementation at the patient care level in both the public and private sectors.

As part of national health policy, childhood immunization policy priorities and initiatives are therefore seen as potentially important factors in universally framing the normative context wherever immunization services are delivered. Expectations about patterns of individual provider behaviors are implied in policy even when policy is not explicitly directed at the behavior of specific individuals. The contemporary national emphasis stressing the role of health care providers in improving childhood immunization levels is evident in several emerging priorities and trends in health care policy affecting research, education, and delivery related to childhood immunizations. Several major developments potentially affecting the normative beliefs and subsequent behaviors of nurses as health care providers in delivering immunization services are described in the following section.

National health promotion/disease prevention goals. A generation has passed since the urgent need to improve childhood immunization levels was identified as an important preventive activity for providers beginning with the Surgeon General's first Healthy people report in 1979. This landmark report iterated a now obvious wisdom that because delivery of some preventive services like immunizations depends on the involvement of health care providers, improvements in preventive services cannot be achieved without some level of provider commitment. More recently, and perhaps most importantly for broader policy implications and because they addressed specific targets, a combination of four health status, one risk reduction, and four immunization service and protection objectives for VPDs were included in the Healthy people 2000 report released by the U.S. DHHS in 1991.

This focus was highlighted in 1996 when the week of April 21 was declared as National Infant Immunization Week, now an annual event hallmarked by visible public support from important public officials such as DHHS Secretary Donna Shalala ("National Infant Immunization Week," 1996). As a component in a national strategy to refocus on health promotion and disease prevention and one approach to resolving the cost-quality-access dilemma, it is likely that immunization programs and activities will continue as a national priority well into the future (Harris, Gordon, White, Stange, & Harper, 1995). In continuation of this theme, a number of specific objectives for childhood immunizations and targets for control of VPDs are therefore included in the Healthy People 2010 Objectives now available to the public (Office of Disease Prevention and Health Promotion, 1999).

Do policy goals promoting childhood immunizations at the national, state, or even local level influence the normative beliefs, motivation to comply, or subjective norms of nurses concerning their intention to immunize? Immunization levels among children in a community or clinical practice setting may be affected or determined by many factors other than individual provider behaviors or intention to immunize. But to the extent that providers individually and collectively feel accountability (or are held accountable) for progress toward achieving policy goals, social pressure to immunize and motivation to comply with recommendations may increase. For example, all VFC program sites receive periodic feedback about immunization levels among the children they serve, but it is unclear if the nature of the feedback is meaningful or taken seriously by providers at the respective sites. Further, the behavior of individual clinicians functioning independently on a day to day basis cannot be continuously monitored by programs providing the vaccines.

However, social pressure and desire to comply with vaccine recommendations may be far greater for some clinicians if achievement of specific vaccine coverage level goals is among the elements included in their workplace job evaluation or performance appraisal. The magnitude of pressure to immunize may be heightened in federally funded programs such as the Indian Health Service where top program administrators are held accountable for progress toward specific immunization goals and may in turn hold their subordinate employees accountable for accomplishing specific objectives (S. Scheuermann, personal communication, November 6, 1999). Similarly, in private managed care settings, the immunization coverage level among enrolled children is evolving as a benchmark or measure included in the health plan evaluation report card movement (Fairbrother, Freed, & Thompson, 2000; IOM, 2000; Pollock & Rice, 1997). For example, a critical determinant in deciding that indicators such as immunization coverage levels were selected for inclusion among the HEDIS monitors "is the ability to link them to public health objectives, particularly the Healthy People 2000 goals" (Goldberg, 1998, p. 535). The Health Care Financing Administration (HCFA) was mandated by Congress to move toward establishing similar quality requirements for managed care organizations (Voelker, 1997). Health care providers employed in systems where such expectations have been articulated may experience greater pressure to immunize than those employed where they are not articulated.

Specific childhood vaccine campaigns. In a major program launched in 1993, President Clinton announced a new national initiative called the Childhood Immunization Initiative (CII) as part of an international campaign to ensure that all children are protected against VPDs (Cutts, Waldman, & Zoffman, 1993; Grabowsky, 1994; Mitchell et al., 1993; Robinson, Sepe, & Lin, 1993; Wright, 1995). Aimed at improving the infrastructure for providing vaccines and reducing direct costs to consumers in vaccine delivery, the CII called for improvements in the quality and quantity of vaccine delivery services, safer vaccines, improved surveillance, and increased community participation in vaccination programs (Grabowsky; National Vaccine Program Office, 1994; Robinson, Evans, Mahanes, & Sepe, 1994; Satcher, 1994).

In a politically significant corollary, the Omnibus Budget Reconciliation Act of 1993 authorized the Vaccines for Children (VFC) program, enabling new public and private partnerships aimed at providing free vaccines to programs targeting high risk children eligible for Medicaid, children without health insurance, and Native American children (CDC, 1994d; Durch, 1994). Funded by HCFA, there are currently 64 VFC grantees with all 50 states, several large cities, and some U.S. territories now receiving these funds for vaccine purchase, ordering, distribution, and management (L. Hostler, personal communication, October 14, 1999). For several years after implementation, both the CII and the VFC program were criticized by GAO, providers, and public officials for failure to target populations most in need (Edelson, 1995; GAO, 1995; Lazaro, 1995). Today, VFC has become a cornerstone in a widespread national immunization program for the targeted groups, with a total of nearly 44,000 participating provider sites (VFC, 1999). A net result nationally has been a continuing increase in the percentage of vaccines for children purchased through public funds (CDC, 1995d; GAO, 1993) even as the percentage of children receiving vaccines through private providers continues to increase.

Offering free vaccines to providers through publicly funded programs like VFC tacitly implies an expectation that providers will use vaccines liberally and appropriately at every opportunity. In fact, providers participating in VFC must agree to comply with the recommended immunization schedule and guidelines as established by the Advisory Committee on Immunization Practices (ACIP) and state law (VFC, 1999). All public and a portion of private VFC sites are subject to periodic monitoring and quality assurance reviews by a responsible state agency. However, compliance with details of specific vaccine guidelines is viewed through a filter of concern for maintaining good public relations and building on intentions of good will. VFC program administrators are much more concerned about identification of cases of flagrant vaccine fraud and abuse (i.e., selling free vaccine or giving it to ineligible children). Some providers have been removed from the VFC program, and some have been prosecuted, but only in instances involving the most serious fraud and abuse (L. Hostler, personal communication, December 15, 1999).

Freed, Clark, et al. (1996) concluded that federal initiatives like VFC to provide free vaccines to providers will not necessarily improve preschool immunization rates, suggesting factors other than vaccine cost and availability strongly influence provider decisions and actions concerning immunizations. The evidence that improved access does not always change provider behavior leading to better immunization levels in a target population is supported by the work of Short and Lefkowitz (1992) and Wood and Halfon (1998). These investigators found that although expanded Medicaid coverage increased the likelihood of some well child visits, increased access for low income and underinsured children was not paralleled by better application of preventive strategies and services by providers. Providers continued to make inappropriate referrals and often failed to provide recommended preventive services including immunizations, even for children who did access the system. But in a national study, Santoli, Rodewald, Maes, Battaglia, and Coronado (2000) found penetration of children receiving vaccines through VFC to be increasing, with higher participation by private pediatricians and family physicians likely to lead to higher immunization levels among children seen in those practices.

Evidence concerning the overall influence of national vaccine policy on provider subjective norms related to vaccinations is inconclusive. However, because this policy emanates from public sources, it may influence providers in public and private settings differently. It is unknown if providers in public settings feel greater social pressure and motivation to comply with vaccine recommendations than providers in private settings, and if motivation to comply with vaccine recommendations is greater for those that do participate in VFC than for those who do not in both public and private settings.

Standards for Pediatric Immunization Practices. Building on the reality that consumer access to vaccines is controlled by health care providers, improving provider immunizing behavior has become an area of continuing focus in achieving national goals (AAP, 1997; ANA, 1994a, 1994b; DHEW, 1979; Durch, 1994; Knollmueller, 1993; Mawn & Pakkala, 2000; NAPNAP, 2000; Peter, 1992; Wallace et al., 1994). Approaches to changing provider practices and clinical behaviors are seen as critical in efforts to improve quality and control costs in preventive efforts that include immunization (Greco & Isenberg, 1993; Tannenbaum et al., 1994).

In addition to policy positions on childhood immunizations taken by professional groups, an important strategic landmark with the potential to shape and improve provider immunization practices occurred in 1992 when the National Vaccine Advisory Committee brought together health care and public health experts to achieve consensus and develop standards about the most desirable health care provider immunization practices for children. Provider immunization practices are defined as an aggregation of repetitive activities that include provider immunizing or vaccinating behaviors. Standards are considered authoritative statements establishing criteria, measures, expectations, or benchmarks in relation to providing a specific service. Standards of practice are therefore defined as "a set of guidelines that identify the content of practice and serves as a model to guide care toward excellence" (O'Toole, 1997, p. 1524). Published by CDC in 1993, the Standards for pediatric immunization practices provide a comprehensive framework to capture and assess the full scope of provider practices relative to immunizations for children. See Table 1 for an abbreviated listing of the Standards.

Prescribing desired behaviors for health care providers who immunize preschool children, the Standards may serve as proxy statements representing social pressures from another salient referent--the community of professional peers. Like national immunization priorities and initiatives, the Standards are relevant to the proposed study for their broad potential influence in shaping the subjective norms and resultant behaviors of nurses in immunizing preschool children. Individually, they address and describe specific aspects of desired provider practice and behavior in planning, administering, improving, and evaluating immunization services. Several pertain to the more limited focus of this study as related to the central concepts of the TPB, calling for screening and administration of age-appropriate vaccines on every clinical encounter (standard 4), simultaneous vaccine administration (standard 8), adherence to only true contraindications (standard 7), and reducing cost as factor for immunization deferral (standard 3). In toto, the Standards and their interpretation are germane to virtually all activities and decisions made by a health care provider in the routine administration of immunizations to children. Collectively, the Standards are interwoven and become comprehensive in scope. While elaboration on individual standards appears in the text of the complete standards document, details are of a general nature since the standards are intended to fit myriad situations in countless clinical settings. This circumstance requires development of local guidelines, policies, and criteria for effective implementation.

Initial publication of the Standards was accompanied by a flurry of activity geared toward their implementation and precipitated research related to provider knowledge, attitudes, beliefs, and practices concerning preschool immunizations. Much of the contemporary research reported in the literature concerning health care provider immunization decisions pertains to one or more of the Standards. Dominant themes in this research are focused on provider knowledge of immunization schedules and contraindications as well as analysis of adverse attitudes toward administration of multiple antigens by injection during the same visit.

In an important baseline study organized prior to public release of the Standards, Hughart et al. (1994) surveyed a population of 173 nurses and physicians at 40 pediatric provider sites in an urban setting to determine the extent to which practices were consistent with the Standards. In this descriptive study, findings ranged from nearly universal acceptance of the need for consumer education about immunizations to nearly total non-acceptance of the standard for simultaneous vaccine administration. Findings confirmed that providers found the standards to be ambiguous and that issuance of the standards alone would not in itself necessarily lead to improved immunization rates.

In another study comprehensively examining the overall impact of implementation of the Standards in a practice setting, Pierce et al. (1996) implemented a non-randomized controlled intervention in two public health clinics in Albuquerque. One or more indicators were developed for each of the 18 standards. After one year, significant improvement was noted in immunization coverage levels for children 12 months of age at the intervention site, increasing from 50.5 to 80.7%. There was a concurrent reduction in children lost to follow-up. Immunization levels at the control site decreased slightly during the same period. However, results should be viewed with some skepticism since is unclear whether improvements noted were the result of a Hawthorne effect and if higher immunization levels would be sustained over time since the study has ended. The study did not attempt to attribute any portion of changes observed in immunization levels to improved provider adherence to any of the specific standards.

Nurses were included as subjects in the study by Hughart et al. (1994) whereas in the study by Pierce et al. (1996), participants were simply referred to as health care providers without other differentiation. Only one study concerning provider practices and adherence to the standard is identified in the recent literature in which the subjects were exclusively nurses. In a qualitative study of 46 nurses employed in pediatric and adolescent units of an urban medical center, Dixon, Keeling, and Kennel (1994) found only 23% correctly identified the appropriate immunizations required by the second birthday. Only one subject identified all immunizations required for school entry. While respondents generally supported the notion they should have an increasing role in immunization activities, these results may not be surprising considering routine immunizations are more frequently given to healthy children in ambulatory care settings. One could question whether it is as important for nurses in acute care settings to be as familiar with the age-appropriate vaccine schedule as it is for nurses in other practice settings where vaccinations are given more routinely.

Is provider interest in the Standards for pediatric immunization practices waning? At the 30th National Immunization Conference in 1996, over 400 presentations were made covering a vast array of topics related to immunizations. From this total field, only one presentation focused specifically on the topic of the Standards. In this report, Martinkus and Rushing (1996) conducted a three year follow-up of 115 private providers in a rural western state. Findings indicated a majority had made some progress toward implementation of the Standards and that clinic practices had improved overall. While the impact of changes made using the Standards on immunization levels in this study is unknown, it should be noted that many other presentations and conference abstracts were directly related to one or more specific standards, including strategies for improved computerized record and recall systems (Dini, Linkins, & Sigafoos, 1996; Ortega, 1996), building of community partnerships and coalitions through public and provider education (Barber, 1996; Burton & Bifano, 1996; McKracken & Lenihan 1996), and planned approaches to reduce missed opportunities and barriers to immunization (Agostinelli, McCurdy, & Dow, 1996; Gross & Brown, 1996).

Following the trend observed in 1996, the theme of the 31st National Immunization Conference in 1997 focused on immunization partnerships and included over 300 offerings, but none were on the specific topic of immunization practice standards. A similar distribution of topics is noted in the 1998-2001 conferences. Since 1997, the integration of principles found in the Standards document into building coalitions and partnerships and other related subject areas is evident, with a host of presentations on assessment and feedback, specific barriers to vaccination, linkages and partnerships, communications, immunization registries, program evaluation, reminder and recall, and other topics included in the program. Hence, emphasis on the general principles outlined in the Standards may have continued utility through applications focused on interventions designed using principles in one or more of the specific standards.

Implementation of standard 15, calling for providers to maintain current and easily retrievable medical protocols wherever vaccines are administered, also has implications for the normative dimensions of provider immunizing behavior. Protocols are intended to outline desired situational behaviors and to reduce the variability in provider decisions and behavior when these defined situations are encountered. In several earlier reports and studies, Greco and Eisenberg (1993), Lomas and Haynes (1988), and McKinney and Barnas (1989) remark the quality of care may improve if providers of immunization services actively participate in planned administrative interventions to change and restructure their own normative behavioral expectations using tools such as prompts, reminders, and protocols to encourage and promote more appropriate behavior, thus reducing the opportunity for errors of omission leading to missed opportunities. Simpson, Kamerow, and Frazier (1998) concluded guidelines for pediatric services including immunizations can improve the quality of care, but are most successful when implemented with other approaches such as education, audits, reminders, or incentives. In a review of 41 studies concerning the influence of reminder systems on immunization rates, Szilagyi et al. (2000) found reminder systems were effective in 80% of the studies with increases ranging from 5 to 20%. An appropriate area for inquiry is to assess if nurses who immunize preschool children have such protocols or reminder systems available, and if they have an effect on behavior.

Survey of Brandon/Hill List references. An important potential source of comprehensive and authoritative information about the basic knowledge requirements, usual responsibilities, and the scope of role expectations of nurses who immunize preschool children includes nursing textbooks, at least for beginning practitioners. What information is contained in nursing textbooks concerning the topics of immunity, the vaccination of preschool children, and related subjects?

The ninth biennial Brandon/Hill Selected List of Nursing Books and Journals (Hill

& Stickell, 1998) compiles a respected yet convenient and useful list referencing selecting textbooks for inclusion in this analysis. First published in 1979, the list was originally developed with the goal of providing libraries and librarians with a selection guide in the acquisition of nursing literature. While far from exhaustive, the list includes the authors' compilation of what they consider to be the best books and journals representing both sound clinical practice and methods as well as contemporary theories, concepts, and trends in nursing. Textbooks in three of the list's 56 broad subject headings presumed most likely to include information about preschool immunizations and vaccinations were chosen for analysis. The following synopsis summarizes the content on the topic of immunizations from all seven community health nursing, four family nursing, and twelve pediatric nursing texts included on the ninth Brandon/Hill list.

Information on a range of general subtopics related to knowledge about VPDs, vaccines, and vaccine trends is found in many of the texts. Common subtopics include a description of the concept of immunity, VPD and immunization rates and trends, and the routine childhood vaccine schedule. Some texts include more specific information about valid and invalid vaccine contraindications, barriers to immunization, and even a complete list of the Standards.

A second common theme spans a broad category of subjects linked to planning care and application of steps in the nursing process in delivering childhood vaccinations. Texts from all three categories organized information and described appropriate routine care for individuals, while some community nursing texts outlined immunization services for groups, communities, and school children. Table 2 lists the major topics or themes found in texts in each of the three list categories included in this review. Since the texts are representational but not proportional to all the literature in the categories, a frequency distribution of topic citations would not be meaningful and is not included.

Information on childhood immunizations was absent in two atypical, highly specialized community health texts. One text focused on selected case studies in which preschool immunizations was not mentioned; the other synopsized interventions and tools to manage defined community health problems. All other references gave varying degrees of more comprehensive treatment to the topics of interest. Among topics cited less frequently, one text included information on national vaccine policy and programs, two described barriers to immunization, and three included year 2000 goals and an overview of the Standards. Sections on legal and ethical issues related to vaccination, informed consent, and listings of other informational resources were included in each of three texts. One text named immunization deficiency as a nursing diagnosis. It should be noted the routine vaccination schedule and other VPD information, while present, was outdated in a number of texts with publication dates as early as 1995. Older references also failed to include information on newer vaccines.

In summary, what can be gleaned from this review? Two dominant themes are apparent concerning normative expectations of nurses who immunize preschool children. First, beginning practitioners of nursing and those employed in community health, pediatric, and family nursing can be expected to possess a comprehensive but general knowledge base about all aspects of vaccine delivery to children. The review of nursing textbooks on the Brandon/Hill list also suggests nurses have access to a full scope of more detailed information about vaccines and vaccine delivery. While a number of these reference texts describe missed opportunities and other barriers to immunization, they are presented in a context suggesting nurses are fully capable and empowered to change organizational practices and practice patterns to overcome these barriers.

Secondly, parameters prohibiting or warning against particular behaviors related to nurses' immunizing children are not described. Immunizing behaviors are not qualified in any way other than according to appropriate care guidelines that apply equally to all health care providers who participate in immunizing children. Normative prohibitions pertaining to any aspect of immunizations being given by nurses are not identified in any of these textbooks.

Perceived Behavioral Control and Immunizing Behavior

In contrast to the scope of research and other literature available describing the possible influences of attitudinal and normative factors on health care provider immunizing behaviors, a relative paucity exists concerning possible links to their perceptions of control over the behavior, suggesting variations in control beliefs and perceived power over performing immunizing behaviors have not been identified or systematically studied in understanding differences in provider immunizing behaviors. It is unclear whether nurses believe they possess the requisite resources including the time, supplies, or other supports necessary to immunize when opportunities arise. It may be assumed nurses and other providers believe they possess the necessary vaccines for vaccination if vaccines are provided free of charge through state programs or the VFC program, but this assumption has not been confirmed.

The element of perceived control enveloping nurses' perceived power over their own immunizing behavior may be a revealing unit of analysis in the proposed study. Do nurses legally or professionally need medical oversight in immunizing preschool children? Common experiences suggest some nurses function with more autonomy and make immunization decisions more independently than others do in their day to day practice. The anecdotal finding cited previously (Wilson, 1994) wherein high immunization coverage levels were noted in rural South Dakota counties where nurses provide immunization services independently is illustrative. This observation suggests nurses in these settings may perceive they have greater authority and power over their own immunizing behaviors than nurses employed in other settings, including private physician practices where a physician employs the nurse and may be perceived as having more control over the behavior of the nurse.

The potential for gradations in the perceived control of nurses over their own immunizing behaviors is not identified as a concern in the review of nursing textbooks included in the Brandon/Hill list, but is implied in a few citations about the potential benefits of written guidelines for provider immunization practices. In New York, state regulations allowing nurses to administer immunizations under non-patient-specific orders are seen as a means to improve access to immunization services (New York State Nurses Association, 2000). Simpson, Kamerow, and Fraser (1998) state several terms including guidelines, practice parameters, clinical policies, critical paths, and protocols are often used interchangeably to refer to statements developed to assist practitioners and patients to make appropriate decisions in specific circumstances. Although these related terms are often used synonymously, guidelines or protocols are used to outline a course of treatment for a particular condition, whereas standing orders authorize a nurse or other provider to assess an individual's immunization status and to administer vaccines according to an accepted schedule without a specific physician's order.

Gold (1994) indicates care provided by physicians who adhere to clinical practice guidelines is superior to care provided by those who do not, provided the science and standards underlying the guidelines are solid. Several studies suggest use of guidelines and standing orders may be associated with improved immunization coverage levels (Cutts et al., 1992; Lieu, Black, Sorel, Ray, & Shinefield, 1996; The Johns Hopkins University, 1993). Szilagyi , Rodewald, et al. (1994) recommend that at a minimum, immunization guidelines should call for (a) vaccination on every clinical encounter, (b) simultaneous vaccine administration, (c) tracking to monitor undervaccinated children, and (d) systems to reduce patient vaccination costs be implemented to promote consistency and improve vaccination coverage rates. However, variations in the quality and frequency with which standing orders and similar tools for immunization services are used across practice settings has not been assessed. It is unknown if standing orders currently in place are consistent with recommendations or if they incorporate elements suggested as improving vaccination coverage levels.

<u>Summary</u>

A review of the literature reveals the cognitive and behavioral processes underpinning the seemingly simple act of immunizing a child may be exceedingly complex. Understanding the behaviors of nurses who immunize children has potential significance in devising strategies to improve public health services for the control of

VPDs, but very little research has been done to study these behaviors. Physicians have been the primary subjects in contemporary research concerning provider immunization practices. Existing research has focused on providers in urban settings. Nurses would appear to be uninvolved in VPD efforts considering the lack of research about their activities wherever they are engaged in immunizing children.

Ample evidence is found in the research literature suggesting the behavioral intentions and immunizing behaviors of health care providers may be influenced by their salient beliefs and attitudes toward the behavior of administering certain vaccines, as well as their beliefs and attitudes toward the behavior of vaccine administration under certain conditions. The presence of an array of false contraindications, the prospect of perceived risks and discomfort caused by simultaneous vaccine administration, cost factors associated with vaccines, and perceived legal risks are suggested as among the key factors contributing toward provider negative attitudes toward vaccination and vaccination deferral decisions. Attitudes of complacency, disinterest, and even neglect are also suggested as among the factors contributing to missed opportunities in clinical encounters where provider intention to immune is paramount. Research concerning provider beliefs and attitudes toward immunizations reflects an attitudinal bias in that it is commonly focused on negative attitudes contributing to missed opportunities; seemingly lacking in the literature is balance in presenting and highlighting favorable beliefs and attitudes associated with provider decisions to immunize.

Expectations and subjective norms concerning health care provider immunizing behaviors may emanate from a variety of sources including national vaccine policy priorities and specific programs or initiatives in which providers may be directly involved.

In particular, research findings suggest feedback and other incentives may increase the motivation to comply with vaccine recommendations and resultant behavioral intention to immunize. While comparisons of outcomes between public and private providers and changes occurring in managed care organizations are inconclusive, the relationships between beliefs about other dimensions of social, organizational, and cultural factors (including a sense of personal ethics) as antecedents to subjective norms and immunizing behavior remain areas where few research findings are reported in the literature.

Studies of variations in nurses' perceptions of how much control they have over their own behavior when immunizing children as a component in understanding their immunizing behaviors is another provocative area for study in which virtually no research is reported in the literature. The central concepts of the TPB seem ideal to examine if autonomy is a factor in explaining variations in perceived behavioral control among nurses who immunize children, and if perceived control may be used to predict behavioral intention and actual immunizing behavior.

As the model used to organize variables in this study, the TPB has rarely been used previously to study any health care provider behaviors, including those of nurses. The review of literature suggests there is overlap between the potential influences of the central variables of the TPB and their antecedent factors on immunizing behaviors. Analysis of the relative weights and importance of attitudinal, normative, and control components of the model may therefore contribute to improved understanding of the behavioral contribution of nurses to both successful and unsuccessful immunization efforts.

<u>Research Questions and Hypotheses</u>

The possible effects of independent TBP variables on immunizing behavior as an independent variable have not been studied. The possible effects of nurses' demographic variables on these variables and immunizing behaviors have also not been studied. The following exploratory questions related to TPB constructs and their relationships were examined in the study:

Question 1: To what extent do attitudes, subjective norms, perceived behavioral control, and intention influence immunizing behavior among nurses who immunize children?

> Question 1A: What is the relationship between attitudes and immunizing behavior among nurses who immunize children?
>
> Question 1B: What is the relationship between subjective norms and immunizing behavior among nurses who immunize children?
>
> Question 1C: What is the relationship between perceived behavioral control and immunizing behavior among nurses who immunize children?
>
> Question 1D: What is the relationship between behavioral intention and immunizing behavior among nurses who immunize children?

Question 2: How does nurses' immunizing behavior differ by selected characteristics including age, educational level, level of licensure (registered or practical nurse), certification, type of employing agency (private or public), and personal parental status?

Question 3: What influence do facilitators to immunization (i.e., immunization goals, audits, schedule poster or wall chart, standing orders, patient reminder systems, tracking systems, charting reminders, WIC linkage, AAP "Red Book", Standards for Pediatric Immunization Practices (CDC, 1993), immunization policies, patient education materials, and participation in partnerships) have on behavioral intention and immunizing behavior of nurses who immunize children?

The study examines the following four hypotheses:

Hypothesis 1: There is a positive correlation between perceived behavioral control and intention to immunize among nurses who immunize children.

Hypothesis 2: There is a positive correlation between perceived behavioral and immunizing behavior among nurses who immunize children.

Hypothesis 3: There is a positive correlation between intention to immunize and immunizing behavior among nurses who immunize children.

Hypothesis 4: The belief-based determinants of attitudes, subjective norms, and perceived behavioral control have (a) an indirect effect on behavioral intention to immunize and (b) a direct effect on their respective direct measures of attitudes, subjective norms, and perceived behavioral control, and (c) the measures of attitudes, subjective norms, and perceived behavioral control have a direct effect on behavioral intention to immunize.

Additional research questions to be examined not central to testing the TPB included:

Question 1: What interventions or strategies do nurses employ for immediate relief of discomfort and pain associated with administration of injectable vaccines to children?

Question 2: To what extent are nurses able to identify age-appropriate vaccines for children in defined clinical situations?

Question 3: To what extent is level of education positively correlated with knowledge of age-appropriate vaccine recommendations?

Method

Sample

The sample for the study consisted of licensed registered and practical nurses in South Dakota randomly selected from among all nurses who immunize children in the state. The randomization procedure for sample selection began using a listing of all vaccine provider sites in the state provided by the South Dakota Department of Health (SDDH). From this list of 311 sites, SDDH staff initially identified 37 as not routinely providing childhood immunizations. Nurses from these sites (including adult and juvenile correctional facilities, schools, long-term care facilities, and temporary SDDH offices open only during communicable disease outbreaks) were removed from consideration for the study sample.

A letter of introduction was sent to the primary contact at each of the remaining 274 sites from the SDDH listing, explaining the purpose of the study and indicating they would be contacted by telephone to determine the number of nurses at the site who immunize children. See Appendix B for a copy of the letter. Individuals at five sites contacted me by telephone or by e-mail with the requested information. Over a three week period, I contacted each of the remaining 269 sites by telephone to determine if they routinely immunize children, and if so, the total number of nurses there providing childhood immunizations in order to determine the pool for the final sample. Names of individuals were not requested at this stage. Nurses at another 56 facilities were removed from consideration for inclusion in the sample at this stage. These included nurses at 12 hospitals where childhood immunizations are generally limited to providing the first hepatitis B vaccine dose to newborns, 4 closed facilities, 15 satellite or part time clinics having the same nursing providers as another vaccine site, 19 facilities primarily caring for adult patients, and 6 sites where childhood immunizations were given by a combination of physicians, physicians assistants, or medical assistants. Of the remaining pool of 218 sites, 215 were successfully contacted to determine the number of nurses working there who immunize children. The three remaining sites were never contacted despite repeated attempts to request this information; hence nurses at these sites were not included in the sample.

Up to 20 nurses who immunize children were reported as being employed at each site for a total of 720 individuals at the 215 sites. After contacting the 215 sites, each nurse was systematically assigned a number from 1 to 720, beginning with the first nurse at the first site on the list and continuing through the last nurse at the last site. SPSS was used to select a random sample of 340 individual numbers from the 720. I then contacted each facility again by telephone or electronically and asked for the names of individuals with the corresponding numbers from my list, suggesting these be systematically identified using local alphabetical or staffing lists if there was more than one nurse at the site. This step was unnecessary at several sites when complete name lists had been provided during the initial contact. Efforts to contact one site to ascertain names of two randomly selected nurses were unsuccessful despite repeated attempts.

From the remaining pool of 338 individuals, 7 were removed from consideration because of unwillingness to provide names ($\underline{n}$ = 3), position vacancy ($\underline{n}$ = 1), duplicate reporting of the same person ($\underline{n}$ = 1), and temporary leave of absence during pregnancy ($\underline{n}$ = 2). Remaining names were then matched with names of all registered nurses and practical nurses licensed in South Dakota using home address labels purchased from the South Dakota Board of Nursing. Names of another 15 individuals lacking matching Board of Nursing labels were never successfully identified as being nurses and were then removed from consideration. The final sample (N = 316) included in the survey mailing consisted primarily of those with matched Board of Nursing labels (n = 288). For a smaller group (n = 24 or less than 8% of the total sample) at eight sites, the contact person acted as an information gatekeeper and would not disclose names, instead agreeing to distribute surveys to the appropriate individuals with the corresponding numbered position if questionnaires were mailed directly to the gatekeeper at an employment address. Surveys were also sent to employment addresses for nurses lacking Board of Nursing address labels if they were employed by the federal government in South Dakota but disclosed they were licensed elsewhere (n = 4).

Instrument

An instrument named the Nurses Childhood Immunization Belief Questionnaire (NCIBQ) was developed for this study. Questionnaire sections were organized according to the theory of planned behavior (TPB) variables. See Figure 1. Questionnaire items were derived from the related research and other sources of information included in the literature review. Most items were structured and arranged using a 7-point semantic differential scale and closely followed guidelines recommended by Ajzen and Fishbein (1980).

Attitudes. A total of 28 attitudinal scale items were included in Part 1 of the initial version of the instrument. The first four items were designed to assess (a) attitude toward immunizing children (with anchors extremely favorable to extremely unfavorable), (b) the experience of immunizing children (extremely useless to extremely useful), (c) the value of immunizing children (extremely important to extremely unimportant), and (d) the safety of immunizing children (extremely safe to extremely unsafe).

Outcome evaluation components included in NCIBQ Part 1, items 5-16 were organized along a semantic differential using anchors of "extremely good" to "extremely bad". These included items related to the consequences of (a) preventing disease by giving vaccines (1 item), (b) causing harm, side effects, sickness symptoms, more parental stress, and discomfort by giving vaccines (6 items), (c) hepatitis B and varicella vaccine requirements (2 items), and (d) legal risks, payment for vaccines, and continuing education (3 items). Parallel behavioral belief questions (items 17-28) were similarly structured with anchors "strongly agree" to "strongly disagree."

Subjective norms. A total of 20 items were included in NCIBQ Part 3 to measure the normative component. Azjen and Fishbein (1980) recommend using a single question to assess subjective norms. Item 1 assessed general expectations of others the respondent works with and if these others think getting children immunized is important, with anchors "strongly agree" to "strongly disagree."

Azjen and Fishbein (1980) recommend eliciting the identity of salient referents from respondents and then constructing normative belief and motivation to comply questions in relation to these salient referents. However, salient referents concerning nurses' immunizing behaviors were already explicitly or implicitly identified in the literature and were easily gleaned from these sources. Normative belief questions are then usually structured to ask if respondents agree salient referents think they (the respondent) should engage in the behavior in question, i.e., immunizing children. There was concern that nurses might misreport normative beliefs by concluding salient referents normally expect them to immunize unerringly linked to the social desirability of this behavior, given prevailing expectations and the context of their employment where professional competence is expected. False reporting and inaccuracy resulting from a social desirability response set is identified as a potentially serious threat to survey validity and reliability (Fowler, 1988). Therefore, normative belief items were restructured to assess familiarity with the positions or recommendations of nine salient referents from the literature sources in NCIBQ items 2-10. These referents included physician and nurse coworkers, the state health department, the Standards for pediatric immunization practices, the current vaccine schedule, administrators, insurers, parents, and the federal VFC program. Each item was structured using a semantic differential from "extremely familiar" to "extremely unfamiliar." Parallel motivation to comply questions (items 11-19) about each of the nine salient referents included anchors "extremely motivated" to "extremely unmotivated." The final question (item 20) asked respondents to list the three most important influences on their decisions about immunizations including but not limited to the entities identified in the belief and motivation to comply items.

Perceived behavioral control. A total of 16 items were included in NCIBQ Part 4 to measure the control component. Perceived behavioral control questions (items 1-6) about perceived difficulty in making immunization decisions, immunization decisional authority, adequacy of immunization resources, adequacy of time to immunize, the presence of other interference when immunizing, and overall control of immunization decisions. Questions were structured with anchors "strongly agree" to "strongly disagree."

Control belief components were included in items 7-11 to assess respondent beliefs about control over activities including screening of immunization status, deciding which immunizations are due, determining the safety of immunizing a child, assessing parental information needs, and overcoming parental objections, with anchors "strongly agree" to "strongly disagree." Five parallel perceived control questions (items 12-16) about these same activities were constructed using anchors of "extremely easy" to "extremely difficult."

Behavioral intention and immunizing behavior. Ajzen and Fishbein (1980, p. 42) stress that most behavior is predictable from intention, further stating "to predict a behavioral criterion from intention, it is essential to ensure that the measure of intention corresponds to the measure of behavior." Elements of the intention and behavioral components must therefore be identical. Using this prescription, NCIBQ behavioral intention and behavioral components were structured identically. The behavioral intention component (Part 2) was structured to assess the intention of giving immunizations in typical situations nurses might encounter when seeing children who are due for immunizations. Two scenarios were developed for this purpose, with case 1 involving a 5-month-old well child due for four age-appropriate immunizations. In case 2, a 30-month-old child with a common acute minor illness (and also due for four immunizations) presents with false contraindications (upper respiratory infection, a history of otitis media with serous fluid remaining behind one ear drum, and low grade fever), i.e., conditions commonly identified as reasons for immunization deferral as cited in the literature. Item 1 following each case scenario was open-ended, asking what the respondent would intend to do next in this situation. Item 2 asked which immunizations were currently due from seven possible choices: DTaP, rotavirus, Hib, HepB, MMR, varicella, and polio. Five questions (items 3-7) asked if the child would be immunized now, if someone else would decide if immunizations would be given, if all or some immunizations would be rescheduled, and if the child would be referred elsewhere to receive immunizations, with anchors "extremely probable" to "extremely improbable."

Behavior was assessed in NCIBQ Part 5, again using two case scenarios. Case 1 involved a 15-month-old well child due for four immunizations. In case 2, a 12 month-old child also due for four immunizations presents with common false contraindications (prematurity, low grade fever, mild diarrhea, and taking an antibiotic). Item 1 for both cases was open-ended to assess what the nurse would do next in this situation. Item 2 asked for the age-appropriate immunizations from among the same seven vaccine choices used in the behavioral intention case scenarios. Items 3-7 for both immunizing behavior case scenarios were identical to the corresponding behavioral intention questions in Part 2. In summary, the four clinical case scenarios were constructed to vary four (and only four) appropriate vaccine choices as a function of the child's age, prior vaccine history, and clinical condition.

Supplemental demographic and other information. Part 6 asked respondents how frequently they perform certain immunization activities including assessing a child's immunization status, deciding which immunizations a child should have, actually administering vaccines, and making a nursing diagnosis about a child's immunization status. These items were arranged on a five point scale with anchors "not at all" and "all the time." In an open-ended format, respondents were then asked to list up to three measures employed before giving vaccines to reduce discomfort associated with giving vaccines by injection and three measures used after immunizing a child to relieve this discomfort.

Questions to assess workplace demographics included the type of practice setting from among a list of public and private choices, and the percentage mix of children receiving services paid by the VFC program, managed care, other insurance, or out of pocket. One question assessed the number of other nurses at the site from three categories for small (less than 10 nurses employed), medium (10 to 19), and large (20 or more). Questions were asked about workplace immunization resources or tools from a list assessing the presence or availability of immunization goals, audits, recommended immunization schedule posters or wall charts, immunization standing orders, reminder and tracking systems, WIC co-scheduling, the "Red Book", the Standards, written immunization policies, and patient education materials.

Personal demographic questions included the year of birth, gender, number of children from among three categories (6 and under, 7 to 16 years, and 17 and older), educational level, current job position and whether staff or managerial, information about national certification, and the year they began practicing as a nurse. Finally, the instrument asked for an estimate of the time required to complete the questionnaire and invited the respondent to make additional comments. Instructions were also given about how to request a copy of survey results.

<u>Questionnaire format.</u> The NCIBQ was developed in a 12 page (8 1/2" by 7") page booklet format following Dillman's (1978) guidelines. The initial image was reduced to 80% to allow printing on each page on half of an 8 1/2" by 14" sheet. Each

booklet (consisting of three folded 8 1/2" by 11 sheets" printed on both sides) was reproduced on white paper with two staples at the spine.

The front cover briefly described the study focus, showed a graphic illustration depicting questions about vaccines, gave instructions on requesting study results, and identified the UW-Madison School of Nursing as the researcher's institutional affiliation. The back cover included instructions on how to request a copy of study results, encouraged questions or additional comments about any aspect of the NCIBQ or its contents, with nearly a full blank page available for written comments. No survey questions were placed on either the front or back cover.

Pilot study. The purposes of the pilot study were twofold. First, the pilot study was intended to generate feedback and other comments from respondents in order to refine the instrument, e.g., to determine if respondents found any items or sections unclear, confusing, redundant, or objectionable. This was intended to reduce the likelihood of error and non-response in the larger study. Secondly, the pilot was intended to assess the overall feasibility of a study of nurses' immunizing behaviors using a written questionnaire and survey approach following Dillman's (1978) TDM guidelines. Additionally, it was hoped pilot study results would provide information for a preliminary power analysis and estimation of effect size needed to determine the minimum sample needed for the actual study.

The sample for the pilot study was identified through colleagues as well as personal professional contacts and included nurses from the following five groups:

1. Nurses employed in public clinic settings in the Milwaukee, Wisconsin using a snowball sampling technique. These individuals were contacted through Professor

Karen Pridham who hand carried a number of questionnaires to a Milwaukee site where they were distributed among available staff who immunize children.

2. Nurses employed in public clinic settings in Madison, Wisconsin, also using a snowball sampling technique. These nurses were contacted through Professor Susan Riesch who hand carried a number of questionnaires to a Madison site where they were distributed among available staff who immunize children.

3. Two nurses who do volunteer work immunizing children in South Dakota but who are not employed at any of the free vaccine sites included in the study sample.

4. Several practicing Indian Health Service nurses who immunize children outside the South Dakota free vaccine sites contacted through my personal professional network. These individuals were included to assess cultural sensitivity and appropriateness given the possible inclusion of American Indian nurses in the larger study sample.

5. Several nurses employed in the National Immunization Program at CDC as vaccine experts, one of whom is active in volunteer work immunizing children.

All individuals in the pilot study received a complete packet in a manila envelope. Packet contents included an introductory cover letter, the NCIBQ booklet, a reduced version of the current Recommended Childhood Immunization Schedule with explanatory notes, a preaddressed postage paid return envelope, and a one dollar bill. This was expected to be very similar to the proposed contents of the mailing for the larger study with the exception of minor changes that might be made following the pilot study.

Thirty questionnaires were returned out of the 34 distributed. One respondent from CDC gave a critique of the instrument but did not complete the actual questionnaire items. The pilot study respondents were all registered nurses, were mostly female, and ranged in age from 26 to 69 years of age with a mean age of 46. The overall response rate was over 88%.

With the exception of the one individual who did not complete the questionnaire, most respondents completed all questionnaire items, including open-ended and narrative items. None of the respondents expressed concern about instrument length, size, or format, and none of the items were reported as objectionable. All respondent comments and questions concerning questionnaire instructions, format, wording, specific items, and similar details were recorded and taken into account in revising the questionnaire. Data were coded and entered using SPSS, including string variables. Some specific item scores were later recoded (reverse coded) using a consensus process following analysis by the Riesch Research Group and after consultation with one uninvolved doctoral candidate in the School of Nursing.

Data analysis included examination of descriptive statistics and frequency distributions, bivariate scatterplot analysis, reliability analysis for each of the major scales in the instrument, and content analysis of all string variables and written comments. The mean completion time reported by respondents was roughly 36 minutes.

Instrument revisions. In addition to minor editing to improve wording and correct spelling, the following substantive revisions were made in the instrument following completion of the pilot study:

1. The anchors of "extremely useless" and "extremely useful" for the attitudinal question about the experience of immunizing children (Part 1, item 2) were changed

to "extremely unrewarding" and "extremely rewarding."

2. Outcome evaluation and behavioral belief statements in Part 1 were reworded for improved clarity, consistency, and parallel language construction.
3. Two general questions about harm and side effects caused by vaccine were removed in the outcome evaluation (items 6 and 7) and behavioral belief (items 18 and 19) sections and replaced by more specific questions to contrast beliefs and outcomes of minor and major side effects caused by vaccines.
4. The order of bipolar anchors of “good” and “bad” in the outcome evaluation questions were reversed to reduce the likelihood of evoking repetitive agreeable responses as a form of acquiescence bias (Mangione, 1995).
5. Key information concerning vaccine spacing in each of the four clinical scenarios was found to be lacking and was subsequently added. The scenarios were subsequently reviewed by three vaccine experts, with 100% agreement about the accuracy of false contraindications and the four age-appropriate vaccines in each case.
6. Rotavirus was (correctly) not selected by any of the respondents as an appropriate vaccine choice in any of the four scenarios. Since it had been removed from among the recommended vaccines, it was removed from among the seven questionnaire vaccine choices. Hepatitis A was substituted as a vaccine choice since it is a recommended vaccine in South Dakota counties with resident American Indian communities.
7. Because of little variation in responses to the single subjective norms question, and to increase the degrees of freedom for statistical interpretation of this scale, four new

questions to create three dimensions for the subjective norms component. These included role expectations, interpersonal agreement, and self concept as described by Triandis (1964). Questions assessed if others think giving vaccines is an important part of the respondent's job and if coworkers believe childhood immunizations are important (interpersonal agreement), the extent of social pressures for the respondent to immunize and displeasure of others over missed opportunities (role expectation), and the individual's perceived need for feedback about immunizing behavior (self concept). These items (Part 3, items 1-5) were worded with anchors "strongly agree" to "strongly disagree."

8. Responses to the subjective norms open ended question asking respondents to list the three most important influences over their immunizing decisions (item 20) were generally redundant or non-specific, so this item was deleted from the questionnaire.
9. One item each was found to be redundant in the control beliefs, perceived control, and perceived behavioral control sections. These three items were therefore removed.
10. One respondent suggested substituting a golden (Sacajawea) dollar for the dollar bill in each packet.

In summary, the response to pilot testing was excellent and considered successful. The purposes of the pilot were accomplished, i.e., to identify where changes were needed in the instrument and to demonstrate the feasibility of overall approach for the actual study.

The theoretical model used to design the NCIBQ includes 11 concepts, and scales were developed to measure each of these concepts in designing the instrument.

Table 3 provides a conceptual definition and gives an example of the items used to measure each concept in the final version of the NCIBQ.

Under consultation with Professor Roger Brown, preliminary analysis of data for 29 subjects using structural equation modeling (SIMPLIS 1.3) showed a goodness of fit index (GFI) of 0.785 for the proposed model and GFI of 0.922 for an alternative model. However, since some questionnaire items were revised and since pilot sample size was small, population parameter estimates derived from this sample were likely to be unstable and of questionable value in determining either effect size or the desired sample size. It is therefore suggested that the desired sample size be set using the convention of at least 10 and preferably 20 or up to 30 subjects per variable or parameter. Hence choosing the sample was approached with the goal of identifying a minimum of 300 potential subjects.

Survey Mailing Procedure

Questionnaire design (including the booklet format and layout) and survey mailing procedures closely followed Total Design Method (TDM) guidelines and recommendations (Dillman, 1978). Each packet for the first mailing included a cover letter invitation to participate (Appendix C), a copy of the NCIBQ (Appendix D), a reduced version of the current childhood immunization schedule including the footnotes page (Appendix A), a postage paid business reply return envelope, and a golden (Sacajawea) dollar coin. The cover letter was printed on School of Nursing letterhead. Each letter was personally signed by the principal investigator in blue ink. Each questionnaire was numbered to confidentially identify the respondent. Each packet was mailed in a 6" by 9" manila envelope using first class postage consisting of multicolored stamps.

The first follow-up was a post card sent as a reminder to all questionnaire recipients a week to 10 days after the initial mailing. This was also sent using first class postage, and each was signed by the principal investigator with an original signature.

The second follow-up was sent about three weeks after the initial mailing to all nurses in the sample for whom a completed questionnaire had not yet been returned. This mailing included a cover letter on School of Nursing letterhead signed with an original signature of the investigator, replacement copies of the questionnaire and the immunization schedule, and a business reply return envelope. A 6" by 9" manila envelope was again used for the packet using first class postage and multicolored stamps.

The third and final reminder was mailed to non-respondents by certified mail 2-3 weeks after the second reminder. This packet included a unique letter of appeal but otherwise contained the same enclosures as the second mailing. Copies of the first follow-up post card message and second and third reminder letters are reproduced in Appendix E.

Human Subjects Protocol

All procedures for sample selection, the pilot study, and final survey mailings were reviewed and approved by the local UW-Madison Clinical Sciences Center Human Subjects Committee.

Results

Data from completed surveys were entered into a computer using a standard SPSS statistical package. Questionnaire items from scales in which item response categories were worded using a semantic differential were coded 1 through 7. After data entry, some of these items were recoded (reverse coded) using the same process followed in the pilot study so the item high score of 7 always corresponded to the response most favorable or conducive to the behavior of immunizing. Demographic, personal, and qualitative information was also entered using SPSS using customary data entry procedures.

Data were first analyzed using frequency analysis. Bivariate correlation was performed to examine relationships between theory of planned behavior variables, followed by sequential regression analyses and a path analysis related to the study questions and four specific study hypotheses. Specific statistical tests of association or significance were performed for the additional study questions, and narrative data were analyzed using content analysis. This chapter describes the survey response and respondent profiles, explores the descriptive statistics and variable correlations, and examines the study research questions, hypotheses, and model testing.

Survey Response

Of the total sample of 316 Nurses' Childhood Immunization Belief Questionnaire (NCIBQ) surveys mailed, 261 completed surveys were returned. Dillman (1978, p. 50) recommends calculation of the response rate for mail surveys using TDM guidelines according to the following equation:

$$\text{Response rate} = \frac{\text{number returned}}{\text{number in sample - (noneligible + nonreachable)}} \times 100$$

Of the 316 subjects sent questionnaires in the original sample, 1 respondent was identified as a medical assistant and 2 reported lack of involvement in immunizing children. These individuals were deemed noneligible and removed from the sample. In addition, surveys to two individuals during the first mailing were returned undeliverable with no forwarding address. These potential subjects were considered nonreachable. The sample size was therefore reduced by five for an adjusted sample size of 311 and corresponding response rate of about 84%.

A total of 12 final follow-up survey packets sent by certified mail to non-respondents were returned unclaimed. It is unknown if these individuals had received prior mailings and refused to participate or if they were actually noneligible or nonreachable. Accounting for these possibilities reduced the sample size to 299 and a corresponding response rate of 87%. The actual response rate was therefore somewhere between lower and upper limits of 84% and 87%, or about 85%. Respondents reported a mean completion time of 34 minutes with a minimum of 5 and a maximum of 120 minutes.

Respondent Profile

Responses were received from nurses providing immunization services at 134 different sites. The number of individuals who returned completed questionnaires responding from each site ranged from a minimum of 1 to a maximum of 9. Roughly 74% ($\underline{n}$ = 194) of respondents categorized their work site as small with less than 10 nurse employees (registered and practical nurses) who immunize children, 20% (n = 53) categorized their work site as medium sized (10 to 19 nurse employees), and 2% (n = 5) were categorized as large (20 or more nurse employees). Nearly half (46%) of responses were received from sites with one or two respondents from the site. Over 77% (n = 202) indicated serving at least some children eligible for services through the VFC program, and 20% (n = 51) reported their entire childhood immunization service population is VFC eligible. Most indicated immunization services were funded through a mix of funding sources including VFC, managed care, other insurance, and out-of pocket as summarized in Table 4. The number of sites from which responses were received according to the number of respondents per site is summarized in Table 5.

Respondents were overwhelmingly female (over 98%) and reported an average age of 44.0 years (with a minimum of 21 and a maximum of 66 years) and 20.5 years in nursing (with a minimum of less than 1 to a maximum of 46 years). Most (94%, n = 246) reported having one or more natural or adopted children. Over 21% (n = 56) reported having at least one child six years of age and under, 44% (n = 115) reported having children 7 to 16 years, and 60% (n = 157) reported children 17 years and older.

Approximately one fourth were educated and licensed as practical nurses. Roughly 60% were employed in private settings, and the remainder were employed in public (state, county, city, federal including Indian Health Service, tribal, or rural health clinic) settings. Over 45% (n = 119) were staff registered nurses. About 18% (n = 47) reported practicing in community health or public health nursing roles, and 17 (6.6%) were advanced practice nurses including 14 nurse practitioners, 2 clinical nurse specialists, and 1 certified nurse midwife. A total of 217 (84%) considered their position as staff level, with 43 (17%) reporting their position as supervisory or managerial. Although only 14% (n = 36) reported they hold current certification in a nursing specialty by a national certification program for nursing, over half (n = 134) indicated they would be interested in obtaining a specialty certification in the area of childhood immunizations if one were offered.

When asked about how often they perform specific activities related to immunizing children, over 80% of respondents indicated they assess a child's immunization status, decide the immunizations a child should receive, and actually give vaccinations to children "very often" or "all the time." Fewer (56%) reported they make a nursing diagnosis about a child's immunization status in these same response categories of "very often" or "all the time." Nearly all specified one or more of 13 selected facilitators to immunization listed in the questionnaire were available at their work site. Tables 6 through 14 provide frequency and summary statistics concerning respondents' age and length of career in nursing, gender and reported parenthood status by children's age groupings, current educational level, type and level of position, professional certification and interest in specialty certification for childhood immunizations, agency size, agency type, availability of selected facilitators to immunization, and frequency of performance of selected immunization activities.

Item Analysis

Initial examination of item and scale frequencies revealed nearly all respondents completed the entire questionnaire. Missing values for individual items were rare, isolated, and few in number, and were mostly limited to open-ended questions. Variation was noted in all scale scores, with standard deviations scores ranging from a low of 2.74 in the 4-item attitude scale to a high of 6.97 in the second behavior scale case scenario. Table 15 shows the summary statistics for the initial analysis of questionnaire component scales.

Appendix F provides frequencies for all questionnaire scale items. Results for several individual items in each part of the questionnaire were of interest given the aim and long term goal of the study, adding dimension to understanding nurses' views about vaccination and their role in immunizing children. Among questions measuring attitudes, 94% considered their immunizing children extremely important, but fewer (80%) reported an extremely favorable attitude toward immunizing children. Less than a third (27%) considered their immunizing children extremely rewarding, and 43% considered it somewhat rewarding. There was considerably more ambivalence toward vaccine safety, with barely half (58%) considering immunizing children extremely safe and another 34% who considered it only somewhat safe. With regard to causing vaccine side effects, 26% strongly agreed giving children vaccines will cause minor side effects, with 6% strongly agreeing with the statement "Giving children vaccines will cause major side effects." A large majority (82%) agreed slightly, somewhat, or strongly with the statement "Giving a child multiple shots on the same visit causes stress for the parent(s)." Nearly 12% indicated they would feel extremely bad about causing discomfort by giving four vaccine injections on the same visit, compared with 5% who would feel extremely bad over discomfort from one injection. Only 62% strongly agreed that vaccination of children against hepatitis B should be required. In contrast, far fewer (30%) strongly agreed varicella vaccination should be required.

Among subjective norms questions, 72% strongly agreed with the statement

"Others I work with think immunizing children is an important part of my job." However, only 12% strongly agreed that their missing an opportunity to immunize a child on time would displease coworkers. About two-thirds (67%) were extremely familiar with state health department recommendations, similar to the percentage (68%) of those who were extremely motivated to comply with these recommendations. Only 11% were extremely familiar with recommendations of insurance paying for a child's immunizations, and slightly more (15%) were extremely motivated to comply with these recommendations. Less than half (48%) considered themselves to be extremely familiar with the Standards for Pediatric Immunization Practices (CDC, 1993), and only slightly more (58%) were extremely motivated to comply with the Standards. With regard to the recommended childhood vaccine schedule, 70% considered themselves extremely familiar, and 73% were extremely motivated to comply. Fewer (36%) considered themselves extremely familiar with the VFC program, and less than half (45%) were extremely motivated to comply with VFC program recommendations.

Only about 13% strongly agreed with the perceived behavioral control question "When a child is due for a vaccine, I am the one who decides if I will give it," and 13% strongly, somewhat, or slightly agreed they have no control in deciding if a child will be immunized or not. Only about a third (33%) strongly agreed with the statement "Time is adequate to immunize children when I think I should." Roughly two-thirds (65%) strongly agreed they have control over determining if a child is due for particular immunizations; in contrast, only about a third (33%) strongly agreed they have control over deciding if it is safe or unsafe to immunize a child. About 75% strongly agreed they have control over assessing parents' educational needs, but far fewer (27%) strongly agreed they have control in overcoming a parent's objections to immunization.

In the first case scenario for behavioral intention, involving a well child due for four vaccines by injection, only 73% responded it was extremely probable they would immunize the child now with all appropriate vaccines. About 18% reported it was slightly, quite, or extremely probable the child would be rescheduled to get some needed immunizations at a later time. In the second case scenario for behavioral intention, involving a child due for four vaccines but with an acute minor illness and no true contraindications to vaccination, barely a fifth (20%) strongly agreed the child would receive all needed vaccines now. The majority (60%) responded it was extremely, quite, or slightly probable all needed vaccines would be rescheduled.

A parallel tendency to treat a well child and sick child differently was found in responses to the case scenarios for behavior. In the first case (well child, four vaccines due), 77% reported it was extremely probable all vaccines would be given now, and 14 would extremely, quite, or slightly probably reschedule some vaccines. In the second case (sick child, four vaccines due, no true contraindications), 38% would give all vaccines now, and 36% responded it was extremely, quite, or slightly probable all needed vaccines would be rescheduled.

Approach to Analysis of Model Components and Theoretical Model Testing

In this exploratory study, the theory of planned behavior (TPB) was used to examine the behavioral intentions and behaviors of nurses who immunize children, providing an a priori structure to organize and examine the relationships of variables influencing immunizing behavior. Refer to Figure 1. Procedural questions thus arose about approaches to separating theoretical constructs and their relationships, particularly the distinctions between attitudes, subjective norms, and perceived behavioral control and their respective antecedent belief-based measures.

In their early writings describing the theory of reasoned action (TRA) which evolved into the TPB, Ajzen and Fishbein (1980, p. 58) contend intention may be predicted by "weighted" attitudinal and normative components. However, studies in which the TRA and TPB elements are used to organize study variable concepts or for theoretical modeling are not uniform in their approach to their conceptualization of weighting or treatment of belief-based composite (weighted) scores in relation to behavioral intention. For example, Jennings-Dozier (1999) distinguished between (a) separate <u>direct</u> measures of attitudes, subjective norms, and perceived behavioral control, i.e., discrete measures having a direct effect on intention, and (b) the weighted belief-based determinants of attitudes, subjective norms, and perceived behavioral control in which the proposed effect on intention is only <u>indirect</u>. Prislin et al. (1998) followed similar analytical procedures in using the TPB and separated belief-based determinants of attitudes from attitudes (although not including normative components for reasons unique to the study).

Other investigators using the TPB (Millstein, 1996; Pellino, 1994; Taylor, Montano, & Koepsell, 1994) for conceptual modeling do not separate direct and indirect (belief-based) structures, instead treating weighted belief-based variables as having a direct effect on intention. In these studies, belief-based measures are used to predict intention directly without introducing a discrete intermediate measure of attitudes. Multiple and diverse approaches to interpreting relationships of these TRA and TPB structures have led to confusion concerning the distinctions between the direct measures of attitudes, subjective norms, and perceived behavioral control and their respective belief-based determinants in the application and testing of both theories.

In conceptualizing the TRA, Ajzen and Fishbein (1980) indicate behavior is determined and may be predicted from behavioral intention, which itself is determined and predicted by attitudes and subjective norms. In turn, measurement and prediction of attitudes toward the behavior in question is determined by the strength of attitudinal beliefs about the behavior (behavioral beliefs) weighted by the behavior's perceived consequences (outcome evaluation). Similarly, subjective norms are determined and may be predicted by multiplying scores or indices of its antecedent belief- based measures, i.e., the product scores of normative beliefs and motivation to comply. Thus, direct measures of attitudes and subjective norms stand between their respective belief-based measures and intention. Ajzen and Fishbein (p.77) stress "...our theory cannot be tested by examining only the relations between [weighted] beliefs and either intentions or behavior." Although not developed as a variable in the TRA, the direct measure of perceived behavioral control (introduced in subsequent work as a variable in the TPB) may be predicted using the same approach by multiplying scores of its antecedent belief-based measures, i.e. control beliefs weighted by perceived control.

For these reasons, in this study testing the TPB, separate direct measures of attitudes, subjective norms, and perceived behavioral control were developed and treated conceptually as being distinct from their corresponding belief-based determinant structures in examining variable relationship. Specifically, the belief-based determinant of attitude was calculated by multiplying the score for each behavioral belief item by the score for its corresponding outcome evaluation item and then summing the products.

The belief-based determinant of subjective norms was calculated by multiplying the score for each normative belief item by the score for its corresponding motivation to comply item, and then summing the products. The belief-based determinant of perceived behavioral control was calculated by multiplying the score for each control belief item by its corresponding perceived control item, and then summing the products.

Scale Analysis and Revisions

Because the NCIBQ was being used for the first time, reliability analysis using Cronbach's alpha was performed on all instrument scales to determine their performance in measuring concepts. Weinstein (1993) cautions the reliability of model component measures exerts a critical influence on statistical test results, especially when they are based on multiplicative scores used in testing behavioral theories including the TRA and TPB. In particular, imperfect measurement and declining scale reliability leads to reduced variance explained by the interaction term, generating phantom main effects of the separate variables.

This study utilized a new instrument to explore multiple group-level comparisons. Following criteria set forth by Polit and Hungler (1983, p. 393), it was determined alpha coefficients above .60 were acceptable for statistical analysis. Alpha coefficients for five scales (outcome evaluation, intention, normative beliefs, perceived behavior control, and control beliefs) were above .60. Three scales (motivation to comply, perceived control, and behavior,) attained alphas above .70. Alphas below .60 were obtained for the three remaining scales including attitudes (.44), behavioral beliefs (.47), and subjective norms (.28). See Table 16.

Behavioral belief scale. The 12-item behavioral belief scale (alpha .47) was closely examined to identify weaker items that might be eliminated to improve scale reliability. Six items (about the strength of beliefs about vaccine effectiveness, minor vaccine side effects, hepatitis B and varicella vaccine requirements, fees charged for vaccine services, and the value of learning about giving vaccines) were found to be poorly correlated with other items and were removed from the scale. The remaining six items (measuring the strength of beliefs about vaccines causing major side effects, parental stress, legal risks, exacerbation of an acute minor illness, and discomfort from one and from four injections) were retained. The alpha of .62 on these six items alone was deemed acceptable for analysis. The alpha of .73 obtained for the six corresponding items in the outcome evaluation scale (needed for weighting of the retained belief-based items) was also acceptable. The revised scales then consisted of six items each for the behavioral belief and outcome evaluation components of the belief-based determinant of attitude.

Subjective norms scale. The 5-item subjective norms scale was similarly examined to identify weak items that might be eliminated and improve scale reliability. Two items assessing shared subjective norms ("Others I work with think immunizing children is an important part of my job" and "Most people I work with think getting children immunized is important") were moderately correlated ($r = .521$, $p < .001$). Considered together, they yielded a reliability coefficient of .66 and were accepted to comprise the subjective norms scale. The other three items were removed from this scale.

Attitudes scale. The four items comprising the attitudes scale were similarly examined, with no combination of two or three items yielding an acceptable reliability coefficient. It was determined the item asking about the attitude toward immunizing children (with anchors of extremely favorable and extremely unfavorable) was the best measure of the concept of attitudes and was accepted as the single item to be used as a global direct measure of attitudes toward the behavior of immunizing children.

Table 17 shows revised summary statistics for TPB variable scales in the model after these changes.

Study Questions and Hypotheses

The following exploratory questions were examined in the study:

Question 1: To what extent do attitudes, subjective norms, perceived behavioral control, and intention influence immunizing behavior among nurses who immunize children?

Relationships between all study variable scales were first analyzed using bivariate correlation techniques. The dependent variable of behavior was found to be significantly correlated with five measures which were (a) intention ($r = .648$, $p < .001$), (b) attitude ($r = .176$, $p < .01$), (c) perceived behavioral control ($r = .427$, $p < .001$), (d) the belief-based determinant of subjective norms ($r = .193$, $p < .01$) and (e) the belief-based determinant of perceived behavioral control ($r = .404$, $p < .001$). A number of independent variables were also significantly correlated to one another ($p < .05$). See Table 18.

Because multiple independent variables were significantly related to each other, multiple regression was used to examine how well the independent variables taken together predicted the dependent variable of behavior. Using stepwise regression with forward selection, the dependent variable of behavior was regressed on all seven predictor variables (behavioral intention, attitudes, subjective norms, and perceived behavioral control, and the three belief-based determinants of attitudes, subjective norms, and perceived behavioral control) to examine their relative contribution to variance in the measure of behavior. This procedure deletes (a) nonsignificant paths based on an alpha of .05 and (b) non-meaningful paths ($ß < .10$).

Three predictor variables met selection criteria for inclusion in this analysis, accounting for nearly 50% of the variance (adjusted $R^2 = .483$) with significance at the .000 level. These predictors in order of importance were behavioral intention ($ß = .546$, $p = .000$), perceived behavioral control ($ß = .178$, $p = .001$), and the belief-based determinant of perceived behavioral control ($ß = .146$, $p = .006$). Four predictors (attitudes, the belief-based determinant of attitudes, subjective norms, and the belief-based determinant of subjective norms as described in following sections) failed to contribute significantly to the R^2 and were excluded from the analysis. Thus, in this analysis three measures together (behavioral intention, perceived behavioral control, and the belief-based determinant of perceived behavioral control) explained nearly half the variance in behavior.

Question 1A: What is the relationship between attitudes and immunizing behavior among nurses who immunize children?

The measure of attitudes was significantly correlated with behavior in the bivariate correlation analysis ($r = .193$, $p < .01$); the belief-based determinant of attitudes was not. Neither attitudes ($ß = -.013$, $p = .778$) nor the belief-based determinant of attitudes ($ß = .028$, $p = .530$) were significantly correlated with immunizing behavior in the multiple regression analysis.

Question 1B: What is the relationship between subjective norms and immunizing behavior among nurses who immunize children?

Neither subjective norms nor the belief-based determinant of subjective norms were significantly correlated with behavior in the bivariate correlation analysis. Neither subjective norms (ß = -.036, p = .433) nor the belief-based determinant of subjective norms (ß = .020, p = .667) were significantly correlated with immunizing behavior in the multiple regression analysis.

Question 1C: What is the relationship between perceived behavioral control and immunizing behavior among nurses who immunize children?

Both perceived behavioral control (r = .427, p < .001) and the belief-based determinant of perceived behavioral control (r = .404, p < .001) were significantly correlated with behavior in the bivariate correlation. Perceived behavioral control (ß = .178, p = .001) and the belief-based determinant of perceived behavioral control (ß = .146, p = .006) were also significantly correlated with behavior in the multiple regression analyses described above.

Question 1D: What is the relationship between behavioral intention and immunizing behavior among nurses who immunize children?

The measure of intention showed a significant and moderate correlation with behavior in both the bivariate correlation (r = .648, p <.001) and multiple regression analyses (ß = .546, p = .000) described above.

Question 2: How does nurses' immunizing behavior differ by selected characteristics including age, educational level, level of licensure (registered or practical nurse), certification, type of employing agency (private or public), and personal parental status?

Age. The Pearson correlation test (1-tailed) was performed between respondents' (n = 258) age and immunizing behavior scale sum scores. The weak positive correlation (r = .108, p = .042) indicated behavior scale scores increased as age increased.

Educational level. The Spearman rho correlation test (1-tailed) was performed between respondents' current educational level and immunizing behavior scale sum scores. The weak significant positive correlation (r_s = .210, p < .001) indicated behavior scale sores increased as educational level increased.

Level of licensure. Respondents were categorized as either LPNs (n = 74) or RNs (n = 187) according to their level of licensure using dummy coding. To test for association between level of licensure and immunizing behavior, behavior scale scores were split at the median (Mdn = 56.00) into dummy categories for low (LPN = 0) and high (RN = 1). The Yates' correction was applied, and RNs demonstrated significantly higher behavior scale scores than LPNs, X^2 (1, N = 261) = 4.085, p = .043.

Professional certification. Respondents were asked in the questionnaire if they were currently certified in a nursing specialty by a national certification program for nursing. They were then categorized as being certified (n = 36) or not certified (n = 220) using dummy coding. To test for association between certification and immunizing behavior, behavior scale scores were split at the median (Mdn = 56.00) into dummy categories for low (uncertified = 0) and high (certified = 1). The Yates' correction was applied, and certified nurses demonstrated significantly higher behavior scale scores than those who were not, X^2 (1, N = 256) = 5.947, p = .015.

Type of employing agency (private or public). The original eleven NCIBQ workplace categories were recategorized into private or public. The private category included private physician solo practice offices for pediatrics, general and family practice, and private physician group practices. The public category included nurses employed by state, county, and city agencies, the federal Indian Health Service, Indian tribes, and designated rural health clinics. County community health nurses employed by private agencies and contracted by counties to provide immunization services were included in the public category because they function in a public capacity in the performance of these duties. Several respondents serving as volunteers at a free immunization clinic at a shopping mall funded through a private grant were also included in the public category.

Independent t tests (2-tailed) were performed to examine differences in behavioral intention and behavior scale sum scores comparing respondents in the public and private categories. Mean scores for the public category were higher for both variables, and significant differences were found for both intention ($p < .001$) and behavior ($p < .01$) as shown in Table 19. Thus, nurses employed in public settings tended to have higher scores for behavioral intention and immunizing behavior than nurses in private settings.

Personal parental status. Respondents were asked to list the number of natural, adopted, or guardian children in their immediate family in three categories for (a) 6 years of age and under, (b) 7 to 16 years of age, and (c) 17 years of age and older. In the first analysis, one-way ANOVA was used to compare immunizing behavior scale scores for those with (n = 56) and those without (n = 201) one or more children 6 years of age and under. Results were not significant, F (1, 255) = 1.435, p = .232. There was no significant difference in immunizing behavior scale scores for respondents with and without young children.

In the second analysis, one-way ANOVA was also used to compare immunizing behavior scale scores for those with children of any age (n = 246) and those with no children whatsoever (n = 11). Results were again not significant, F (1, 255) = 1.616, p = .205.

From among the 258 respondents providing information about their personal parental status, 11 reported having no children whatsoever. The maximum number of children of all ages reported by a single respondent was 7 (n = 2). In the third analysis, the Pearson correlation test (1-tailed) was performed to determine if having more children of any age was positively correlated with immunizing behavior. The correlation was nearly zero and not significant (r = -.026, p = .338).

<u>Question 3: What influence do facilitators to immunization (i.e., immunization goals, audits, schedule poster or wall chart, standing orders, patient reminder systems, tracking systems, charting reminders, WIC linkage, AAP "Red Book", Standards for Pediatric Immunization Practices (CDC, 1993), immunization policies, patient education materials, and participation in partnerships) have on behavioral intention and immunizing behavior of nurses who immunize children?</u>

Based on the literature, 13 common facilitators to immunization associated with higher immunization coverage levels were identified and listed in the questionnaire, and respondents were asked to check all those used at their agency or work site. Responses were summed for each respondent to indicate a total number of facilitators present. Pearson correlation tests were performed between the tally of facilitators present (i.e., the number of facilitators checked) and scale sum scores for both behavioral intention and immunizing behavior. Facilitators were weakly correlated with both intention ($r = .219$, $p < .01$) and behavior ($r = .183$, $p < .01$), i.e., those with more facilitators present had higher scores for both behavioral intention and behavior.

To determine if some facilitators were more important than others and to detect if there were differences between which facilitators were associated with intention and behavior, a series of independent t tests (2-tailed) were performed comparing groups with and without each facilitator for both behavioral intention and behavior. From among the 13 facilitators, behavioral intention scale scores were significantly higher ($p < .05$) for five facilitators if the individual facilitator was present. These were immunization goals, immunization audits, standing orders, availability of the AAP "Red Book", and availability of the Standards. Similarly, behavior scales scores were significantly higher ($p < .05$) if one of five facilitators were present. These were immunization audits, standing orders, WIC linkage, availability of the AAP "Red Book", and availability of the Standards. Significant differences in both behavioral intention and behavior scores were therefore noted between respondents with and without four facilitators--immunization audits, standing orders, availability of the AAP "Red Book", and availability of the Standards. Significant differences in scores for those with and without goals were only found for behavioral intention, and for those with and without WIC linkage for behavior. Results of t tests are summarized in Tables 20 and 21.

To validate which (if any) of these facilitators with significant findings might have predictive value for behavior, behavior was regressed on each of the six facilitators identified with significant differences for either behavioral intention or behavior from the t-test analyses. Using a separate simple regression analysis treating each facilitator as an independent variable, a weak but significant correlation was found with five of the facilitators. These were immunization audits (ß = .159, p = .010), standing orders (ß = .218, p = .000), WIC linkage (ß = .126, p = .044), availability of the "Red Book" (ß = .192, p = .002), and availability of the Standards (ß = .159, p = .010). The relationship between immunization goals and the measure of behavior was not significant (ß = .041, p = .507).

Hypotheses

There are four study hypotheses. Given the anecdotal findings described in the literature review wherein higher childhood immunization coverage levels were achieved in South Dakota counties and locations where nurses provide immunization independently and without physician supervision (Wilson, 1994), the first three hypotheses examine the relationships between perceived behavior control and behavioral intention, perceived behavioral control and immunizing behavior, and behavioral intention and immunizing behavior. The fourth hypothesis tests the adequacy of the model to predict behavioral intention based on the TPB.

Hypothesis 1: There is a positive correlation between perceived behavioral control and behavioral intention to immunize among nurses who immunize children.

Using simple regression, behavioral intention was regressed on the measure of perceived behavioral control. There was a weak but significant positive correlation between perceived behavioral control and behavioral intention (ß = .319, p = .000). The analysis accounted for less than 10% of the variance in behavioral intention (adjusted

$\underline{R}^2$ = .098) with significance at the .000 level. Hypothesis 1 was supported using simple regression analysis.

Hypothesis 2: There is a positive correlation between perceived behavioral control and immunizing behavior among nurses who immunize children.

Using simple regression, immunizing behavior was regressed on the measure of perceived behavioral control. There was a weak to moderate significant positive correlation between perceived behavioral control and immunizing behavior (ß = .427, $\underline{p}$ = .000), and the analysis accounted for slightly less than 20% of the variance in behavior (adjusted $\underline{R}^2$ = .179) with significance at the .000 level. Hypothesis 2 was supported in both the simple and multiple regression analysis reported above.

Hypothesis 3: There is a positive correlation between intention to immunize and immunizing behavior among nurses who immunize children.

Using simple regression, immunizing behavior was regressed on the measure of behavioral intention as the independent variable. There was a moderate and significant positive correlation between behavioral intention and behavior (ß = .648, $\underline{p}$ = .000), and the analysis accounted for over 40% of the variance (adjusted $\underline{R}^2$ = .417) with significance at the .000 level. Hypothesis 3 was supported in both the simple and multiple regression analysis reported above.

Hypothesis 4 (Model Testing): In this study, the TPB was used as the theoretical framework within which variables affecting nurses' behavioral intention to immunize and immunizing behavior were considered. In order to examine the adequacy of the TPB in predicting behavioral intention to immunize, the following hypothesis was tested: The belief-based determinants of attitudes, subjective norms, and perceived behavioral control have (a) an indirect effect on behavioral intention to immunize and (b) a direct effect on their respective measures of attitudes, subjective norms, and perceived behavioral control, and (c) the measures of attitudes, subjective norms, and perceived behavioral control have a direct effect on behavioral intention to immunize.

Using the initial path structure from the TPB in Figure 1 as the a priori model, path analysis was performed in order to examine these relationships between variables, i.e., the effects of attitudes, subjective norms, and perceived behavioral control and their respective belief-based determinants on behavioral intention. In this procedure, each endogenous variable is sequentially regressed on the variables on which it is thought to depend (Polit, 1996, p.418). Following procedures described by Munro (1997) in conducting this type of path analysis and those used by Jennings-Dozier (1999) in a study also testing the adequacy of the TPB in predicting behavioral intention, the following regression expressions were calculated: (a) behavioral intention was regressed simultaneously on the measures of attitudes, subjective norms, and perceived behavioral control; (b) attitude was regressed on the belief-based determinant of attitude; (c) subjective norms was regressed on the belief-based determinant of subjective norms; and (d) perceived behavioral control was regressed on the belief-based determinant of perceived behavioral control. The criteria for identification of nonsignificant and non-meaningful paths were alphas of .05 and betas less than .10, regardless of statistical significance.

Results of these analyses are shown in Table 22 and depicted in Figure 2. Meaningful paths were identified between attitudes, subjective norms, and perceived behavioral control and their respective belief-based determinants in support of

Hypothesis 4b. Meaningful, significant paths were identified between (a) attitudes and behavioral intention and (b) perceived behavioral control and behavioral intention. The correlation between the subjective norms and behavioral intention was nonsignificant. Hypotheses 4a and 4c were therefore not supported.

Based on this analysis, multiple regression with simultaneous entry was again performed on the entire model with immunizing behavior as the dependent variable but removing the non-significant path between subjective norms and behavioral intention. This analysis also explained about half of the variance (adjusted $\underline{R}^2$ = .480) with significance at the .000 level, but prediction was not improved from the prior analysis in which all six direct and belief-based predictor variables were considered ($\underline{R}^2$ = .489).

External variables. Based on results of the preceding analyses examining Question 2, three demographic characteristics positively and significantly correlated with higher behavior scores were considered as external variables in further attempts to refine and test the model. These external variables were (a) age, (b) current level of education, and (c) professional certification. Although differences in behavior scores based on the nominal measure of individual licensure status (RN or LPN) were also weakly significant, this distinction was viewed as a redundant measure for educational attainment (an ordinal measure). I therefore decided to examine age, current level of education, and professional certification as exogenous external variables with possible direct effects on the belief-based determinants of attitudes, subjective norms, and perceived behavioral control in testing the model using paths within the a priori TPB model. Licensure status (RN or LPN) was not included in this analysis.

It should be noted these three variables selected for analysis were viewed as individual characteristics independent of workplace considerations. In contrast, the facilitators to immunization also associated with higher behavior scores as described in Question 3 were interpreted as environmental factors or manifestations of workplace characteristics rather than individual demographic or personality characteristics. Hence, these were not considered in attempts to refine and testing the model. Similarly, distinctions between the type of agency (public or private) were considered to be environmental and outside the theoretical framework.

In this analysis, the belief-based determinants of attitudes, subjective norms, and perceived behavioral control were regressed individually on respondents' age, current level of education, and professional certification as exogenous (external) variables unique to the individual. A weak but significant correlation was demonstrated between (a) age and the belief-based determinant of subjective norms ($\beta = .122$, $p = .05$), (b) current level of education and the belief-based determinants of attitude ($\beta = .139$, $p = .025$), and perceived behavioral control ($\beta = .186$, $p = .002$), and (c) certification and the belief-based determinants of attitude ($\beta = .139$, $p = .027$), and perceived behavioral control ($\beta = .166$, $p = .008$).

The belief-based determinant of attitude was then regressed simultaneously on the variables on which it was thought to depend--education and certification. Coefficients for education ($\beta = .080$, $p = .256$) and certification ($\beta = .100$, $p = .158$) were nonsignificant. The belief-based determinant of perceived behavioral control was also regressed simultaneously on the variables on which it was thought to depend--education and certification. The coefficient for education was weakly significant ($\beta = .143$, $p = .042$). The coefficient for certification was nonsignificant ($\beta = .100$, $p = .166$).

Results of these analyses are shown in Figure 3 showing only meaningful and significant paths.

Multiple regression with simultaneous entry was again performed on the entire model including educational level and certification as external variables but without the non-significant path between age, the belief-based determinant of subjective norms, subjective norms, and behavioral intention. This analysis failed to improve prediction of the variance ($\underline{R}^2 = .476$) with significance at the .000 level. In summary, including educational level and certification as external variables in accordance with the TPB structure did not change the ability of the model to predict behavior.

Additional Research Questions

Several additional research questions were examined but were not central to testing the TPB. These included:

Question 1: What interventions or strategies do nurses employ for immediate relief of discomfort and pain associated with administration of injectable vaccines to children?

As described in the literature review, there is a paucity of research or other scholarly information published concerning actions taken by nurses and other health care providers to deal with the discomfort caused to children by vaccine administration by injection. Prior to the pilot study it was conjectured that nurses who can articulate strategies they actually do use to reduce this discomfort might be more receptive to administration of multiple vaccines on the same visit than nurses who do not identify specific comfort measures they use. However, pilot study findings revealed that almost all respondents were able to identify one or more interventions they employ to deal with this discomfort.

In the larger study, respondents were asked to list up to three measures they use before and three measures they use after giving vaccine injections to reduce discomfort. Most respondents identified multiple strategies, and some included more than three. Responses were generally brief, consisting of a few words or phrases. These qualitative data were analyzed for dominant themes and then categorized into five groups with the following conceptual definitions:

Pharmacological Agents: Use of systemic oral acetaminophen and other non-steroidal anti-inflammatory agents or application of external numbing agents to the skin to reduce discomfort;

"TLC" (Tender Loving Care): Physical contact and verbal communication to calm, emotionally support, comfort, or sooth the child, sometimes including requests for parents or caregivers to hug or hold the child;

Distraction: Actions to divert attention away from the immediate experience of an injection, including singing, blowing bubbles, changing the interaction context, application of band-aids, and giving food, stickers, toys, or other distracting objects to the child;

Specific Techniques: Employment of other specific non-pharmacologic strategies, such as deliberate or proper positioning, simultaneous administration of two vaccines by two nurses, rubbing the injection site, and application of warmth or cold to reduce or minimize discomfort; and

Cognitive Strategies: Verbal and non-verbal communication intended to prepare the parent or child mentally for the painful experience or to elicit their cooperation during the procedure. These include specific instructions about what they should do, explanations about what to expect and common side effects, verbal minimization of the painful experience, conveying information about home treatment, and verbal praise and encouragement.

All responses were counted and categorized. A total of 481 "before" and 555 "after" actions were listed by respondents. Findings indicated all five types of interventions were commonly used, with some differences in the rankings between those employed most frequently before and after giving injections. Before vaccination, specific techniques were the most common interventions cited followed by pharmacological agents, cognitive strategies, "TLC", and distraction. After vaccination, distraction was the most frequently cited followed by "TLC"', pharmacological agents, specific techniques, and cognitive strategies.

Many subjects reported using identical strategies both before and after giving a child immunizations. There was also general consistency among the various interventions reported, with the exception of the category for specific techniques where certain differences were noted. For example, some reported application of heat to the vaccine site while others reported using cold. Similarly, some reported rubbing the vaccine site and others recommended against this practice. Table 23 summarizes frequencies for each of the five intervention categories before and after vaccination.

Question 2: To what extent are nurses able to identify age-appropriate vaccines for children in defined clinical situations?

In each of four case scenarios, respondents were asked to identify which immunizations were currently due from among seven possible choices (DTaP, HepA, Hib, HepB, MMR, varicella, and polio) irrespective of whether or not any of the vaccines would actually be given at this time. Two case scenarios were constructed to assess behavioral intention, and two were intended to assess behavior. In each case, exactly four age-appropriate vaccines were due according to the current Recommended Childhood Immunization Schedule (CDC, 2000b) and were confirmed by expert opinion. The number of correct responses for each scenario was scored with a possible range of 0-7. Incorrect responses were counted as the combined total of (a) age-appropriate vaccines not selected and (b) inappropriately selected vaccines given the child's age and prior vaccine history. Table 24 summarizes the descriptive statistics and frequencies of scores for each of the four cases.

Individual respondent scores for each of the four case scenarios ranged from a minimum of 1 to the upper limit of 7. The intention case 1 scenario involved a healthy 5-month old child with an immunization delay in need of the primary vaccine series, and nearly all (95%) of respondents correctly identified all age-appropriate vaccines, thus achieving the maximum score of 7. The other three case scenarios involved older children (20, 15, and 12 months) having more complicated vaccine histories. Here markedly fewer subjects correctly identified all age appropriate vaccines, with about 55% (intention case 2), 65% (behavior case 1), and a low of 29% (behavior case 2) correctly identifying all age appropriate vaccines. Only 35 subjects (13%) had scores of 7 for all four case studies as shown in Table 25. Inappropriate vaccine choices were also made in each of the four scenarios with a high of 36 respondents (14%) selecting one inappropriate vaccine in one case scenario as summarized in Table 26.

<u>Question 3: To what extent is level of education positively correlated with</u>

knowledge of age-appropriate vaccine recommendations?

It is unknown if nurses with different levels of educational preparation have differing knowledge of age-appropriate vaccine recommendations, or if those with successively higher levels of education have better knowledge of recommendations as measured by ability to interpret the vaccine schedule to identify age-appropriate vaccines. Respondents were provided with a copy of the current Recommended Childhood Immunization Schedule along with the NCIBQ for reference in identifying the appropriate vaccines in each case scenario. Educational level categories were examined on the basis of questionnaire educational groupings with nine educational categories: (a) practical nurse, (b) associate degree in nursing, (c) diploma in nursing, (d) baccalaureate degree in nursing, (e) post-baccalaureate certificate, (f) master's degree in nursing, (g) master's degree in another field, (h) doctorate in nursing, and (i) doctorate in another field. The Spearman rho correlation (1-tailed) was performed and found to be significant ($r_s = .105$, $p < .05$).

Analysis of Qualitative Data from General Comments

Respondents were invited to comment on any aspect of the questionnaire or their experiences in immunizing children, and over 75% ($n = 196$) did provide comments. Many comments highlighted worries and concerns about childhood immunizations or elucidated vivid perceptions about specific issues of interest related to the study topic. Substantive comments were analyzed for major ideas and then categorized into themes pertaining to (a) support for immunizations, (b) interactions with children, (c) relationships with parents, (d) relationships with other providers, (e) workplace concerns, (f) approaches to simultaneous vaccine administration, (g) varicella vaccine concerns, and (h) questionable immunization practices. A brief synopsis and examples of specific comments are provided for each of these themes.

Support for immunizations. Many respondents gave comments generally supporting immunizations. Several acknowledged that giving immunizations can be unpleasant, but also stressed the value and importance of childhood immunizations, as in the following:

"I just don't enjoy giving baby shots, but they are very important and you always have to remember that."

"I realize that immunes can cause discomfort for kids and parents, but I still feel this discomfort is minimal compared to discomfort of the diseases."

"I view immunizing children as extremely important. It is difficult to deal with the crying it causes but the outcome far outweighs avoiding it."

"Discomfort is very short lived and tolerable."

"Shots are not one of my favorite jobs. I don't like causing someone discomfort and pain but I want to help them stay or get well."

"It's easier to give all injections at once and I'm a firm believer in that."

"We believe in immunizations and they are of utmost importance in providing care to our patients."

Interactions with children. Several respondents portrayed their interactions with children when giving immunizations as a positive experience:

"I take a lot of time with my kids and they do really well when receiving their shots."

"My 5-year-olds get to choose where they get certain shots (arm or leg) and 'fast or slow.' This helps them gain some control over the situation and I've found they do much better."

However, others expressed dislike of giving multiple injections to small babies, dismay at being cast in a role by children as the agent responsible for needlesticks and associated pain, and difficulty in maintaining cooperation once children realize they are about to be immunized, as these comments illustrate:

"Giving a 12 pound baby four or five shots is too much. Older children hate you cry and scream when they see you."

"I am not thrilled about having to give so many immunizations at the same time, especially those under 4 months of age as they have so little muscle mass!"

"It makes me sad when little kids recognize me as the 'shot lady' and are immediately scared before I do anything."

"The older kids start fighting back and...it's hard to hold them still therefore causing a more dangerous situation and causing more side effects, more trauma to the skin."

"Giving four or five injections to an infant or child I feel is torture."

"I don't mind giving kids imms, but giving four shots especially at 2, 4, and 6 months is very uncomfortable for me, the parents, and the baby."

"I have found that spreading out vaccines after 12 months of age causes problems when children return and remember."

"I've had kids 'hate' me between 12 and 15 months of age when they return for immunizations. They don't forget!"

Relationships with parents. The ability to deal constructively and effectively with parents was an important concern for a number of respondents. Some stressed the importance of caregiver education and the need to elicit parental participation and cooperation when their children are to be immunized. Others expressed concern over dilemmas encountered when parents and providers disagree over vaccine recommendations:

"I believe if I'm not educating the clients I'm not doing my job to the best of my ability."

"Parental stress has never been a problem. This is a normal, expected life stressor one deals with."

"Questions about parents objections are touchy issues. I try to educate, not talk them into anything they are scared of."

"Parents always need education and reassurance."

"We encourage giving every vaccine the child is due for at each visit, but do also ask the parent. Some, despite education, don't want them if child has cold or other minor illness."

"We respect a parents right to refuse immunizations, we provide educated knowledge and recommendations regarding vaccines…."

"I absolutely hate parent comments about 'that mean nurse,' 'how can you do that?' etc. Most of them I'm sure don't mean it but it bothers me anyway."

"Without exception parents dislike their child getting four shots at a time. This puts the nurse in a difficult position."

"Occasionally I need to set up a second visit to complete the needed shots because a parent's feelings are so strongly against a child having four at once."

"I feel sorry for the child who has to receive six immunes at once due to parents neglect, ignorance, and laziness."

Relationships with other providers. Comments suggested respondents vary widely in the nature of their interactions, decisional authority, and extent of collaboration with physicians and other health care providers concerning childhood immunization decisions:

"I am a team leader nurse for two staff doctors and six residents...we feel very strongly about educating our doctors before they leave our program and start their own practices."

"Nurses are a valuable resource for immunization information. In our clinic, the doctors take advice from the nurses about what immunizations are due."

"...I am always under direction of physician."

" In community health we have doctor's standing orders but we determine what shots we give."

"The pediatricians are very good at staying up on the latest recommendations and helping us whenever needed."

"I don't feel that I have any say in whether or not imms are ordered."

"The doctor has the final say."

"We have nurse-only visits and it is there we give lots of imms. If questions there is always a doctor to ask."

"At our clinic if a child has any symptoms of an illness the health care provider makes the final decision if the child should be immunized at that time or wait."

"I do make the call on any questionable situation like an ill child...."

"The RN I work with makes the decision on most immunization situations."

"In my office the physician I work for has authority over vaccines given."

"I work in a peds clinic where well baby exams are required, but if the mother refuses a doctor exam, I have to decide what to give.

"Three staff always concur prior to delivering immunizations to children—one RN, one LPN, one PAC."

Workplace concerns. Various comments identified an assortment of workplace problems and causes of frustration linked to immunizing children, including work overload and time constraints, repeated changes in the immunization schedule, paperwork requirements, and personal liability:

"Our schedule is usually very busy and ends up putting me and my doctor behind schedule."

"Immunizations take up too much time, we schedule patients every 15 minutes. It takes that much time to draw them up and document."

"I don't like the fact that immunization schedules are always changing, almost every 6 months or less for example...."

"Any time a parent calls back after immunizations have been given, my heart jumps, worried that something may have happened, especially if I administered them."

"The biggest drag about immunizing is having to give four vaccines at one visit. It's quite time consuming for me to draw them up, label syringes, write down lot numbers, put on (the computer)...."

"We are closely monitored for immunization mistakes and this information can go in our performance evaluations. I trust my knowledge but sometimes it is CYA."

"There is a lot of documentation and sometimes we are very rushed. That greatens the margin of error."

"It is only getting worse--more vaccinations, more paperwork! Help!"

Approaches to simultaneous vaccine administration. Several respondents described how they deal with giving multiple vaccines on the same visit, while others pleaded for rapid development of more combination vaccines:

"We are fortunate at this clinic as we have two administer injections at the same time, one nurse to each thigh. This way it's only two times each nurse has to inject the child. This makes it easier on all of us."

"I pray for the day we can give all vaccines in one syringe. We need either more oral vaccines or combinations."

"I hope there comes a time we can give 1 shot to cover them all."

"I feel drug companies should work hard to combine immunizations to reduce trauma to peds patients."

"I have talked and talked...to ask them to work on trying to get more combined immunes. Excuse my compassion, but veterinary medicine has been able to do it for years, why can't we have research accomplished to do it for humans?"

Varicella vaccine concerns. Varicella was the only vaccine about which respondents made specific comments. Several questioned its value or expressed concern over mandatory vaccine requirements as the following comments illustrate:

"There is still skepticism about the varicella vaccine."

"It is mandatory for kids going to kindergarten who have not had chickenpox to get it. I even had one mom consider home-schooling her child because of her concerns with the vaccine."

"Still undecided about chicken pox vaccine."

"Unsure of how long chicken pox vaccine lasts, hate to prevent in childhood and then have pregnant mom acquire."

"I think this shot is highly debatable--I have a real problem giving this shot (varicella) !!!"

Questionable practice patterns. Lastly, several comments revealed immunization practices known to be associated with ineffective immunization delivery or integration of immunization and other well child services. These included practices conflicting with one or more of the Standards including adherence to false contraindications and failure to administer all needed vaccines on the same visit. Other questionable practices included denial of other preventive services if immunizations are refused, and local adjustments in the recommended immunization schedule:

"I am a bit uneasy about giving immunizations to ill children. If we know our clients will return I may reschedule for the next week...."

"Don't feel nurses in clinics with a doctor present can give all at the same time. If doctor feels they should be spread out they have to follow orders, they may feel the same way because of doctors beliefs."

"I observe a lot of records where infants and toddlers were not given all immunes that could have been given at their clinic.

"The pediatric clinic where I work will not see patients who for whatever reason refuse to have immunes. "

"If parent chooses not to have child immunized, they must find alternative health care."

"I know some nurses do shots simultaneously, but I don't approve of this as it seems like they are ganging up on the child."

"Our clinic administers MMR at 15 months."

Summary

Study results include a number of important findings of interest. Among the variables included in the TPB, only behavioral intention, perceived behavioral control, and the belief-based determinant of perceived behavioral control as predictor variables were significantly correlated with the dependent variable of behavior. Hypotheses were supported that the relationships between (a) perceived behavioral control and behavioral intention, (b) perceived behavioral control and behavior, and (c) behavioral intention and behavior were positively correlated. Neither direct nor indirect measures of attitudes and subjective norms toward the behavior of immunizing children were demonstrated to contribute significantly in explaining variance in the dependent variable of behavior. Although a significant correlation was noted between the indirect and direct measures of attitudes, subjective norms, and perceived behavioral control, findings failed to support a significant path between the direct and indirect measures of subjective norms and behavioral intention.

Findings also revealed a positive correlation between age and sum scores for immunizing behavior, indicating older nurses were more likely to immunize as were nurses with successively higher levels of education. A significant difference was noted in immunizing behavior between RNs and LPNs, with RNs more likely to immunize than LPNs. Certified nurses were also more likely to immunize than nurses who were not certified. Incorporating current level of education and certification as external variables into the theoretical model using TPB constructs failed to improve the model's predictive value for immunizing behavior. Significant differences were found in behavioral intention and behavior scale scores between nurses in public and private settings; scores for nurses in public settings were higher for both scales. No significant differences in immunizing behavior were observed comparing nurses with and without small children, and comparing nurses with and without children of any age. The total number of children was not significantly correlated with immunizing behavior scale scores. Availability of as many as five separate facilitators to immunization (immunization audits, standing orders, the Pediatric "Red Book", the immunization Standards, and WIC linkage) were significantly correlated with higher scale scores for behavioral intention to immunize and immunizing behavior.

Findings from additional exploratory study questions revealed nurses in the sample employ a variety of strategies to deal with vaccine-associated discomfort both before and after administering immunizations by injection. These include pharmacological interventions, distraction, "tender loving care (TLC)", specific administration techniques, and cognitive appeals. Only about 13% of respondents were able to correctly identify all age-appropriate vaccines in each of four clinical case scenarios, and inappropriate vaccines accounted for a portion of incorrect vaccine choices. A positive correlation was noted between successively higher current levels of education and ability to correctly identify age-appropriate vaccines.

Lastly, respondents gave additional comments categorized into general support of vaccines, the dynamics of interactions with children, parents, and other providers, workplace issues, approaches to simultaneous vaccine administration, concerns about varicella vaccine, and questionable immunization practices. The following discussion examines salient implications of these findings.

Discussion

In this discussion, pertinent study findings are identified and compared with findings from prior research. Several important new findings are also highlighted and the adequacy of the study design and method is explored. Study strengths and limitations are reviewed, and implications for nursing practice, nursing education, and nursing research are considered.

Summary

The purpose of this investigation was to examine and understand the behaviors of nurses who immunize children as a factor affecting the maintenance of optimal immunization coverage levels for the prevention of VPDs. The subjects for the study were a sample of 316 randomly selected nurses who immunize children in South Dakota. A mail survey approach using Dillman's (1978) total design method (TDM) was used for data collection, employing an instrument developed for this study named the Nurses' Childhood Immunization Belief Questionnaire (NCIBQ). The NCIBQ was organized in accordance with guidelines for testing Ajzen and Fishbein's (1980) theory of reasoned action (TRA) and structured to include variables in Ajzen's (1985) theory of planned behavior (TPB).

There were 261 completed surveys returned for a response rate of about 85%. Major significant findings showed behavioral intention was an important determinant of behavior, and perceived behavioral control was positively correlated with behavioral intention and also a major predictor of immunizing behavior in this group of nurses. Significant positive correlations were found between immunizing behavior scale scores and respondents' age, current educational level, and professional certification. Nurses employed in public settings had higher immunizing behavior scale scores than those employed in private settings, and RNs had higher immunizing behavior scale scores than LPNs in the sample. Significant differences were noted in immunizing behavior scale scores for nurses with five facilitators to immunization present; these were immunization audits, standing orders, the AAP "Red Book", the Standards for pediatric immunization practices (CDC, 1993), and WIC linkage.

Respondents identified a number of strategies or interventions they employ to relieve discomfort caused by giving immunizations by injection. Only 13% of respondents correctly identified all age-appropriate vaccines in each of four case scenarios, and most were reluctant to adhere to true contraindications when immunizing sick children, contributing to missed opportunities to immunize. Inappropriate vaccine choices were also noted in each of the four case scenarios. Lastly, nurses with higher levels of education were more likely to be able to correctly identify age-appropriate vaccines.

Linking Current Findings to Prior Research

Facilitators to immunization. A number of results from this investigation support findings from prior research about the effects of certain health care provider activities when they immunize children on immunization coverage levels. In particular, findings lend credence to the impact of key facilitators to immunization in influencing childhood immunization levels, but fail to support the value of others. For example, the positive correlation between WIC linkage and higher immunizing behavior scale scores is consistent with findings of earlier studies (Birkhead et al., 1995; Hoeckstra et al., 1998; Wood & Halfon, 1998) leading to policy recommendations stressing the value of this linkage (CDC, 1996e). However, the value of local or regional community partnerships or similar linkages identified in the theme at the 31st National Immunization Conference (DHHS, 1997) as an effective strategy to improve the effectiveness of immunization services was not supported.

Findings failed to demonstrate a significant relationship between the presence of immunization tracking or patient reminder systems and higher immunizing behavior scores despite the contemporary emphasis on these as important program tools (CDC, 1993; Pierce et al., 1996; Szilagyi, Rodewald, Humiston et al., 1994; Wilson, 2000; Zahner, 1999). On the other hand, the value of audits or similar information to monitor immunization coverage levels and to give provider feedback (CDC, 1993, 1996f; Dini et al., 1996; Fairbrother et al., 1999; Landon et al, 1998; LeBaron et al., 1997; Thompson, 1997) leading to improvements in immunization services is supported. The benefit of non-patient-specific standing orders to allow administration of vaccines without a specific physician's order identified in the literature (CDC, 1993; Cutts et al., 1992; Lieu et al., 1996; New York State Nurses Association, 2000; Szilagyi, Rodewald, Humiston et al., 1994; The Johns Hopkins University, 1993) is also supported.

Findings lend credence to the study by Pierce et al. (1996) showing implementation of the Standards for pediatric immunization practices (CDC, 1993) at the work site may be associated with improved vaccination coverage levels. Although prior studies have not examined if there are differences between the immunizing behaviors of providers with and without the availability of the AAP "Red Book" at the work site, the Standards do underscore the importance of having timely and accurate information available about current vaccine recommendations. As both the "Red Book" and the Standards are technically only passive instruments and information repositories (as opposed to activities or tools like audits or standing orders intended to be woven into organizational infrastructure as a means of changing behavior), it can be conjectured that the influence of their presence may be linked to general provider awareness of contemporary immunization policy issues or the co-presence of other environmental conditions in the workplace.

Other provider immunization practices and demographics. Some study findings are consistent with results of prior research. Results including verbal comments demonstrate some nurses, like some physicians, express serious concerns about giving a child multiple vaccines on the same visit as reported in the literature (Chen et al., 1995; Dietz et al., 1994; Madlon-Kay & Harper, 1994; Szilagyi, Rodewald, Humiston et al., 1994). Many respondents reported a tendency to schedule additional visits for additional vaccines, a practice contrary to current recommendations (CDC, 1993). Like physicians, nurses in this study also reported frequent adherence to false contraindications to immunize as described in the literature (Campbell et al, 1994; Szilagyi, Rodewald, Humiston et al., 1994; Zimmerman et al, 1997), expressing reluctance to give needed vaccines to children with a variety of acute minor illnesses.

This finding is surprising, given the high percentage of respondents reporting they were extremely familiar with and extremely motivated to comply with the Standards for pediatric immunization practices as well as recommendations of the state health department which mirror Advisory Committee on Immunization Practices and CDC guidelines. The index of scores used to measure immunizing behavior in this study does not support consistent or strong compliance with several accepted standards or recommendations of these authorities. In particular, these include standards for screening and administration of age-appropriate vaccines on every clinical encounter (standard 4), adherence to only true contraindications (standard 7), and simultaneous vaccine administration (standard 8). Hughart et al. (1994) report similar variability in provider conformance with these particular standards. It is also possible high scores for familiarity and motivation to comply with guidelines reflect a form of social desirability bias as described by Dillman (1978, p. 62) given the study topic and perceived workplace expectations about following current recommendations when immunizing children.

As reported in the literature, the finding in which nurses in public settings had higher immunizing behavior scores is consistent with findings showing physician providers in public settings were more likely to follow vaccine recommendations than those in private settings (Askew et al., 1995). But Hughart et al. (1994) and Wood et al. (1996) found knowledge deficits concerning the immunization schedule and true vaccine contraindications were commonplace in both public and private sites, as they were in this study. In contrast, other studies have shown more desirable practice patterns may also exist in private settings (Szilagyi et al., 1994). Compared to other studies, it is possible public and private differences in immunizing behavior found in this study were somehow related to the minimal penetration of managed care payment systems in South Dakota or higher levels of perceived behavioral control among nurses employed in public settings.

Findings in this study showed nurses who were older had higher scores for immunizing behavior, i.e., they were more likely to follow vaccine recommendations.

This contrasts with findings by Szilagyi, Rodewald, Humiston et al. (1994) who found older physicians were less likely to follow immunization guidelines than those who graduated from medical school more recently. Perhaps findings in this study of nurses support the opinions of Katz (1998) and Grantmakers in Health (2000) who suggests younger parents and providers place less emphasis on the importance of vaccines because they increasingly lack personal experience in dealing with the killer diseases of yesteryear since they have effectively been controlled through contemporary immunization efforts.

New Findings

As the first empirical study to focus exclusively on the behaviors of nurses who give routine immunizations to children, this study has generated a number of interesting and important new findings. Results indicate nurses are involved in many aspects of vaccine delivery and play an essential role in providing vaccine services in varied settings where childhood vaccines are given. But analysis of responses to several specific questionnaire items are of great concern to those attempting to optimize vaccine delivery services and improve immunization coverage levels, challenging any assumption that nurses are unfailing in their beliefs about the need for vaccines or that they are always strong vaccine advocates.

For example, while nurses' attitudes were generally favorable toward giving immunizations and most consider it extremely important, support for immunizations was not always consistent and was far from being universal. Nurses' concerns about vaccine safety were pervasive in this study group, with barely half considering immunizing children extremely safe, and significant minorities reporting concern about causing minor as well as major side effects by giving vaccines. While most respondents were comfortable in their ability to educate parents about needed vaccines, causing parental stress from giving multiple vaccines on the same visit was a ubiquitous concern, and a sizeable portion expressed lack of confidence in their ability to overcome parents' objections. A particularly worrisome finding was the apparent lack of strong support for hepatitis B vaccine requirements, and there was markedly less support for varicella vaccine. In the aggregate, these factors could have some impact on nurses' immunization decisions and dealings with patients as shown in other studies examining the reluctance of some physicians in giving hepatitis B vaccine (Freed et al., 1996; Kraus et al., 1994; Taylor et al., 1997) and varicella vaccine (Newman & Taylor, 1998; Schaffer & Bruno, 1999). Findings of this nature from an important health care provider group are particularly alarming at a time when eroded public confidence in vaccine safety and effectiveness threaten the ability of the public health community to sustain vaccine coverage levels essential to protecting the public's health.

Prior studies have not systematically examined if nurses possess the requisite resources including time, supplies, or other supports necessary to immunize when opportunities arise. Findings of this study reveal nurses sometimes feel they lack the resources they need to be effective vaccine providers. A minority felt they have very little control in making vaccine decisions. And despite provisions to assure availability of vaccines through the state's universal purchase program as a recognized means of improving access to immunization services (Hueston et al., 1994), nurses in this study reported frustrations resulting from time pressures, the complex details of vaccine preparation, workplace constraints, and the growing burdens of paperwork when they are giving vaccines. As several respondents commented, the magnitude of these concerns is likely to increase as more vaccines now under development are added to the recommended vaccine schedule. Solutions described by respondents include tapping other human resources (as in two nurses giving two vaccines at the same time), but there were also strong appeals for more research leading to the development of additional combined vaccines. As noted previously, only one study by French et al. (1994) explores the usefulness of a particular strategy (blowing bubbles) to distract children from the discomfort associated with vaccine injections. Importantly, in this study, respondents were able to articulate a host of other inventive strategies or interventions they have devised and regularly employ to address issues stemming from the discomfort caused when they give children vaccines by injection.

Several findings have potentially important policy implications, particularly the analyses showing nurses with higher levels of education had higher immunizing behavior scale scores and were also more successful in identifying age-appropriate vaccines. These are both critical components in provider decisions to optimize vaccine delivery. Nurses certified by a national certification program for nursing as a mark of professional recognition also had higher immunizing behavior scale scores. But among the most important findings in this study of nurses was the positive correlation between two measures of perceived behavioral control over immunization decisions and immunizing behavior. This finding supports Wilson's (1994) observation that immunization coverage levels tended to be better in locations where nurses immunize children independently and where they have greater levels of individual control over their own immunization decisions. As a means of improving immunization coverage levels, perhaps consideration should be given to building on this finding by giving nurses more responsibility and authority for making immunization decisions independently with commensurate accountability for those decisions. This could be accomplished through better utilization of standing orders, regulatory changes, or other protocols to expand their scope of practice when immunizing children.

Study Method and Theoretical Approach

A new instrument called the Nurses' Childhood Immunization Belief Questionnaire (NCIBQ) was developed, tested, and implemented as part of this study. Using the NCIBQ for data collection, this study closely followed recommendations outlined in Dillman's (1978) total design method for mail surveys. The favorable survey response rate of about 85% is considered very good to excellent for mail survey research and validates Miller's (1991, p. 155) analyses showing the mail survey approach applying these guidelines can be successful.

The study design offered an incentive of only a one dollar coin and employed a questionnaire of 12 pages with reduced size print. Some would consider the small monetary incentive and NCIBQ length or small print size as disincentives for participation. Dillman (1978, p. 16) notes that token financial incentives can be effective in mail survey research and that more expensive or larger financial incentives may actually be a disincentive for participation leading to a lower response rate. Given the length of the questionnaire, the reduced size of print, and the nominal financial incentive included in this study, the high response rate also suggests other factors including TDM features and elements identified by Dillman (1978) may also be important in promoting participation. These include the basic topic of the research, the overall questionnaire design, the messages and appeals contained in the first and subsequent mailings, and the structured approach to reminder mailings.

As the instrument for data collection this study, the NCIBQ applied instructions for item and scale development accompanying descriptions of Ajzen and Fishbein's (1980) TRA and Azjen's (1985) TPB. Hence the instrument was structured in accordance with their recommendations for item development and scale construction and measurement. The study is the first to use the TPB to study the immunizing behavior of nurses and one of only a handful to examine the behaviors of any health care provider group.

Questionnaire scales for perceived behavioral control, the belief-based determinants of perceived behavioral control, behavioral intention, and immunizing behavior performed adequately for statistical analysis. But scales for attitudes, the belief-based determinants of attitudes, subjective norms, and the belief-based determinants of subjective norms did not perform adequately and required revision to achieve acceptable scale reliability prior to analysis. I propose several possible reasons to explain the problems with measurement and performance of these scales. First, I considered the wording for some motivation to comply items for the belief-based measures of attitudes to be awkward due to being worded similarly for parallel item construction. Although respondents did not offer comments to support this, these items may have still been difficult for some respondents to interpret despite rewording following the pilot study. Second, in most studies using the TPB, the focal behavior in question typically concerns individual choices to perform or not perform a behavior directed at oneself, i.e. directly or primarily affecting only the individual making the behavioral decision. In this study, as the behavior in question, immunizing is always directed at another individual. Clearly, an infant or child as the target of this behavior is not always expected to be cooperative or supportive of the health care provider's behavioral decision to immunize. Third, as licensed professionals employed in health care settings where they are accountable for performing certain functions in society, nurses' attitudes and individual interpretation of subjective norms may be immaterial if they function under role prescriptions about their preferred immunizing behavior. Hence nurses may be subject to professional or ethical expectations about how they should perform in a particular clinical circumstance regardless of what they think or feel about the behavior.

Organized on TPB concepts, findings of this study suggest that among nurses in this sample, behavioral intention to immunize is an important determinant of immunizing behavior, and perceived behavioral control over immunizing decisions is an important determinant of intention to immunize and immunizing behavior. Failure of data to support other theorized relationships in the model suggest the theory may need revision in subsequent studies, or that measurement may have been inadequate to demonstrate meaningful structural paths proposed in the TPB. For example, it is quite possible that using only one item for attitudes and two items for subjective norms may have contributed to the nonsignificant betas between these variables and behavioral intention in the multiple regression analysis.

Breaking New Ground

As identified in the literature review, prior research concerning the practices and behaviors of health care providers who immunize children has focused primarily on physicians. Examination of the behaviors of nurses was needed for improved understanding of how this provider group contributes to successful and unsuccessful vaccination delivery. Additionally, except for the recent study by Wilson (2000) examining some provider factors affecting immunization coverage levels of rural children, prior research on immunization practices has focused on studies of providers serving urban populations. This study from a largely rural state addresses another void in the literature. Simple random selection of subjects, the response rate of about 85%, and the fact the entire questionnaire was completed by nearly all respondents demonstrate high interest in the topic while lending credence to results and the extent to which findings may be generalized to other populations.

Another important strength of the study is its exact focus--behavior, and specifically, the immunizing behavior of nurses. Prior research on provider immunization practices has been dominated by studies in which factors including provider attitudes and practice setting characteristics have been linked to the outcome measure of immunization coverage levels. Studies specifically analyzing provider immunization decisions and what they actually do are much less common in the related literature.

While associations between certain provider or setting characteristics and immunization coverage levels have often been demonstrated, the extent to which outcomes may be the product of other extraneous forces is unclear and poorly understood. In other words, the outcome of immunization coverage may be influenced by factors other than what providers do, for example patient and environmental factors. In research using the TRA (as the antecedent model to the TPB), Ajzen and Fishbein (1980, p. 29) warn of the importance of distinguishing between behaviors (e.g., the immunizing behavior of nurses who serve a population) and related measures of behavioral outcomes (e.g., immunization coverage levels in that population). Thus they caution that prediction of outcomes is possible only to the extent that outcomes are actually controlled by a specific human behavior. Results of this study (focused on behavior as opposed to immunization coverage levels as the outcome variable) help to more clearly understand how provider activities may explain or contribute to differences and changes in immunization coverage levels.

Further, while study findings demonstrate immunization decisions are often complicated, the fact remains that nurses are frequently the ones who actually administer vaccines. Hence better understanding of how different factors may affect nurses' behavior when they immunize children is important to understanding how immunization coverage levels can be improved by policy changes and educational interventions to elicit specific changes in provider behavior for greater compliance with recommended practices.

Study Limitations

Several aspects of the study setting and population contribute to its limitations. With the sample drawn from the population of nurses in a largely rural state, the extent to which results may be generalized to other populations and nurses in urban settings may be limited. Additionally, South Dakota is one of only 15 states with a state-managed universal vaccine purchase program (IOM, 2000, p. 8). Although shown to be associated with improved overall access to immunization services (Hueston et al., 1994), it is unknown what impact this specific feature has on nurses' behavior. Perhaps nurses in other states where providers are responsible for their own vaccine purchases view their role in vaccination differently.

Another potential limitation stems from the study method and instrument design. Questionnaire items to measure study variables were constructed with response categories arranged using a typical Likert scale or semantic differential format. This practice, common in social research and psychological measurement, assumes response categories can be treated as interval measures, i.e., equal distances apart (Miller, 1991, p. 324). It can be argued such measures are technically ordinal measures, since the true difference between measurement points may be unequal and in most cases, cannot be accurately measured. Nonetheless, others have argued possible disadvantages and distortion errors resulting from treating such data using higher level interval measurement techniques is outweighed by the advantages of being able to apply more powerful statistical analysis as long as scale characteristics approximate interval measurement (Polit, 1996) as they were designed in this study.

Perhaps the most important study limitation is linked to the decision to use a mail survey approach for data collection as a threat to data reliability. The social desirability of certain behaviors (in this case, immunizing children according to recommendations) may contribute to response bias in conducting survey research (Fowler, 1988). Ajzen and Fishbein (1980, p. 30) advocate direct observation as the preferred means of measuring and validating behavior, but add (p. 38) self-reports of behavior are usually quite accurate. Given assurances protecting their confidentiality, there is no reason to suspect the actual behavior of subjects in this study would differ significantly from their self-report. The degree of correspondence between behavioral intention and behavioral measures for both the well child and sick child case scenarios also provide evidence supporting the consistency of responses, giving little reason to suspect the accuracy of self-reported behavior in this study.

Implications for Nursing Practice

Several study findings are of potential importance for nursing practice, including the potential benefits of facilitators to immunizations, pressing needs for evidence of professional competence in immunization practice, and observations about behavioral differences between nurses in public and private settings.

Facilitators to vaccination. As outlined above, study findings validate some prior research findings about the value of facilitators to vaccination, but extend an important step beyond these findings in using immunizing behavior rather than immunization coverage levels as the measure concerning the relationship or demonstrating the influence of the facilitator. In particular, implementation of provider feedback about immunization coverage levels (as in immunization audits), WIC linkage, and standing orders have all been associated with achieving higher immunization coverage levels in the past and whenever possible are recommended to improve immunization coverage levels wherever immunizations are given.

Findings in this study now suggest some facilitators exert their influence through a link to changing provider behaviors as the mechanism whereby higher vaccine coverage levels are attained. Although distinctions are not uniform or clear, some facilitators could be conceptualized as manifestations of subjective norms (e.g., immunization audits, WIC linkage, or the Standards for pediatric immunization practices) and perceived behavioral control (immunization standing orders) in future research.

In prior studies, the availability of tracking systems has also been associated with higher coverage levels, but for reasons that are unclear, the current investigation did not demonstrate that providers who reported tracking systems were available were more likely to immunize according to recommendations. Is it possible higher immunization coverage levels in the prior studies were attained through some mechanism other than through an influence on provider behavior? More study is needed to understand these relationships or the way facilitators to immunization influence immunizing behavior, if in fact they do. Regardless, in the overall analysis serious consideration should be given to augmenting current immunization delivery services by adding more facilitators to immunization in practice settings where they are not currently present.

Professional competence in immunization practice. Findings that nurses with higher levels of current education had higher immunizing behavior scale scores (as did nurses who were certified) have been described. It has been noted that nurses with more education were also more successful in making correct vaccine choices. These and related findings have important implications for nursing practice and policy relating to competent professional practice as described in the following discussion.

Each NCIBQ mailing included a copy of the then current Recommended Childhood Immunization Schedule for 2000 (CDC, 2000b), allowing the respondent convenient access to information needed for identification of age-appropriate vaccines in each case scenario. Surprisingly, despite having immediate access to this information, most respondents misidentified age-appropriate vaccines in at least one of the four case scenarios. This finding is consistent with the report by Wood et al. (1996) showing provider deficiencies in knowledge of the recommended vaccine schedule are pervasive. This finding is also disappointing given the growing public unrest surrounding vaccine safety and effectiveness, since vaccine opponents could easily use such observations to challenge the ability or willingness of health care providers to follow their own recommendations. The study by Gellin, Maibach, and Marcuse (2000) revealed the majority of consumers continue to rely on information from health professionals in making vaccine decisions, and a perceived inability of some nurses to consistently identify age-appropriate vaccines could seriously undermine the credibility of nurses as reliable vaccine providers in the eyes of the public.

Is there a solution to the problem of failure to follow vaccine recommendations or inability to identify age-appropriate vaccines? Standard 17 of the Standards for pediatric immunization practices (CDC, 1993) specifies immunizations should be given only by properly qualified personnel. Taken together, several study findings offer evidence to question the trend in contemporary health care delivery where decisions about age-appropriate vaccines are increasingly being made by lesser-qualified personnel. Perhaps health care organizations should examine the criteria applied to determine the qualifications of providers who make decisions about what vaccines a child should receive. In particular, the finding that successively higher levels of education were significantly correlated with more desirable immunizing behavior and higher scores for correct identification of age-appropriate vaccines has policy implications and potential clinical importance.

Interpretation of the recommended vaccine schedule may seem a simple and mundane task. Thus, in some regions of the country, in small group practices, and in large managed care organizations, decisions about age-appropriate vaccines are increasingly being delegated to lesser-educated providers including unlicensed technicians and medical assistants. Perhaps this trend should be challenged, with development of additional requirements for providers to validate their knowledge of vaccine recommendations and their ability to identify age-appropriate vaccines in varying simulated clinical circumstances before they are allowed to assume responsibility for this important public health function.

Another facet of problems associated with inadequacies in nurses' knowledge of vaccine recommendations and ability to correctly interpret the recommended vaccine schedule stems from the importance of vaccine timing and the frequency that inappropriate vaccines were identified as age-appropriate vaccine choices. In contrast to errors of omission (i.e., failure to identify a needed vaccine), this represents a potentially serious error of commission, in which giving the vaccine is inappropriate and contrary to recommendations. A child receiving an inappropriate vaccine may be recorded as being up-to-date, an error with potentially serious clinical implications, since the vaccine may be ineffective in bestowing desired immunity due to immaturity of the immune system or inadequate timing between vaccines. Whereas an omitted vaccine may easily be detected at a subsequent visit, giving a vaccine before it is due may lead to complacency and a false sense of protection. For example, although a requisite number of doses may have been given and properly documented, vaccines given before they are due are more likely to be ineffective in bestowing desired immunity. Health care providers routinely reviewing vaccine histories can easily overlook such errors of commission. Such errors contribute to wasting of increasingly expensive vaccines, and discovery and disclosure at some later time poses challenges for providers who must explain to parents how the mistake occurred and why an additional dose of vaccine may be needed at a later visit.

The specific finding in which certified nurses had higher immunizing behavior scores also has implications for nursing practice related to demonstrating professional competence. Although certification may simply be a manifestation of higher levels of education (i.e., most certified nurses in this study were nurse practitioners prepared at the master's level), certification is a voluntary process recognized by society, holding meaning for the public as a measure of professional competence and expertise. If it can be demonstrated that nurses who are certified are more likely to follow current vaccine recommendations in immunizing children, perhaps consideration should be given to a development of a voluntary certification process to validate competence in immunization practice for nurses and other health care providers. In particular, perhaps the time has come to expand and promulgate professional standards necessary to develop a separate professional certification for immunization practice in nursing to supplement basic licensure for practice in this area.

<u>Private and public differences.</u> This investigation revealed a small but significant difference in the immunizing behavior of nurses when comparing those employed in private and public settings, with those in public settings more likely to follow current vaccine recommendations. In this study population, the reasons for this difference are unclear. Nonetheless, some strategies used successfully elsewhere could be considered to improve compliance with vaccine recommendations for both public and private sites in South Dakota and elsewhere.

In particular, the benefits of feedback about performance as measured by immunization coverage levels have been demonstrated repeatedly but is underutilized as a strategy to change provider behavior. With VFC sites and wherever aggregate information about vaccine coverage levels is available, providers including nurses should not only have access, but should be made aware of audit results and information. Such an initiative could be organized through the state health department or other responsible health authority already having responsibility for monitoring vaccine usage through the state universal purchase program and for coverage assessment of children enrolled in the VFC program.

Implications for Nursing Education

Study findings have several implications for nursing education. Although not every nurse is engaged in practice where childhood vaccines are routinely given, all licensed nurses need basic knowledge about the role of vaccines in preventing VPDs and the status of current vaccine recommendations. As health advocates in public and private life and sometimes as parents themselves, nurses are often asked for advice about aspects of child care in sickness and in health, including questions about the risks and benefits of routine childhood vaccines. Nurses should therefore understand and appreciate the role of immunizations in prevention and should be able to provide reliable information about childhood immunizations, whether or not they routinely give them as part of their practice.

From this perspective, study findings have implications for both basic and continuing nursing education. As described in the literature review, information about childhood immunizations in the nursing textbooks most commonly used for basic nursing education today has been found to be incomplete, outdated, or otherwise inaccurate. Those responsible for this part of the basic nursing education curriculum should be aware of these deficiencies and augment or substitute information in these texts with up-to-date information from reliable sources.

The need for educational interventions to improve the practice of licensed nurses who immunize children is also evident. For example, nurses who make vaccine decisions need better information or tools to simplify the seemingly simple task of interpreting the vaccine schedule about what vaccines to give. While nurses may be aware of standards and recommendations concerning false contraindications and simultaneous vaccine administration, they are not automatically accepting of these recommendations as described by Hughart et al. (1994) and Madlon-Kay and Harper (1994). Educational strategies are needed to underscore the risks to patients and the public generated by failure to comply with standards and recommendations and to move knowledge of these recommendations from knowledge and cognition to affective behavioral change.

Implications for Nursing Research

Prior to this study, research findings focused exclusively on the practice and behaviors of nurses who administer routine childhood immunizations have not been published in the scientific literature. Findings suggest pressing research needs exist with many opportunities for further investigation related to nursing roles along the continuum of vaccine development and service delivery. Nurses with expertise in basic sciences and pharmacology are needed to participate as investigators in organized studies for the development of new vaccines, including field trials and development of new combination vaccines to alleviate the need for single antigen injections. Research is also clearly needed to test and evaluate innovations in methods of vaccine delivery for hard to reach populations and communities with chronically low immunization coverage levels.

Another implication for further research is the opportunity to replicate this study in a larger population with a national sample, again comparing nurse providers across settings but including multiple provider types including physicians and medical assistants. As the instrument used in this study, the NCIBQ could easily be adapted for data collection in other provider groups. Such a study would be useful in supporting (or not supporting) study findings and in exploring differences in provider groups in relation to study variables, particularly differences in provider knowledge and compliance with vaccine recommendations and the effects of control factors in predicting provider behavior. Replication in a larger population would also assist in determining if the behavior of nurses is different in states without a universal vaccine purchase program or in locales where managed care has become the dominant mode of health care financing.

Study findings have implications for two additional interesting areas for possible research. While the study by French et al. (1994) demonstrated the effectiveness of blowing bubbles as an approach to managing discomfort associated with vaccine administration by injection among toddlers and young children, the many responses in this study in which nurses identified other interventions and strategies they use to deal with this discomfort provide baseline information for additional research in this area. It is unknown if these interventions are effective or ineffective, if parents prefer some interventions over others, or if some are effective for some patients and not for others.

Research could be designed to develop and evaluate a schema of age-appropriate interventions to deal with discomfort to make the experience of giving and getting vaccines by injection more acceptable to children as patients, parents, and the nurses responsible for giving the vaccines.

Another area for possible research would explore the quality of standing orders as an adjunct to the practice of nurses and other non-physician providers who make decisions about giving childhood immunizations. Although standing orders have been promoted as having important benefits, these benefits have not been systematically studied. A sample of immunization standing orders from a mix of different vaccine sites could be analyzed using criteria outlined by Szilagyi, Rodewald, Humiston, Hager et al. (1994) to compare differences pertaining to simultaneous vaccine administration and guidelines for valid and false contraindications. Standing orders could also be analyzed to evaluate their basic content, scope or degree of comprehensiveness, scope of decisional authority, and basic accuracy in an effort to identify strengths as well as areas for improvement to maximize their potential benefits in improving immunization services in locations where they are used.

Conclusion

This study represents the first attempt to examine the behaviors of nurses who immunize children and is also the first study using the TPB to explore factors affecting health care provider behavior when they immunize children. Results showed a moderate correlation between behavioral intention and behavior and revealed perceived behavioral control was positively correlated with both behavioral intention and behavior.

Additional findings showed behavior scale scores were higher for nurses employed at settings where five separate facilitators to immunization were present compared to scores for nurses at locations where these facilitators were absent. The age of the respondent and current level of education were both positively correlated with higher behavior scale scores. Holding professional certification, RN status, and employment in a public setting were all associated with higher behavior scale scores. Respondents were not consistently able to identify age-appropriate vaccines, and adherence to false contraindications for immunizing children with acute minor illness was a common occurrence. Finally, many respondents identified strategies or interventions they employ to relieve discomfort caused by giving vaccines by injection.

Within the health literature, studies testing the TPB have focused almost exclusively on the behaviors of patients. This study, focused exclusively on nurses, suggests the TPB may have relevance when they are engaged in giving childhood immunizations but also for examining a multitude of health care provider behaviors in other areas of clinical practice. This study is the first step in identifying factors to explain differences in the immunizing behaviors of nurses. Additional research to examine and further understand these behaviors will be useful in developing policy and educational strategies to improve provider behavior to immunize appropriately as one aspect ofachieving successful control of VPDs through continuing national and global i immunization efforts.

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Recommended Childhood Immunization Schedule
United States, January - December 2000

Vaccines[1] are listed under routinely recommended ages. Bars indicate range of recommended ages for immunization. Any dose not given at the recommended age should be given as a "catch-up" immunization at any subsequent visit when indicated and feasible. Ovals indicate vaccines to be given if previously recommended doses were missed or given earlier than the recommended minimum age.

Age ▶ Vaccine ▼	Birth	1 mo	2 mos	4 mos	6 mos	12 mos	15 mos	18 mos	24 mos	4-6 yrs	11-12 yrs	14-16 yrs
Hepatitis B[2]	Hep B											
			Hep B			Hep B					(Hep B)	
Diphtheria, Tetanus, Pertussis[3]			DTaP	DTaP	DTaP		DTaP[3]			DTaP	Td	
H. influenzae type b[4]			Hib	Hib	Hib	Hib						
Polio[5]			IPV	IPV		IPV[5]				IPV[5]		
Measles, Mumps, Rubella[6]						MMR				MMR[6]	(MMR[6])	
Varicella[7]							Var				(Var[7])	
Hepatitis A[8]									Hep A[8]-in selected areas			

Approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP).

On October 22, 1999, the Advisory Committee on Immunization Practices (ACIP) recommended that Rotashield® (RRV-TV), the only U.S.-licensed rotavirus vaccine, no longer be used in the United States (MMWR, Volume 48, Number 43, Nov. 5, 1999). Parents should be reassured that their children who received rotavirus vaccine before July are not at increased risk for intussusception now.

[1]This schedule indicates the recommended ages for routine administration of currently licensed childhood vaccines as of 11/1/99. Additional vaccines may be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and its other components are not contraindicated. Providers should consult the manufacturers' package inserts for detailed recommendations.

[2]Infants born to HBsAg-negative mothers should receive the 1st dose of hepatitis B (Hep B) vaccine by age 2 months. The 2nd dose should be at least one month after the 1st dose. The 3rd dose should be administered at least 4 months after the 1st dose and at least 2 months after the 2nd dose, but not before 6 months of age for infants.

Infants born to HBsAg-positive mothers should receive hepatitis B vaccine and 0.5 mL hepatitis B immune globulin (HBIG) within 12 hours of birth at separate sites. The 2nd dose is recommended at 1-2 months of age and the 3rd dose at 6 months of age.

Infants born to mothers whose HBsAg status is unknown should receive hepatitis B vaccine within 12 hours of birth. Maternal blood should be drawn at the time of delivery to determine the mother's HBsAg status; if the HBsAg test is positive, the infant should receive HBIG as soon as possible (no later than 1 week of age).

All children and adolescents (through 18 years of age) who have not been immunized against hepatitis B may begin the series during any visit. Special efforts should be made to immunize children who were born in or whose parents were born in areas of the world with moderate or high endemicity of hepatitis B virus infection.

[3]The 4th dose of DTaP (diphtheria and tetanus toxoids and acellular pertussis vaccine) may be administered as early as 12 months of age, provided 6 months have elapsed since the 3rd dose and the child is unlikely to return at age 15-18 months. Td (tetanus and diphtheria toxoids) is recommended at 11-12 years of age if at least 5 years have elapsed since the last dose of DTP, DTaP or DT. Subsequent routine Td boosters are recommended every 10 years.

[4]Three Haemophilus influenzae type b (Hib) conjugate vaccines are licensed for infant use. If PRP-OMP (PedvaxHIB® or ComVax® [Merck]) is administered at 2 and 4 months of age, a dose at 6 months is not required. Because clinical studies in infants have demonstrated that using some combination products may induce a lower immune response to the Hib vaccine component, DTaP/Hib combination products should not be used for primary immunization in infants at 2, 4 or 6 months of age, unless FDA-approved for these ages.

[5]To eliminate the risk of vaccine-associated paralytic polio (VAPP), an all-IPV schedule is now recommended for routine childhood polio vaccination in the United States. All children should receive four doses of IPV at 2 months, 4 months, 6-18 months, and 4-6 years. OPV (if available) may be used only for the following special *circumstances*:

1. Mass vaccination campaigns to control outbreaks of paralytic polio.
2. Unvaccinated children who will be traveling in <4 weeks to areas where polio is endemic or epidemic.
3. Children of parents who do not accept the recommended number of vaccine injections. These children may receive OPV only for the third or fourth dose or both; in this situation, health-care providers should administer OPV only after discussing the risk for VAPP with parents or caregivers.
4. During the transition to an all-IPV schedule, recommendations for the use of remaining OPV supplies in physicians' offices and clinics have been issued by the American Academy of Pediatrics (see Pediatrics, December 1999).

[6]The 2nd dose of measles, mumps, and rubella (MMR) vaccine is recommended routinely at 4-6 years of age but may be administered during any visit, provided at least 4 weeks have elapsed since receipt of the 1st dose and that both doses are administered beginning at or after 12 months of age. Those who have not previously received the second dose should complete the schedule by the 11-12 year old visit.

[7]Varicella (Var) vaccine is recommended at any visit on or after the first birthday for susceptible children, i.e. those who lack a reliable history of chickenpox (as judged by a health care provider) and who have not been immunized. Susceptible persons 13 years of age or older should receive 2 doses, given at least 4 weeks apart.

[8]Hepatitis A (Hep A) *is shaded to indicate its recommended use in selected states and/or regions; consult your local public health authority. (Also see MMWR Oct. 01,* 1999/48(RR12); 1-37).

Appendix B

October 25, 2000

Dear Colleague,

What do nurses think about when they immunize children? Everyday experiences tell us nurses are often the ones who actually give children vaccines, but no one really knows how or what they think about when they immunize children. As a doctoral candidate at the University of Wisconsin-Madison School of Nursing, I have chosen the behaviors of nurses who immunize children in South Dakota as the topic of my research. This is a research study to understand the behaviors of nurses who immunize children. Your willingness to participate will be invaluable in completing this research. Your participation in this study is completely voluntary, and you may withdraw at any time without negatively affecting your medical care.

Your name was obtained through the South Dakota Department of Health as the contact at your site from the list of vaccine provider sites in South Dakota. If you decide to participate in this study, there are several steps in this process. First, in the next few weeks I will contact you by telephone to ask one question: **What is the total number of nurses who immunize children currently working at your site?** This will include RNs, LPNs, and nurses in advanced practice roles whether they are employed full-time or part-time. No other information will be requested when you receive this call. If you do not have this information, you may refer me to someone else. After the list with the total number of nurses from all sites is compiled, a random sample will be drawn. Then, and only then, I may contact you and ask to identify specific individuals from your site using an alphabetized or ordered list. Once identified, these individuals will be mailed a confidential questionnaire named the "Nurses' Childhood Immunization Belief Questionnaire" with separate instructions accompanying the mailing. It is entirely possible no individuals from your site will be chosen for the study sample. If so, your participation will not extend beyond the initial phone call.

This is a research study to understand the behaviors of nurses who immunize children. Your participation in this study is completely voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. Your consent to participate is assumed if you respond to my question about the number of nurses who immunize children currently working at your site, and there is no separate consent form. Your period of involvement in the study is expected to require less than five minutes and is limited to the length of time it will take you to answer this question. Other than the time required for the inconvenience this may impose on you, there are no foreseeable potential risks to you if you decide to participate. There are no foreseeable direct benefits for you in participating, but results may benefit society by improving understanding of the behaviors of nurses who immunize children. You may choose not to participate in the study and are under no obligation to answer my question about the number of nurses immunizing children at your site if you decide not to participate.

No one other than you and I will ever know if you participated in this study. You are also assured your response is completely confidential. Your name will never be revealed to anyone, and results in the final report can never be tracked back to any particular individual.

This study is part of my dissertation research in partial fulfillment of degree requirements for a doctoral degree in nursing. However, results may be made available to nurses, administrators, federal, state, and local public health officials who may be interested in this topic. When I place my phone call to you, you may also request a summary of the results, and a copy will be sent to you at completion of the study.

I am happy to answer any questions you have about the study or the request for information I will call you about. You may write to me at the address above, or contact me by phone at 608-[redacted] or e-mail at [redacted]. If you have already decided you wish to participate, you can respond to my question about the number of nurses immunizing children at your site by e-mail at the address above.

The research protocol for this study has been reviewed by the University of Wisconsin-Madison Health Sciences Human Subjects Committee. If you have questions about your rights as a research subject, you may contact the UW-Madison Patient Relations Representative at 608-[redacted]. If you have questions or concerns about your rights as a participant in the study, you may also contact the Human Subjects Committee directly by phone at 608-[redacted], through their website at http://www.medicine.wisc.edu/hsc/, or by e-mail directly to the committee chair at [redacted]

Thank you for considering my request to participate in this study.

Sincerely,

Thomas E. Stenvig
Doctoral Candidate

Appendix C

November 15, 2000

Dear Colleague in Nursing,

What do nurses think about when they immunize children? Everyday experiences tell us nurses are often the ones who actually give children vaccines, but no one really knows what they think about when they immunize children. As a doctoral candidate at the University of Wisconsin-Madison School of Nursing, I have chosen the behaviors of nurses who immunize children in South Dakota as the topic of my research. I have developed a questionnaire named the "Nurses' Childhood Immunization Belief Questionnaire" to study these behaviors. This is a research study to understand the behaviors of nurses who immunize children. Your willingness to participate will be invaluable in completing this research. Your participation in this study is completely voluntary, and you may withdraw at any time without negatively affecting your medical care.

If you decide to participate in this study, there are three steps in this process. **First,** answer the questions in the questionnaire itself, being sure to answer every item. **Second,** please comment on questions you were unable to answer in the questionnaire format as well as the format or contents of the questionnaire. Were the instructions clear? Were any items confusing, redundant, or objectionable? Make written comments on a separate piece of paper or directly on the document using the margins or the last blank page intended for comments. **Third,** return the completed questionnaire to me in the enclosed pre-addressed postage-paid envelope.

This is a research study to understand the behaviors of nurses who immunize children using the "Nurses' Childhood Immunization Belief Questionnaire." Your participation in this study is completely voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. Your consent to participate is assumed if you complete and return the questionnaire, and there is no separate consent form. Your period of involvement in the study is expected to require less about 40 minutes and is limited to the length of time it will take you to complete and return the questionnaire. Other than the time required for completion and the inconvenience this may impose on you, there are no foreseeable potential risks to you if you decide to participate. There are no foreseeable direct benefits for you in completing the study, but results may benefit society by improving understanding of the behaviors of nurses who immunize children. You may choose not to participate in the study and are under no obligation to return the questionnaire or any of the accompanying materials even if you decide not to participate.

No one other than you and I will ever know if you participated in this study. You are also assured your responses are completely confidential. Each questionnaire has a unique identification number so I will know if yours has been returned. Your name will never be placed on the questionnaire, and results in the final report can never be tracked back to any particular individual. Only the questionnaire should be returned to me in the enclosed postage-paid envelope.

This study is part of my dissertation research and will be used in partial fulfillment of degree requirements for a doctoral degree in nursing. However, results may be made available to nurses, administrators, federal, state, and local public health officials who may be interested in this topic. You may also request a summary of the results by writing "copy of results requested" on the back of the return envelope and printing your name and preferred mailing address below it. Do not put this information on the questionnaire itself.

A new golden Sacajawea dollar is enclosed as a small token of appreciation for your decision to participate in this study and is yours to keep even if you decide not to complete the questionnaire. I am most happy to answer any questions you might have about the study. You may write to me at the address above, or contact me by phone at 608-[redacted] or e-mail at [redacted]

The research protocol for this study has been reviewed by the University of Wisconsin-Madison Health Sciences Human Subjects Committee. If you have questions about your rights as a research subject, you may contact the UW-Madison Patient Relations Representative at 608-[redacted]. If you have questions or concerns about your rights as a participant in the study, you may also contact the Human Subjects Committee directly by phone at 608-[redacted], through their website at http://www.medicine.wisc.edu/hsc/, or by e-mail directly to the committee chair at [redacted]

Thank you for considering my request to participate in this study.

Sincerely,

Thomas E. Stenvig, R.N.
Doctoral Candidate

Appendix D

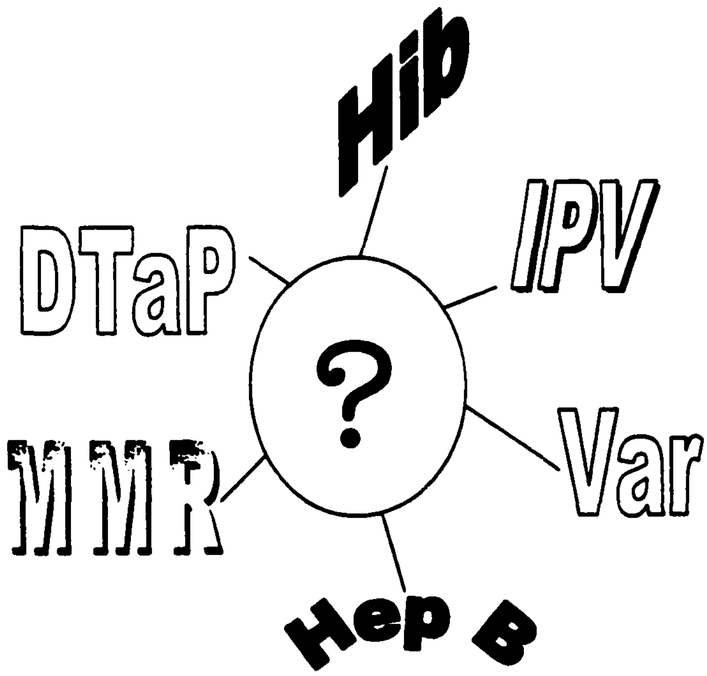
Questionnaire # ________________

WHAT DO NURSES THINK ABOUT IMMUNIZING CHILDREN?

The following questions are being asked to understand what nurses do when they immunize children. Please answer all the questions. There are no right or wrong answers, only your answers. You may also comment on any question or qualify your answers by writing in the margins or on the last page. Your written comments will be read and taken into account.

Completion of this questionnaire is estimated to require about 40 minutes of your time. Please do not put your name on the questionnaire. If you would like a summary of the results, write "copy of results requested" on the back of the return envelope, and print your name and preferred mailing address below it. Do not put this information on the questionnaire itself.

Thank you for your help.



School of Nursing
University of Wisconsin
Madison, WI 53792-2455

NURSES' CHILDHOOD IMMUNIZATION BELIEF QUESTIONNAIRE
Thomas E. Stenvig, Principal Investigator

Instructions

I am interested in learning about what nurses do when they give immunizations to children and their thoughts, beliefs, and attitudes when actually administering vaccines. There are no right or wrong answers to the questions that follow. It is more important to know what you think. Some questions may seem very similar, but please try to answer them all.

For many of the questions, a rating scale with 7 possible answers is used. Please place an X in the place that best fits your answer. You may use an ordinary pen or pencil to record your response. For example, if you were asked to rate the weather where you live on this type of scale, the 7 possible answers should be thought of as:

The weather where I live is
good ____ : ____ : ____ : ____ : ____ : ____ : ____ bad
extremely quite slightly neither slightly quite extremely

If you think the weather where you live is quite good, you would place your mark like this:

The weather where I live is
good ____ : __X__ : ____ : ____ : ____ : ____ : ____ bad
extremely quite slightly neither slightly quite extremely

Other questions will ask whether you agree or disagree or to evaluate certain statements using a similar rating scale. These questions should be answered in the same way as the question above. Place your "X" mark in the middle and not on the boundaries of the answer you select. Do not give more than one response for any question unless you are asked to do so. Please try to answer all the items.

Note – Definition of Terms: "Immunizations for children" means giving the recommended basic vaccine series to children up to six years of age. These are sometimes called preschool immunizations, but are simply referred to as childhood immunizations in all the questions that follow.

The terms immunization and vaccination are used interchangeably to refer to the administration of a biological agent with the intent of bestowing immunity.

Part 1. The first few items are general questions about your experiences in immunizing children.

1. In general, my attitude toward immunizing children is
favorable ____ : ____ : ____ : ____ : ____ : ____ : ____ unfavorable
extremely somewhat slightly neither slightly somewhat extremely

2. In general, my experience of immunizing children is
unrewarding ____ : ____ : ____ : ____ : ____ : ____ : ____ rewarding
extremely somewhat slightly neither slightly somewhat extremely

3. In general, I consider my immunizing children
important ____ : ____ : ____ : ____ : ____ : ____ : ____ unimportant
extremely somewhat slightly neither slightly somewhat extremely

4. In general, I consider my immunizing children
unsafe ____ : ____ : ____ : ____ : ____ : ____ : ____ safe
extremely somewhat slightly neither slightly somewhat extremely

The next questions are about things health care providers have reported can happen when children are immunized. These consequences do not necessarily occur. For each item listed, do not indicate if you believe it will happen. Instead, indicate how good or bad it would make you feel if it does happen.

5. If I prevent diseases by giving children vaccines
bad ____ : ____ : ____ : ____ : ____ : ____ : ____ good
extremely somewhat slightly neither slightly somewhat extremely

6. If I cause minor side effects by giving a vaccine
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

7. If I cause major side effects by giving a vaccine
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

8. If I cause parental stress by giving a child multiple shots on the same visit
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

9. If I worsen a child's acute minor illness by giving immunizations
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

10. If I cause discomfort by giving a vaccine by injection
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

11. If I cause discomfort by giving four vaccines by injection on the same visit
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

12. If I am required to immunize children against hepatitis B
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

13. If I am required to immunize children against chicken pox
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

14. If I am at legal risk of being sued after immunizing a child
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

15. If patients are required to pay for office visits to receive "free" vaccines
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

16. If I do a better job of giving immunizations by learning new things about giving them
bad _____ : _____ : _____ : _____ : _____ : _____ : _____ good
extremely somewhat slightly neither slightly somewhat extremely

The next questions are also about some consequences other health care providers have reported when children are immunized. Indicate the **extent you agree or disagree** with each statement.

17. Giving children vaccines will prevent them from getting diseases
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

18. Giving children vaccines will cause minor side effects
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

19. Giving children vaccines will cause major side effects
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

20. Giving a child multiple shots on the same visit causes stress for the parent(s)
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

21. Giving immunizations may worsen a child's acute minor illness
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

22. Giving a vaccine by injection causes discomfort for the child
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

23. Giving four vaccines by injection on the same visit causes discomfort for the child
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

24. Getting children immunized against hepatitis B should be required
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

25. Getting children immunized against chicken pox should be required
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

26. Immunizing a child puts me at risk of being sued
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

27. Patients should be required to pay an office fee when getting "free" vaccines
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

28. Learning new things about immunizations helps me do a better job of giving them
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

---

Part 2. The next few questions describe two patient situations a nurse might encounter when seeing children who are due for immunizations. For each situation, indicate the response that most closely matches what you would intend or plan to do. There are no right or wrong answers, only your answers. Refer to the enclosed childhood immunization schedule as needed.

Case 1. Five month old Annie was born in another state and is brought in by her mother for a first visit at your facility. The mother has had personal difficulties and has moved several times in the last few months. She reports Annie has not been seen by a health care provider since birth and has not received any immunizations elsewhere "except for one they gave her right after she was born." Annie qualifies for the Vaccines for Children Program. She is happy, well nourished, and appears healthy in every way.

1. Briefly describe what you would intend or plan to do next in this situation.

____

____

2. Assuming no other combination vaccines are available, which of the following immunizations does Annie need today? Circle your answers.

A. DTaP	C. Hib	E. MMR	G. Polio
B. Hep A	D. Hep B	F. Varicella	

Here are a few plans or intentions other nurses have said they might consider in Annie's case. Indicate the probability you would intend or plan to perform each behavior listed.

3. Immunize Annie now with all vaccines appropriate for her age and immunization status
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

5

4. Let someone else decide if Annie should be immunized
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

5. Reschedule Annie to get all immunizations she needs at a later time
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

6. Reschedule Annie to get some immunizations she needs at a later time
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

7. Refer Annie to get immunizations elsewhere
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

Case 2. Bobby is 20 months old, covered under Medicaid, and this is his first visit at your facility. He has an upper respiratory infection, a temperature of 100.6 F (R), a history of chronic otitis media, and serous fluid remains behind the left eardrum. Bobby's mother has his immunization record showing he has received the following immunizations: 3 DTaP, 3 Hib, 2 OPV, 1 IPV, 2 HepB, and 1 varicella. Sufficient time has lapsed since his last immunizations to give all vaccines for which he is otherwise due.

1. Briefly describe what you would intend to do next in this situation.

____

____

2. Assuming no other combination vaccines are available, which of the following immunizations does Bobby need today? Circle your answers.

A. DTaP	C. Hib	E. MMR	G. Polio
B. Hep A	D. Hep B	F. Varicella	

Here are a few plans or intentions other nurses have said they might consider in Bobby's case. Indicate the probability you would intend or plan to perform each behavior listed.

3. Immunize Bobby now with all vaccines appropriate for his age and immunization status
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

4. Let someone else decide if Bobby should be immunized
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

5. Reschedule Bobby to get all immunizations he needs at a later time
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

6. Reschedule Bobby to get some immunizations he needs at a later time
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

7. Refer Bobby to get immunizations elsewhere
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

Part 3. The next questions concern your assessment of expectations of others you work with when immunizing children.

1. Others I work with think immunizing children is an important part of my job.
agree ____ : ____ : ____ : ____ : ____ : ____ : ____ disagree
strongly somewhat slightly neither slightly somewhat strongly

2. Most people I work with think getting children immunized is important.
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

3. People I work with expect a lot of me when I immunize children.
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

4. People I work with are displeased if I miss an opportunity to immunize a child on schedule.
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

5. I'm the kind of nurse who needs to be told if I'm doing a good job of immunizing children.
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

Listed below are individuals, groups, agencies, organizations, or things other nurses have indicated may influence their decisions about immunizing children. Some may influence you as well. Indicate the extent to which you consider yourself **familiar with the positions or recommendations** of the following when you are immunizing children.

6. Physicians I work with
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

7. Other nurses I work with
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

8. State Health Department
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

9. Standards for Pediatric Immunization Practices
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

10. Current Recommended Vaccine Schedule
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

11. Administrators in my agency or workplace
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

12. Insurance paying for a child's immunizations
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

13. Parents of children I immunize
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

14. Federal Vaccines for Children program
familiar _____ : _____ : _____ : _____ : _____ : _____ : _____ unfamiliar
extremely quite slightly neither slightly quite extremely

Now, indicate the extent to which you feel **motivated to comply** with the positions or recommendations of these potential influences when you are involved with immunizing children.

15. Physicians I work with
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

16. Other nurses I work with
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

17. State Health Department
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

18. Standards for Pediatric Immunization Practices
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

19. Current Recommended Vaccine Schedule
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

20. Administrators in my agency or workplace
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

21. Insurance paying for a child's immunizations
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

22. Parents of children I immunize
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

23. Federal Vaccines for Children program
motivated _____ : _____ : _____ : _____ : _____ : _____ : _____ unmotivated
extremely quite slightly neither slightly quite extremely

Part 4. The next set of questions is about how much control you feel you have over your own decisions when you are involved in immunizing children. Mark how much you **agree or disagree** with each of the following statements.

1. When a child is due for a vaccine, I am the one who decides if I will give it
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

2. I have the resources I need to immunize children when I think I should
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

3. Time is adequate to immunize children when I think I should
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

4. Something usually prevents me from immunizing children when I think I should
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

5. I have no control in deciding if a child will be immunized or not
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

The following questions are about some typical activities that are performed when children are immunized. For each question, indicate your beliefs about the extent to which you **agree or disagree** you have **control** over the activity described.

6. Determining if a child is due for particular immunizations
agree _____ : _____ : _____ : _____ : _____ : _____ : _____ disagree
strongly somewhat slightly neither slightly somewhat strongly

7. Deciding if it is safe or unsafe to immunize a child
agree ____ : ____ : ____ : ____ : ____ : ____ : ____ disagree
strongly somewhat slightly neither slightly somewhat strongly

8. Assessing the need to educate a parent about immunizations
agree ____ : ____ : ____ : ____ : ____ : ____ : ____ disagree
strongly somewhat slightly neither slightly somewhat strongly

9. Overcoming objections of a parent who is worried about having their child immunized
agree ____ : ____ : ____ : ____ : ____ : ____ : ____ disagree
strongly somewhat slightly neither slightly somewhat strongly

The following questions also concern typical activities that are performed when children are immunized. For each question, indicate how easy or difficult it would be for you to perform the activity **if you had control over the situation**.

10. Determining if a child is due for an immunization
easy ____ : ____ : ____ : ____ : ____ : ____ : ____ difficult
extremely quite fairly neither fairly quite extremely

11. Deciding if it is safe to immunize a child
easy ____ : ____ : ____ : ____ : ____ : ____ : ____ difficult
extremely quite fairly neither fairly quite extremely

12. Assessing the need to educate a parent about immunizations
easy ____ : ____ : ____ : ____ : ____ : ____ : ____ difficult
extremely quite fairly neither fairly quite extremely

13. Overcoming objections of a parent who is worried about having their child immunized
easy ____ : ____ : ____ : ____ : ____ : ____ : ____ difficult
extremely quite fairly neither fairly quite extremely

Part 5. The next few questions describe two patient situations a nurse might encounter when children are due for immunizations. For each situation, indicate the response that most closely matches what you **actually would do**. There are no right or wrong answers, only your answers. Refer to the enclosed childhood immunization schedule as needed.

<u>Case 1.</u> Jane is 15 months old and is seen regularly at your facility for well child care. Both parents work and the family has excellent health insurance. Today she is healthy, smiling, and this is a routine well child visit. Her record shows she has received the following immunizations: 3 DTaP, 4 Hib, 2 IPV, 1 OPV, and 2 Hep B. Sufficient time has lapsed since her last immunizations to give all vaccines for which she is otherwise due.

1. Briefly describe what you would actually do next in this situation.

____

____

2. Assuming no other combination vaccines are available, which of the following immunizations does Jane need today? Circle your answers.

A. DTaP
B. Hep A
C. Hib
D. Hep B
E. MMR
F. Varicella
G. Polio

Here are a few actions other nurses have said they might consider in Jane's case. Indicate the probability you would actually perform each behavior listed.

3. Immunize Jane now with all vaccines appropriate for her age and immunization status
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

4. Let someone else decide if Jane should be immunized
probable ____ : ____ : ____ : ____ : ____ : ____ : ____ improbable
extremely quite slightly neither slightly quite extremely

5. Reschedule Jane to get <u>all</u> immunizations she needs at a later time
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

6. Reschedule Jane to get <u>some</u> immunizations she needs at a later time
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

7. Refer Jane to get immunizations elsewhere
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

<u>Case 2.</u> *Joey was born 1 month prematurely and is now 12 months old. An American Indian, he receives most of his health care at your facility but has missed many appointments in the past. He is now at the 30th percentile for height and weight given his chronological age. He is getting over an ear infection and is still taking an antibiotic, and today his temperature is 99.8 F (R). His mother reports he has had mild diarrhea since yesterday and you concur with this assessment. Joey's record shows he has received the following immunizations: 3 DTaP, 3 Hib, 3 Hep B, and 2 IPV. He received the last DTaP 3 months ago. Sufficient time has lapsed since his last immunizations to give all other vaccines for which he is otherwise due.*

1. Briefly describe what you would actually do next in this situation.

____

____

2. Assuming no other combination vaccines are available, which of the following immunizations does Joey need today? Circle your answers.

A. DTaP	C. Hib	E. MMR	G. Polio
B. Hep A	D. Hep B	F. Varicella	

Here are a few actions other nurses have said they might consider in Joey's case. Indicate the probability you would actually perform each behavior listed.

3. Immunize Joey now with all vaccines appropriate for his age and immunization status
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

4. Let someone else decide if Joey should be immunized
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

5. Reschedule Joey to get <u>all</u> immunizations he needs at a later time
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

6. Reschedule Joey to get <u>some</u> immunizations he needs at a later time
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

7. Refer Joey to get immunizations elsewhere
probable _____ : _____ : _____ : _____ : _____ : _____ : _____ improbable
extremely quite slightly neither slightly quite extremely

Part 6. The next few questions are about activities nurses report doing related to immunizing children. For each item, indicate the extent to which you currently participate in the activity listed.

1. Assessing a child's immunization status
[_____ : _____ : _____ : _____ : _____]
not at all / infrequently / fairly often / very often / all the time

2. Deciding the immunizations a child should receive
[_____ : _____ : _____ : _____ : _____]
not at all / infrequently / fairly often / very often / all the time

3. Giving vaccinations to children
[_____ : _____ : _____ : _____ : _____]
not at all / infrequently / fairly often / very often / all the time

4. Making a nursing diagnosis for a child's immunization status
[_____ : _____ : _____ : _____ : _____]
not at all / infrequently / fairly often / very often / all the time

Some nurses report they take specific measures to reduce immediate discomfort when they are giving children vaccines by injection. **List up to three measures you use before and after giving vaccine injections** to reduce discomfort. Do not list things other people do or things you think you could do. List only things you actually do yourself.

Things I do to reduce discomfort **before** immunizing a child:
1. ____________________
2. ____________________
3. ____________________

Things I do to reduce discomfort **after** immunizing a child:
1. ____________________
2. ____________________
3. ____________________

Part 7. The next few questions concern you and your work setting.

1. Which of the following categories best describes your work setting when you are immunizing children?

[____]Private physician - solo practice (specify type)
  [____]Pediatrics
  [____]General or family practice
[____]Private physician - group practice

Public/ Community health clinic or agency (specify type)
  [____]State
  [____]County
  [____]City or municipal
  [____]Indian Health Service
  [____]Tribal
  [____]Rural Health Clinic

[____]Other (describe)

2. Estimate the percentage (%) of children receiving immunization services at your work site who receive services through each of the following:

Vaccines for Children Program	_____%
Managed care/ HMO insurance	_____%
Other Private insurance	_____%
Out-of pocket payment	_____%

3. Indicate the category including the total number of RNs and LPNs at your agency or work site who are involved in providing preschool immunization services:
[____]Less than 10
[____]10-19
[____]20 or more

4. Indicate which of the following are used at your agency or work site where immunization services are delivered. Check all that apply:
[____]Specific immunization goals
[____]Audits of immunization levels
[____]Recommended Childhood Immunization Schedule poster or wall chart
[____] Childhood immunization Standing Orders
[____]Childhood immunization patient reminder system
[____]Childhood immunization tracking system
(if yes, specify the name or type :
(________________________________)
[____] Immunization charting reminders
[____]Co-scheduling of childhood immunization and WIC services
[____]American Academy of Pediatrics "Red Book"
[____]Standards for Pediatric Immunization Practices
[____]Written childhood immunization policies
[____]Childhood immunization patient education materials
[____]Participation in a local or regional community immunization partnership

5. In an average week, how many hours do you work in your job where you immunize children? ________ HOURS

Part 8. The following questions are about you.

1. YEAR OF YOUR BIRTH: 19_____	2. GENDER (circle one): 1 Female 2 Male

3. Give the number of children in your immediate family in each age group. Include natural or adopted children, those for whom you have legal guardianship, and grown children no longer living with you.

Number of children
[______] 6 YEARS OF AGE AND UNDER
[______] 7 TO 16 YEARS
[______] 17 YEARS AND OLDER

4. Indicate your current educational preparation from among the following categories.

1. PRACTICAL NURSE
2. ASSOCIATE DEGREE IN NURSING
3. DIPLOMA IN NURSING
4. BACCALAUREATE DEGREE IN NURSING
5. POST-BACCALAUREATE CERTIFICATE
6. MASTER'S DEGREE IN NURSING
7. MASTER'S DEGREE IN ANOTHER FIELD (SPECIFY TYPE______________)
8. DOCTORATE IN NURSING
9. DOCTORATE IN ANOTHER FIELD (SPECIFY TYPE______________)

5. Indicate your current job position from among the following categories. Circle the one number most closely matching your current position.

1. LICENSED PRACTICAL NURSE
2. CLINICAL/STAFF REGISTERED NURSE
3. COMMUNITY/PUBLIC HEALTH NURSE
4. NURSE PRACTITIONER (SPECIFY TYPE______________)
5. CLINICAL NURSE SPECIALIST
6. CERTIFIED NURSE MIDWIFE
7. OTHER (SPECIFY TYPE______________)

6. Is your current position considered staff or supervisory/managerial level? Circle one answer.

1 STAFF
2 SUPERVISORY/MANAGERIAL

7. Are you currently certified in any nursing specialty area by a national certification program for nursing? Circle one answer.

1 YES (Type or area of specialization: ______________________________)
(Certifying agency: ______________________________)
2 NO

8. Would you be interested in obtaining a specialty certification in the area of childhood immunizations if one were offered? Circle one answer.

1 YES
2 NO

9. Indicate the year you began practicing as a nurse: 19____

Please continue on the next page ....

Thank you for participating in this study. Is there anything else you would like to share? In the space below, feel free to make additional comments you may have about the topic of this study or the format or contents of the questionnaire. Are the instructions clear? Are any items confusing, redundant, or objectionable? Most importantly, are there questions that did not allow you to give a complete answer as they were presented? You may make written comments on a separate piece of paper, directly on the document using the margins, or on this page which is intended for comments.

Please estimate the length of time it took you to complete this questionnaire: ____________ minutes.

If you would like a summary of the study results, print your name and preferred mailing address on the back of the return envelope, but not on this questionnaire.

Appendix E

(Date)

Dear

Last week a packet containing a questionnaire asking your views about immunizing children was mailed to you. Your name was drawn in a random sample of all the nurses who immunize children in South Dakota.

If you have already completed and returned your questionnaire, please accept my sincere thanks. If not, please do so today. Because this questionnaire was sent to only a small but representative sample of nurses in South Dakota, it is extremely important that yours be included in the study if the results are to accurately represent the views of nurses in South Dakota.

If by some chance you did not receive the questionnaire, or if it has been misplaced, please call me at [redacted] or contact me by e-mail at [redacted] and I will get another in the mail to you right away.

Sincerely,

Thomas E. Stenvig, R.N.
Doctoral Candidate

December 21, 2000

Dear

About three weeks ago I wrote to you and sent you a questionnaire seeking your opinions about immunizing children. As of today I have not received your completed questionnaire.

I have undertaken this study because I believe nurses play an important role in the immunization of children. Better understanding of nurses' beliefs and attitudes toward giving children immunizations can help us in planning and developing strategies to assist in immunization efforts in the future.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. Your name was drawn randomly from among all the nurses in South Dakota who immunize children. This means that only a fraction of all these nurses received the questionnaire. In order for the results to truly represent the opinions of all nurses, it is important that each nurse in the sample fill out and return their questionnaire.

If you have already returned your questionnaire, perhaps I will receive it in a few days. In the event that your questionnaire has been misplaced, a replacement and a return envelope are enclosed. If you have other questions or comments about the questionnaire or if you want to know if your questionnaire has been received, please call me at [redacted] or contact me by e-mail at [redacted]

Your cooperation is greatly appreciated.

Sincerely,

Thomas E. Stenvig, RN
Doctoral Candidate

January 9, 2001

Dear

I am writing to you about my study of nurses in South Dakota who immune children. As of today I have not yet received your completed questionnaire.

The large number of questionnaires returned is very encouraging. However, whether I will be able to describe accurately how nurses feel on this important issue depends on you and others who have not responded. This is because past experience suggests that those who do not respond may have very different views than those who do.

This is the first statewide study of this type about nurses and immunizations to be done in South Dakota, and perhaps in the entire nation. Therefore, the results are of particular importance to the public, planners, and to health care providers who will benefit from this information. The usefulness of this study depends on how accurately I am able to describe what nurses in South Dakota actually think. *That is why your response is so important.*

It is for these reasons that I am sending this letter by certified mail to ensure delivery. In case my earlier correspondence did not reach you or has been misplaced, a replacement questionnaire and a return envelope are enclosed. I urge you to complete and return it as quickly as possible. If you have already returned your questionnaire, perhaps I will receive it in a few days. You do not need to complete a second questionnaire.

I am happy to send you a copy of the results of my study if you want one. Simply put your name, address, and "copy of results requested" on the back of the return envelope. I expect to have them ready to send in the next few weeks. If you have other questions or comments about the study or the questionnaire, or if you want to know if your questionnaire has been received, please call me at [redacted] or contact me by e-mail at [redacted]

Your contribution to the success of this study is greatly appreciated. Thank you so much for your cooperation.

Sincerely,

Thomas E. Stenvig, RN
Doctoral Candidate

Appendix F

```
FREQUENCIES
  VARIABLES=p1q1r p1q2 p1q3r p1q4 p1q5 p1q6 p1q7 p1q8 p1q9 p1q10 p1q11
p1q12 p1q13 p1q14 p1q15 p1q16 p1q17r p1q18r p1q19r p1q20r p1q21r p1q22r
p1q23r p1q24r p1q25r p1q26r p1q27r p1q28r p2c1q3r p2c1q4 p2c1q5 p2c1q6
p2c1q7 p2c2q3r p2c2q4 p2c2q5 p2c2q6 p2c2q7 p3q1r p3q2r p3q3r p3q4r p3q5
p3q6r p3q7r p3q8r p3q9r p3q10r p3q11r p3q12r p3q13r p3q14r p3q15r
p3q16r p3q17r p3q18r p3q19r p3q20r p3q21r p3q22r p3q23r p4q1r p4q2r
p4q3r p4q4 p4q5 p4q6r p4q7r p4q8r p4q9r p4q10r p4q11r p4q12r p4q13r
p5c1q3r p5c1q4 p5c1q5 p5c1q6 p5c1q7 p5c2q3r p5c2q4 p5c2q5 p5c2q6 p5c2q7
  /ORDER  ANALYSIS .
```

Note: For the Frequency Tables which follow, variable values for all variables listed above with the suffix "r" have been recoded, but value labels are in reverse order.

Frequencies

Statistics

		att-fav	att-rew	att-imp	att-safe	OE-good/bad	OE-mnSE	OE-mjSE
N	Valid	261	260	261	261	261	261	261
	Missing	0	1	0	0	0	0	0

Statistics

		OE-parstress	OE-AMI	OE-1shot	OE-4shots	OE-hepB	OE-var	OE-legal
N	Valid	261	261	261	261	261	261	261
	Missing	0	0	0	0	0	0	0

Statistics

		OE-pay	OE-CE	BB-good/bad	BB-mnSE	BB-mjSE	BB-parstress	BB-AMI
N	Valid	261	261	261	261	261	261	261
	Missing	0	0	0	0	0	0	0

Statistics

		BB-1shot	BB-4shots	BB-hepB	BB-var	BB-legal	BB-pay	BB-CE
N	Valid	260	261	261	261	261	260	261
	Missing	1	0	0	0	0	1	0

Statistics

		int-do now	int-someb odyelse	int-resche d all	int-resche d some	int-refer	int-do now	int-someb odyelse
N	Valid	260	259	261	259	261	260	260
	Missing	1	2	0	2	0	1	1

Statistics

		int-resch all	int-resch some	int-refer	SJ- my job	SJ-cowork ers	SJ-xpectat ot	SJ-displea sed
N	Valid	260	260	261	261	261	260	260
	Missing	1	1	0	0	0	1	1

Statistics

		SJ-need telling	nb-MDs	nb-nurses	nb-SHD	nb-SPIP	nb-vacc sched	nb-admins
N	Valid	261	261	259	261	260	261	260
	Missing	0	0	2	0	1	0	1

Statistics

		nb-ins	nb-parents	nb-VFC	mc-MDs	mc-nurses	mc-SHD	mc-SPIP
N	Valid	260	261	260	260	260	261	261
	Missing	1	0	1	1	1	0	0

Statistics

		mc-vacc sched	mc-admin s	mc-ins	mc-parent s	mc-VFC	PBC-I decide	PBC-reso urces
N	Valid	261	261	260	261	261	261	261
	Missing	0	0	1	0	0	0	0

Statistics

		PBC-time	PBC-som ething prevents	PBC-no control	cb-decide if due	cb-decide if safe	cb-ed parents	cb-objectio ns
N	Valid	260	261	261	261	261	261	261
	Missing	1	0	0	0	0	0	0

Statistics

		pc-decide if due	pc-decide if safe	pc-ed parents	pc-objections	B-do now	B-someone else	B-resched all
N	Valid	261	261	261	261	261	261	261
	Missing	0	0	0	0	0	0	0

Statistics

		B-resched some	B-refer	B-do all	B-someone else	B-resched all	B-resched some	B-refer
N	Valid	261	261	261	261	260	260	261
	Missing	0	0	0	0	1	1	0

Frequency Table

att-fav

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	somewhat favorable	5	1.9	1.9	1.9
	slightly favorable	4	1.5	1.5	3.4
	neither	5	1.9	1.9	5.4
	slightly unfavorable	4	1.5	1.5	6.9
	somewhat unfavorable	34	13.0	13.0	19.9
	extremely unfavorable	209	80.1	80.1	100.0
	Total	261	100.0	100.0	

att-rew

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely unrewarding	7	2.7	2.7	2.7
	somewhat unrewarding	17	6.5	6.5	9.2
	slightly unrewarding	10	3.8	3.8	13.1
	neither	19	7.3	7.3	20.4
	slightly rewarding	24	9.2	9.2	29.6
	somewhat rewarding	112	42.9	43.1	72.7
	extremely rewarding	71	27.2	27.3	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

att-imp

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely important	2	.8	.8	.8
	neither	1	.4	.4	1.1
	slightly unimportant	1	.4	.4	1.5
	somewhat unimportant	13	5.0	5.0	6.5
	extremely unimportant	244	93.5	93.5	100.0
	Total	261	100.0	100.0	

att-safe

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	somewhat unsafe	3	1.1	1.1	1.1
	slightly unsafe	13	5.0	5.0	6.1
	neither	3	1.1	1.1	7.3
	slightly safe	4	1.5	1.5	8.8
	somewhat safe	89	34.1	34.1	42.9
	extremely safe	149	57.1	57.1	100.0
	Total	261	100.0	100.0	

OE-good/bad

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	2	.8	.8	.8
	neither	1	.4	.4	1.1
	slightly good	1	.4	.4	1.5
	somewhat good	11	4.2	4.2	5.7
	extremely good	246	94.3	94.3	100.0
	Total	261	100.0	100.0	

OE-mnSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	5	1.9	1.9	1.9
	somewhat bad	59	22.6	22.6	24.5
	slightly bad	110	42.1	42.1	66.7
	neither	58	22.2	22.2	88.9
	slightly good	4	1.5	1.5	90.4
	somewhat good	18	6.9	6.9	97.3
	extremely good	7	2.7	2.7	100.0
	Total	261	100.0	100.0	

OE-mjSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	171	65.5	65.5	65.5
	somewhat bad	65	24.9	24.9	90.4
	slightly bad	10	3.8	3.8	94.3
	neither	11	4.2	4.2	98.5
	slightly good	1	.4	.4	98.9
	somewhat good	3	1.1	1.1	100.0
	Total	261	100.0	100.0	

OE-parstress

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	11	4.2	4.2	4.2
	somewhat bad	61	23.4	23.4	27.6
	slightly bad	106	40.6	40.6	68.2
	neither	72	27.6	27.6	95.8
	slightly good	6	2.3	2.3	98.1
	somewhat good	3	1.1	1.1	99.2
	extremely good	2	.8	.8	100.0
	Total	261	100.0	100.0	

OE-AMI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	52	19.9	19.9	19.9
	somewhat bad	88	33.7	33.7	53.6
	slightly bad	82	31.4	31.4	85.1
	neither	30	11.5	11.5	96.6
	slightly good	4	1.5	1.5	98.1
	somewhat good	2	.8	.8	98.9
	extremely good	3	1.1	1.1	100.0
	Total	261	100.0	100.0	

OE-1shot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	12	4.6	4.6	4.6
	somewhat bad	82	31.4	31.4	36.0
	slightly bad	116	44.4	44.4	80.5
	neither	44	16.9	16.9	97.3
	slightly good	3	1.1	1.1	98.5
	somewhat good	4	1.5	1.5	100.0
	Total	261	100.0	100.0	

OE-4shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	31	11.9	11.9	11.9
	somewhat bad	78	29.9	29.9	41.8
	slightly bad	108	41.4	41.4	83.1
	neither	40	15.3	15.3	98.5
	slightly good	2	.8	.8	99.2
	somewhat good	2	.8	.8	100.0
	Total	261	100.0	100.0	

OE-hepB

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	somewhat bad	5	1.9	1.9	1.9
	slightly bad	5	1.9	1.9	3.8
	neither	55	21.1	21.1	24.9
	slightly good	12	4.6	4.6	29.5
	somewhat good	57	21.8	21.8	51.3
	extremely good	127	48.7	48.7	100.0
	Total	261	100.0	100.0	

OE-var

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	3	1.1	1.1	1.1
	somewhat bad	18	6.9	6.9	8.0
	slightly bad	15	5.7	5.7	13.8
	neither	53	20.3	20.3	34.1
	slightly good	24	9.2	9.2	43.3
	somewhat good	73	28.0	28.0	71.3
	extremely good	75	28.7	28.7	100.0
	Total	261	100.0	100.0	

OE-legal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	145	55.6	55.6	55.6
	somewhat bad	50	19.2	19.2	74.7
	slightly bad	17	6.5	6.5	81.2
	neither	44	16.9	16.9	98.1
	slightly good	4	1.5	1.5	99.6
	extremely good	1	.4	.4	100.0
	Total	261	100.0	100.0	

OE-pay

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely bad	64	24.5	24.5	24.5
	somewhat bad	53	20.3	20.3	44.8
	slightly bad	33	12.6	12.6	57.5
	neither	86	33.0	33.0	90.4
	slightly good	4	1.5	1.5	92.0
	somewhat good	14	5.4	5.4	97.3
	extremely good	7	2.7	2.7	100.0
	Total	261	100.0	100.0	

OE-CE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	somewhat bad	2	.8	.8	.8
	neither	2	.8	.8	1.5
	slightly good	8	3.1	3.1	4.6
	somewhat good	53	20.3	20.3	24.9
	extremely good	196	75.1	75.1	100.0
	Total	261	100.0	100.0	

BB-good/bad

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	5	1.9	1.9	1.9
	somewhat agree	3	1.1	1.1	3.1
	slightly agree	2	.8	.8	3.8
	neither	1	.4	.4	4.2
	somewhat disagree	33	12.6	12.6	16.9
	strongly disagree	217	83.1	83.1	100.0
	Total	261	100.0	100.0	

BB-mnSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	4	1.5	1.5	1.5
	somewhat agree	3	1.1	1.1	2.7
	slightly agree	4	1.5	1.5	4.2
	neither	13	5.0	5.0	9.2
	slightly disagree	64	24.5	24.5	33.7
	somewhat disagree	105	40.2	40.2	73.9
	strongly disagree	68	26.1	26.1	100.0
	Total	261	100.0	100.0	

BB-mjSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	72	27.6	27.6	27.6
	somewhat agree	70	26.8	26.8	54.4
	slightly agree	30	11.5	11.5	65.9
	neither	27	10.3	10.3	76.2
	slightly disagree	47	18.0	18.0	94.3
	somewhat disagree	15	5.7	5.7	100.0
	Total	261	100.0	100.0	

BB-parstress

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	7	2.7	2.7	2.7
	somewhat agree	18	6.9	6.9	9.6
	slightly agree	13	5.0	5.0	14.6
	neither	10	3.8	3.8	18.4
	slightly disagree	84	32.2	32.2	50.6
	somewhat disagree	82	31.4	31.4	82.0
	strongly disagree	47	18.0	18.0	100.0
	Total	261	100.0	100.0	

BB-AMI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	22	8.4	8.4	8.4
	somewhat agree	50	19.2	19.2	27.6
	slightly agree	14	5.4	5.4	33.0
	neither	24	9.2	9.2	42.1
	slightly disagree	90	34.5	34.5	76.6
	somewhat disagree	56	21.5	21.5	98.1
	stronglu disagree	5	1.9	1.9	100.0
	Total	261	100.0	100.0	

BB-1shot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	1.1	1.2	1.2
	somewhat agree	1	.4	.4	1.5
	slightly agree	3	1.1	1.2	2.7
	neither	3	1.1	1.2	3.8
	slightly disagree	48	18.4	18.5	22.3
	somewhat disagree	92	35.2	35.4	57.7
	strongly disagree	110	42.1	42.3	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

BB-4shots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	4	1.5	1.5	1.5
	somewhat agree	4	1.5	1.5	3.1
	slightly agree	2	.8	.8	3.8
	neither	8	3.1	3.1	6.9
	slightly disagree	41	15.7	15.7	22.6
	somewhat disagree	72	27.6	27.6	50.2
	strongly disagree	130	49.8	49.8	100.0
	Total	261	100.0	100.0	

BB-hepB

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	5	1.9	1.9	1.9
	somewhat agree	4	1.5	1.5	3.4
	slightly agree	6	2.3	2.3	5.7
	neither	9	3.4	3.4	9.2
	slightly disagree	11	4.2	4.2	13.4
	somewhat disagree	64	24.5	24.5	37.9
	strongly disagree	162	62.1	62.1	100.0
	Total	261	100.0	100.0	

BB-var

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	14	5.4	5.4	5.4
	somewhat agree	17	6.5	6.5	11.9
	slightly agree	16	6.1	6.1	18.0
	neither	26	10.0	10.0	28.0
	slightly disagree	38	14.6	14.6	42.5
	somewhat disagree	71	27.2	27.2	69.7
	strongly disagree	79	30.3	30.3	100.0
	Total	261	100.0	100.0	

BB-legal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	29	11.1	11.1	11.1
	somewhat agree	28	10.7	10.7	21.8
	slightly agree	16	6.1	6.1	28.0
	neither	53	20.3	20.3	48.3
	slightly disagree	73	28.0	28.0	76.2
	sommewhat disagree	42	16.1	16.1	92.3
	strongly disagree	20	7.7	7.7	100.0
	Total	261	100.0	100.0	

BB-pay

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	87	33.3	33.5	33.5
	somewhat agree	32	12.3	12.3	45.8
	slightly agree	12	4.6	4.6	50.4
	neither	47	18.0	18.1	68.5
	slightly disagree	24	9.2	9.2	77.7
	somewhat disagree	35	13.4	13.5	91.2
	strongly disagree	23	8.8	8.8	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

BB-CE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	1.1	1.1	1.1
	slightly agree	1	.4	.4	1.5
	neither	3	1.1	1.1	2.7
	slightly disagree	3	1.1	1.1	3.8
	somewhat disagree	28	10.7	10.7	14.6
	strongly disagree	223	85.4	85.4	100.0
	Total	261	100.0	100.0	

int-do now

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	10	3.8	3.8	3.8
	quite probable	3	1.1	1.2	5.0
	slightly possible	1	.4	.4	5.4
	neither	1	.4	.4	5.8
	slightly improbable	6	2.3	2.3	8.1
	quite improbable	48	18.4	18.5	26.5
	extremely improbable	191	73.2	73.5	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

int-somebodyelse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	17	6.5	6.6	6.6
	quite probable	25	9.6	9.7	16.2
	slightly probable	27	10.3	10.4	26.6
	neither	21	8.0	8.1	34.7
	slightly improbable	13	5.0	5.0	39.8
	quite improbable	49	18.8	18.9	58.7
	extremely improbable	107	41.0	41.3	100.0
	Total	259	99.2	100.0	
Missing	9	2	.8		
Total		261	100.0		

int-reached all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	4	1.5	1.5	1.5
	quite probable	5	1.9	1.9	3.4
	slightly probable	6	2.3	2.3	5.7
	neither	5	1.9	1.9	7.7
	slightly improbable	8	3.1	3.1	10.7
	quite improbable	53	20.3	20.3	31.0
	extremely improbable	180	69.0	69.0	100.0
	Total	261	100.0	100.0	

int-reached some

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	21	8.0	8.1	8.1
	quite probable	15	5.7	5.8	13.9
	slightly probable	10	3.8	3.9	17.8
	neither	7	2.7	2.7	20.5
	slightly improbable	11	4.2	4.2	24.7
	quite improbable	51	19.5	19.7	44.4
	extremely improbable	144	55.2	55.6	100.0
	Total	259	99.2	100.0	
Missing	9	2	.8		
Total		261	100.0		

int-refer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	.4	.4	.4
	quite probable	2	.8	.8	1.1
	slightly probable	2	.8	.8	1.9
	neither	6	2.3	2.3	4.2
	slightly improbable	3	1.1	1.1	5.4
	quite improbable	24	9.2	9.2	14.6
	extremely improbable	223	85.4	85.4	100.0
	Total	261	100.0	100.0	

int-do now

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	68	26.1	26.2	26.2
	quite probable	56	21.5	21.5	47.7
	slightly probable	18	6.9	6.9	54.6
	neither	13	5.0	5.0	59.6
	slightly improbable	10	3.8	3.8	63.5
	quite improbable	42	16.1	16.2	79.6
	extremely improbable	53	20.3	20.4	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

int-somebodyelse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	69	26.4	26.5	26.5
	quite probable	48	18.4	18.5	45.0
	slightly probable	27	10.3	10.4	55.4
	neither	11	4.2	4.2	59.6
	slightly improbable	11	4.2	4.2	63.8
	quite improbable	26	10.0	10.0	73.8
	extremely improbable	68	26.1	26.2	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

int-resch all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	82	31.4	31.5	31.5
	quite probable	56	21.5	21.5	53.1
	slightly probable	18	6.9	6.9	60.0
	neither	10	3.8	3.8	63.8
	slightly improbable	10	3.8	3.8	67.7
	quite improbable	36	13.8	13.8	81.5
	extremely improbable	48	18.4	18.5	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

int-resch some

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	17	6.5	6.5	6.5
	quite probable	28	10.7	10.8	17.3
	slightly probable	13	5.0	5.0	22.3
	neither	30	11.5	11.5	33.8
	slightly improbable	15	5.7	5.8	39.6
	quite improbable	47	18.0	18.1	57.7
	extremely improbable	110	42.1	42.3	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

int-refer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite probable	3	1.1	1.1	1.1
	neither	14	5.4	5.4	6.5
	slightly improbable	4	1.5	1.5	8.0
	quite improbable	37	14.2	14.2	22.2
	extremely improbable	203	77.8	77.8	100.0
	Total	261	100.0	100.0	

SJ- my job

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.4	.4	.4
	somewhat agree	1	.4	.4	.8
	slightly agree	2	.8	.8	1.5
	neither	6	2.3	2.3	3.8
	slightly disagree	9	3.4	3.4	7.3
	somewhat disagree	53	20.3	20.3	27.6
	strongly disagree	189	72.4	72.4	100.0
	Total	261	100.0	100.0	

SJ-coworkers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.4	.4	.4
	neither	3	1.1	1.1	1.5
	slightly disagree	2	.8	.8	2.3
	somewhat disagree	44	16.9	16.9	19.2
	strongly disagree	211	80.8	80.8	100.0
	Total	261	100.0	100.0	

SJ-xpectalot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	12	4.6	4.6	4.6
	somewhat agree	7	2.7	2.7	7.3
	slightly agree	5	1.9	1.9	9.2
	neither	52	19.9	20.0	29.2
	slightly disagree	31	11.9	11.9	41.2
	somewhat disagree	62	23.8	23.8	65.0
	strongly disagree	91	34.9	35.0	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

SJ-displeased

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	30	11.5	11.5	11.5
	somewhat agree	20	7.7	7.7	19.2
	slightly agree	14	5.4	5.4	24.6
	neither	72	27.6	27.7	52.3
	slightly disagree	49	18.8	18.8	71.2
	somewhat disagree	42	16.1	16.2	87.3
	strongly disagree	33	12.6	12.7	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

SJ-need telling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	8	3.1	3.1	3.1
	somewhat agree	13	5.0	5.0	8.0
	slightly agree	14	5.4	5.4	13.4
	neither	67	25.7	25.7	39.1
	slightly disagree	11	4.2	4.2	43.3
	somewhat disagree	44	16.9	16.9	60.2
	strongly disagree	104	39.8	39.8	100.0
	Total	261	100.0	100.0	

nb-MDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	1	.4	.4	.4
	quite familiar	2	.8	.8	1.1
	slightly familiar	4	1.5	1.5	2.7
	neither	10	3.8	3.8	6.5
	slightly unfamiliar	16	6.1	6.1	12.6
	quite unfamiliar	95	36.4	36.4	49.0
	extremely unfamiliar	133	51.0	51.0	100.0
	Total	261	100.0	100.0	

nb-nurses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite familiar	1	.4	.4	.4
	slightly familiar	2	.8	.8	1.2
	neither	6	2.3	2.3	3.5
	slightly unfamiliar	16	6.1	6.2	9.7
	quite unfamiliar	105	40.2	40.5	50.2
	extremely unfamiliar	129	49.4	49.8	100.0
	Total	259	99.2	100.0	
Missing	9	2	.8		
Total		261	100.0		

nb-SHD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	1	.4	.4	.4
	quite familiar	1	.4	.4	.8
	slightly familiar	1	.4	.4	1.1
	neither	4	1.5	1.5	2.7
	slightly unfamiliar	14	5.4	5.4	8.0
	quite unfamiliar	66	25.3	25.3	33.3
	extremely unfamiliar	174	66.7	66.7	100.0
	Total	261	100.0	100.0	

nb-SPIP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	1	.4	.4	.4
	quite familiar	3	1.1	1.2	1.5
	slightly familiar	3	1.1	1.2	2.7
	neither	11	4.2	4.2	6.9
	slightly unfamiliar	25	9.6	9.6	16.5
	quite unfamiliar	90	34.5	34.6	51.2
	extremely unfamiliar	127	48.7	48.8	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

nb-vacc sched

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	1	.4	.4	.4
	neither	2	.8	.8	1.1
	slightly unfamiliar	4	1.5	1.5	2.7
	quite unfamiliar	75	28.7	28.7	31.4
	extremely unfamiliar	179	68.6	68.6	100.0
	Total	261	100.0	100.0	

nb-admins

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	10	3.8	3.8	3.8
	quite familiar	10	3.8	3.8	7.7
	slightly familiar	13	5.0	5.0	12.7
	neither	32	12.3	12.3	25.0
	slightly unfamiliar	39	14.9	15.0	40.0
	quite unfamiliar	83	31.8	31.9	71.9
	extremely unfamiliar	73	28.0	28.1	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

nb-ins

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	16	6.1	6.2	6.2
	quite familiar	21	8.0	8.1	14.2
	slightly familiar	27	10.3	10.4	24.6
	neither	64	24.5	24.6	49.2
	slightly unfamiliar	45	17.2	17.3	66.5
	quite unfamiliar	58	22.2	22.3	88.8
	extremely unfamiliar	29	11.1	11.2	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

nb-parents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	2	.8	.8	.8
	quite familiar	8	3.1	3.1	3.8
	slightly familiar	8	3.1	3.1	6.9
	neither	13	5.0	5.0	11.9
	slightly unfamiliar	75	28.7	28.7	40.6
	quite unfamiliar	109	41.8	41.8	82.4
	extremely unfamiliar	46	17.6	17.6	100.0
	Total	261	100.0	100.0	

nb-VFC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely familiar	2	.8	.8	.8
	quite familiar	6	2.3	2.3	3.1
	slightly familiar	9	3.4	3.5	6.5
	neither	28	10.7	10.8	17.3
	slightly unfamiliar	43	16.5	16.5	33.8
	quite unfamiliar	80	30.7	30.8	64.6
	extremely unfamiliar	92	35.2	35.4	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

mc-MDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite motivated	2	.8	.8	.8
	neither	6	2.3	2.3	3.1
	slightly unmotivated	17	6.5	6.5	9.6
	quite unmotivated	77	29.5	29.6	39.2
	extremely unmotivated	158	60.5	60.8	100.0
	Total	260	99.6	100.0	
Missing	System	1	.4		
Total		261	100.0		

mc-nurses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite motivated	1	.4	.4	.4
	slightly motivated	1	.4	.4	.8
	neither	12	4.6	4.6	5.4
	slightly unmotivated	25	9.6	9.6	15.0
	quite unmotivated	106	40.6	40.8	55.8
	extremely unmotivated	115	44.1	44.2	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

mc-SHD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither	1	.4	.4	.4
	slightly unmotovated	10	3.8	3.8	4.2
	quite unmotivated	72	27.6	27.6	31.8
	extremely unmotivated	178	68.2	68.2	100.0
	Total	261	100.0	100.0	

mc-SPIP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither	15	5.7	5.7	5.7
	slightly unmotivated	16	6.1	6.1	11.9
	quite unmotivated	79	30.3	30.3	42.1
	extremely unmotivated	151	57.9	57.9	100.0
	Total	261	100.0	100.0	

mc-vacc sched

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither	2	.8	.8	.8
	slightly unmotivated	3	1.1	1.1	1.9
	quite unmotivated	66	25.3	25.3	27.2
	extremely unmotivated	190	72.8	72.8	100.0
	Total	261	100.0	100.0	

mc-admins

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely motivated	6	2.3	2.3	2.3
	quite motivated	2	.8	.8	3.1
	slightly motivated	6	2.3	2.3	5.4
	neither	42	16.1	16.1	21.5
	slightly unmotovated	39	14.9	14.9	36.4
	quite unmotivated	80	30.7	30.7	67.0
	extremely unmotivated	86	33.0	33.0	100.0
	Total	261	100.0	100.0	

mc-ins

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely motivated	14	5.4	5.4	5.4
	quite motivated	5	1.9	1.9	7.3
	slightly motivated	15	5.7	5.8	13.1
	neither	77	29.5	29.6	42.7
	slightly unmotivated	57	21.8	21.9	64.6
	quite unmotovated	54	20.7	20.8	85.4
	extremely unmotivated	38	14.6	14.6	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

mc-parents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely motivated	2	.8	.8	.8
	quite motivated	4	1.5	1.5	2.3
	slightly motivated	5	1.9	1.9	4.2
	neither	10	3.8	3.8	8.0
	slightly unmotivated	49	18.8	18.8	26.8
	quite unmotivated	122	46.7	46.7	73.6
	extremely unmotivated	69	26.4	26.4	100.0
	Total	261	100.0	100.0	

mc-VFC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite motivated	1	.4	.4	.4
	slightly motivated	1	.4	.4	.8
	neither	37	14.2	14.2	14.9
	slightly unmotivated	27	10.3	10.3	25.3
	quite unmotivated	78	29.9	29.9	55.2
	extremely unmotivated	117	44.8	44.8	100.0
	Total	261	100.0	100.0	

PBC-I decide

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	33	12.6	12.6	12.6
	somewhat agree	30	11.5	11.5	24.1
	slightly agree	18	6.9	6.9	31.0
	neither	13	5.0	5.0	36.0
	slightly disagree	30	11.5	11.5	47.5
	somewhat disagree	61	23.4	23.4	70.9
	strongly disagree	76	29.1	29.1	100.0
	Total	261	100.0	100.0	

PBC-resources

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	8	3.1	3.1	3.1
	somewhat agree	6	2.3	2.3	5.4
	slightly agree	4	1.5	1.5	6.9
	neither	7	2.7	2.7	9.6
	slightly disagree	13	5.0	5.0	14.6
	somehat disagree	59	22.6	22.6	37.2
	strongly disagree	164	62.8	62.8	100.0
	Total	261	100.0	100.0	

PBC-time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	8	3.1	3.1	3.1
	somewhat agree	10	3.8	3.8	6.9
	slightly agree	18	6.9	6.9	13.8
	neither	14	5.4	5.4	19.2
	slightly disagree	30	11.5	11.5	30.8
	somewhat disagree	95	36.4	36.5	67.3
	strongly disagree	85	32.6	32.7	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

PBC-something prevents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	1.1	1.1	1.1
	somewhat agree	9	3.4	3.4	4.6
	slightly agree	8	3.1	3.1	7.7
	neither	29	11.1	11.1	18.8
	slightly disagree	20	7.7	7.7	26.4
	somehat disagree	49	18.8	18.8	45.2
	strongly disagree	143	54.8	54.8	100.0
	Total	261	100.0	100.0	

PBC-no control

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly aree	6	2.3	2.3	2.3
	somewhat agree	15	5.7	5.7	8.0
	slightly agree	13	5.0	5.0	13.0
	neither	16	6.1	6.1	19.2
	slightly disagree	25	9.6	9.6	28.7
	somewhat disagree	69	26.4	26.4	55.2
	strongly disagree	117	44.8	44.8	100.0
	Total	261	100.0	100.0	

cb-decide if due

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	1.1	1.1	1.1
	somewhat agree	2	.8	.8	1.9
	slightly agree	1	.4	.4	2.3
	neither	3	1.1	1.1	3.4
	slightly disagree	12	4.6	4.6	8.0
	somewhat disagree	71	27.2	27.2	35.2
	strongly disagree	169	64.8	64.8	100.0
	Total	261	100.0	100.0	

cb-decide if safe

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	2.3	2.3	2.3
	somewhat agree	10	3.8	3.8	6.1
	slightly agree	8	3.1	3.1	9.2
	neither	10	3.8	3.8	13.0
	slightly disagree	42	16.1	16.1	29.1
	somehat disagree	101	38.7	38.7	67.8
	strongly disagree	84	32.2	32.2	100.0
	Total	261	100.0	100.0	

cb-ed parents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither	5	1.9	1.9	1.9
	slightly disagree	4	1.5	1.5	3.4
	somehat disagree	56	21.5	21.5	24.9
	strongly disagree	196	75.1	75.1	100.0
	Total	261	100.0	100.0	

cb-objections

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	4	1.5	1.5	1.5
	somewhat agree	6	2.3	2.3	3.8
	slightly agree	3	1.1	1.1	5.0
	neither	18	6.9	6.9	11.9
	slightly disagree	47	18.0	18.0	29.9
	somewhat disagree	112	42.9	42.9	72.8
	strongly disagree	71	27.2	27.2	100.0
	Total	261	100.0	100.0	

pc-decide if due

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	fairly easy	1	.4	.4	.4
	neither	7	2.7	2.7	3.1
	fairly difficult	12	4.6	4.6	7.7
	quite difficult	90	34.5	34.5	42.1
	extremely difficult	151	57.9	57.9	100.0
	Total	261	100.0	100.0	

pc-decide if safe

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely easy	2	.8	.8	.8
	quite easy	1	.4	.4	1.1
	fairly easy	3	1.1	1.1	2.3
	neither	11	4.2	4.2	6.5
	fairly difficult	46	17.6	17.6	24.1
	quite difficult	122	46.7	46.7	70.9
	extremely difficult	76	29.1	29.1	100.0
	Total	261	100.0	100.0	

pc-ed parents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite easy	1	.4	.4	.4
	fairly easy	2	.8	.8	1.1
	neither	5	1.9	1.9	3.1
	fairly difficult	21	8.0	8.0	11.1
	quite difficult	96	36.8	36.8	47.9
	extremely difficult	136	52.1	52.1	100.0
	Total	261	100.0	100.0	

pc-objections

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely easy	2	.8	.8	.8
	quite easy	5	1.9	1.9	2.7
	fairly easy	15	5.7	5.7	8.4
	neither	17	6.5	6.5	14.9
	fairly difficult	81	31.0	31.0	46.0
	quite difficult	96	36.8	36.8	82.8
	extremely difficult	45	17.2	17.2	100.0
	Total	261	100.0	100.0	

B-do now

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	4	1.5	1.5	1.5
	quite probable	6	2.3	2.3	3.8
	slightly probable	3	1.1	1.1	5.0
	neither	2	.8	.8	5.7
	slightly improbable	7	2.7	2.7	8.4
	quite improbable	37	14.2	14.2	22.6
	extremely improbable	202	77.4	77.4	100.0
	Total	261	100.0	100.0	

B-someone else

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	17	6.5	6.5	6.5
	quite probable	23	8.8	8.8	15.3
	slightly probable	37	14.2	14.2	29.5
	neither	22	8.4	8.4	37.9
	slightly improbable	14	5.4	5.4	43.3
	quite improbable	43	16.5	16.5	59.8
	extrememly improbable	105	40.2	40.2	100.0
	Total	261	100.0	100.0	

B-reached all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite probable	2	.8	.8	.8
	slightly probable	3	1.1	1.1	1.9
	neither	5	1.9	1.9	3.8
	slightly improbable	2	.8	.8	4.6
	quite improbable	48	18.4	18.4	23.0
	extremely improbable	201	77.0	77.0	100.0
	Total	261	100.0	100.0	

B-reached some

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	9	3.4	3.4	3.4
	quite probable	9	3.4	3.4	6.9
	slightly probable	18	6.9	6.9	13.8
	neither	7	2.7	2.7	16.5
	slightly improbable	9	3.4	3.4	19.9
	quite improbable	42	16.1	16.1	36.0
	extremely improbable	167	64.0	64.0	100.0
	Total	261	100.0	100.0	

B-refer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither	6	2.3	2.3	2.3
	slightly improbable	1	.4	.4	2.7
	quite improbable	28	10.7	10.7	13.4
	extremely improbable	226	86.6	86.6	100.0
	Total	261	100.0	100.0	

B-do all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	39	14.9	14.9	14.9
	quite probable	33	12.6	12.6	27.6
	slightly probable	8	3.1	3.1	30.7
	neither	14	5.4	5.4	36.0
	slightly improbable	21	8.0	8.0	44.1
	quite improbable	47	18.0	18.0	62.1
	extremely improbable	99	37.9	37.9	100.0
	Total	261	100.0	100.0	

B-someone else

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	62	23.8	23.8	23.8
	quite probable	46	17.6	17.6	41.4
	slightly probable	29	11.1	11.1	52.5
	neither	17	6.5	6.5	59.0
	slightly improbable	7	2.7	2.7	61.7
	quite improbable	36	13.8	13.8	75.5
	extremely improbable	64	24.5	24.5	100.0
	Total	261	100.0	100.0	

B-reached all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	37	14.2	14.2	14.2
	quite probable	33	12.6	12.7	26.9
	slightly probable	23	8.8	8.8	35.8
	neither	17	6.5	6.5	42.3
	slightly improbable	9	3.4	3.5	45.8
	quite improbable	42	16.1	16.2	61.9
	extremely improbable	99	37.9	38.1	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

B-reached some

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	extremely probable	20	7.7	7.7	7.7
	quite probable	24	9.2	9.2	16.9
	slightly probable	28	10.7	10.8	27.7
	neither	24	9.2	9.2	36.9
	slightly improbable	16	6.1	6.2	43.1
	quite improbable	38	14.6	14.6	57.7
	extremely improbable	110	42.1	42.3	100.0
	Total	260	99.6	100.0	
Missing	9	1	.4		
Total		261	100.0		

B-refer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quite probable	2	.8	.8	.8
	slightly probable	1	.4	.4	1.1
	neither	13	5.0	5.0	6.1
	slightly improbable	2	.8	.8	6.9
	quite improbable	37	14.2	14.2	21.1
	extremely improbable	206	78.9	78.9	100.0
	Total	261	100.0	100.0	

Table 1.

Standards for Pediatric Immunization Practices

1. Immunization services are readily available.

2. There are no barriers or unnecessary prerequisites to the receipt of vaccines.

3. Immunization services are available free or for a minimal fee.

4. Providers utilize all clinical encounters to screen and, when indicated, immunize children.

5. Providers educate parents and guardians about immunization in general terms.

6. Providers question parents or guardians about contraindications and, before immunizing a child, inform them in specific terms about the risks and benefits of the immunizations their child is to receive.

7. Providers follow only true contraindications.

8. Providers administer simultaneously all vaccine doses for which a child is eligible at the time of each visit.

9. Providers use accurate and complete recording procedures.

10. Providers co-schedule immunization appointments in conjunction with appointments for other child health services.

11. Providers report adverse events following immunization promptly, accurately and completely.

12. Providers operate a tracking system.

13. Providers adhere to appropriate procedures for vaccine management.

(table continues)

Standards for Pediatric Immunization Practices (continued)

14. Providers conduct semi-annual audits to assess immunization coverage levels and to review immunization records in the patient populations they serve.

15. Providers maintain up-to-date, easily retrievable medical protocols at all locations where vaccines are administered.

16. Providers operate with patient-oriented and community-based approaches.

17. Vaccines are administered by properly trained individuals.

18. Providers receive ongoing education and training on current immunization recommendations.

Table 2.

Vaccination of Children: Summary of Related Major Subtopics in Three Categories of Brandon/Hill List Nursing Textbooks

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Informational topics

- Concept of immunity
- Trends in VPD incidence and immunization rates
- Specific VPD, VPD vaccine information
- Routine pediatric vaccine schedule
- True and False Contraindications

Nursing care planning

- Assessment of immunization status
- Planning immunization services
- Handling of vaccines
- Nursing interventions
  - Vaccine administration
- Patient education
  - Special patient cases
- Record keeping
  - Reporting adverse events

Table 3.

Study Concepts, Definitions, and Questionnaire Scale Item Examples and Scoring Based on the Theory of Planned Behavior

Concept	
Behavior	Definition: A course of action to engage in a behavior Example: Immunize the child now with all vaccines appropriate for age and immunization status Scoring: Extremely probable to extremely improbable, scored 1 to 7
Behavioral Intention	Definition: The likelihood of engaging in a behavior Example: Reschedule the child to get all needed vaccines at a later time Scoring: Extremely probable to extremely improbable, scored 1 to 7
Attitudes	Definition: Disposition to respond favorably or unfavorably to a behavior Example: In general, my attitude toward immunizing children is (favorable/unfavorable) Scoring: Extremely favorable to extremely unfavorable, scored 1 to 7
Behavioral beliefs	Definition: Perceived consequences of a particular behavior

(table continues)

	<u>Example:</u> Giving children vaccines will cause major side effects <u>Scoring:</u> Strongly agree to strongly disagree, scored 1 to 7
Outcome Evaluation	<u>Definition:</u> Evaluation of the consequences of a behavior <u>Example:</u> If I am required to immunize children against chicken pox <u>Scoring:</u> Extremely bad to extremely good, scored 1 to 7
Subjective Norms	<u>Definition:</u> Perceptions about social pressures to engage in a behavior <u>Example:</u> Most people I work with think getting children immunized is important <u>Scoring:</u> Strongly agree to strongly disagree, scored 1 to 7
Normative Beliefs	<u>Definition:</u> Beliefs about expectations of salient referents in relation to performing a particular behavior <u>Example:</u> (Familiarity with positions or recommendations of...) Parents of children I immunize <u>Scoring:</u> Extremely familiar to extremely unfamiliar, scored 1 to 7
Motivation to Comply	<u>Definition:</u> Extent of motivation to do what particular referents think <u>Example:</u> (Extent of motivation to comply with positions or recommendations of....) Physicians I work with

(table continues)

Scoring: Extremely motivated to extremely unmotivated, scored 1 to 7

Perceived Behavioral Control

Definition: Perceived ease or difficulty in performing a behavior

Example: When a child is due for a vaccine, I am the one who decides if I will give it

Scoring: Strongly agree to strongly disagree, scored 1 to 7

Control Beliefs

Definition: Beliefs about control over a behavior

Example: Deciding if it is safe or unsafe to immunize a child

Scoring: Strongly agree to strongly disagree, scored 1 to 7

Perceived Control

Definition: Perceived power over behavioral performance

Example: Determining if a child is due for an immunization

Scoring: Extremely easy to extremely difficult, scored 1 to 7

Table 4.

Estimated Number (%) of Respondents (N = 261) at Sites and Percent Range of Vaccine Services Funded Through Selected Vaccine Funding Sources

Source	n	(%)	Range
Vaccines for Children Program	202	77.4	0-100
Managed Care/HMO	195	74.7	0-90
Other Private Insurance	195	74.7	0-90
Out-of Pocket	195	74.7	0-90

Table 5.

Cumulative Frequency (%) of Respondents (N = 261) from Different Vaccine Sites

Respondents per Site	Number of Sites	Percent	Cumulative Percent
1	81	31.0	31.0
2	20	15.3	46.3
3	14	16.1	62.4
4	9	13.8	76.2
5	5	10.0	86.2
6	1	2.3	88.5
7	2	5.4	93.9
8	1	3.1	97.0
9	1	3.4	100.4[a]
Totals	134	100.4[a]	-----

[a]Exceeds 100% due to rounding.

Table 6.

Respondents' Age and Length of Career in Nursing (in Years)

	Age (n = 258)	Length of Career (n = 260)
Mean	44.0	20.5
Median	45.0	21.0
Mode	45	24
SD	9.15	10.6
Range	45 (66 - 21)	45 (46 - >1)

Table 7.

Frequency (%) of Respondents' (N = 261) Gender and Reported Parenthood by Children's Age Groupings

Gender	n	(%)	Valid (%)	Cum (%)
Female	257	98.5	98.5	98.5
Male	4	1.5	1.5	100.0
Total	261	100.0	100.0	
Reported Parenthood[a]				
6 years and younger	56	21.4	21.8	---
7-16 years	115	44.1	44.7	---
17 years and older	157	60.0	61.1	---
Children of any age	257	93.4	95.7	---
Missing value	4	1.5	---	

[a]Indicates respondents reporting one or more natural, adopted, or guardian children in the specified age group.

Table 8.

Frequency (%) of Respondents (N = 261) by Current Educational Level

Educational Level	n	(%)	Valid (%)	Cum (%)
Licensed practical nurse	70	26.8	26.8	26.8
Associate degree in nursing	67	25.7	25.7	52.5
Diploma in nursing	41	15.7	15.7	68.2
Baccalaureate degree in nursing	60	23.0	23.0	91.2
Post-baccalaureate certificate	2	0.8	0.8	92.0
Master's degree in nursing	18	6.9	6.9	98.9
Master's in another field	2	0.8	0.8	99.6
Doctorate in nursing	1	0.4	0.4	100.0
Doctorate in another field	0	0.0	0.0	
Total	261	100.0	100.0	

Table 9.

Frequency (%) of Respondents (N = 261) Job Position and Level of Position

			Valid	Cum
Current Job Position	n	(%)	(%)	(%)
Licensed Practical Nurse	74	28.4	28.4	28.4
Staff Registered Nurse	119	45.6	45.6	73.9
Community/Public Health Nurse	47	18.0	18.0	92.0
Nurse Practitioner	14	5.4	5.4	97.3
Clinical Nurse Specialist	2	0.8	0.8	98.1
Certified Nurse Midwife	1	0.4	0.4	98.5
Other	4	1.5	1.5	100.0
Total	261	100.0	100.0	
Level of Position				
Staff	217	83.1	83.5	83.5
Supervisory/Managerial	43	16.5	16.5	100.0
Total	260	99.6	100.0	
Missing value	1	0.4		
Total	261	100.0		

Table 10.

Frequency (%) of Respondents (N = 261) with Professional Certification and Interest in Obtaining Specialty Certification in Childhood Immunizations

			Valid	Cum
Currently Certified[a]	n	(%)	(%)	(%)
Yes	36	13.4	14.1	14.1
No	220	84.3	85.9	100.0
Total	256	98.1	100.0	
Missing	5	1.9		
Total	261	100.0		
Interested in Certification[b]				
Yes	134	51.3	52.8	52.8
No	120	46.0	47.2	100.0
Total	254	97.3	100.0	
Missing	7	2.7		
Total	261	100.0		

[a]Currently certified in a nursing specialty area by a national certification program for nursing. [b]Expressed interest in obtaining an immunization specialty certification if one were available.

Table 11.

Frequency (%) of Respondents (N = 261) by Agency Size

Agency Size	n	(%)	Valid (%)	Cum (%)
Small[a]	194	74.3	77.0	77.0
Medium[b]	53	20.3	21.0	98.0
Large[c]	5	1.9	2.0	100.0
Total	252	96.6	100.0	
Missing	9	3.4		
Total	261	100.0		

[a] Less than 10 RNs and LPNs. [b]10-19 RNs and LPNs. [c] 20 or more RNs and LPNs.

Table 12.

Frequency (%) of Respondents (N = 261) by Agency Type

Agency Type	n	(%)	Valid (%)	Cum (%)
Private: Solo Practice	1	0.4	0.4	0.4
Pediatric	6	2.3	2.3	2.7
General/Family Practice	47	18.0	18.0	20.7
Group Practice	107	41.0	41.0	61.7
Public: State	22	8.4	8.4	70.1
County	11	4.2	4.2	74.3
City	2	0.8	0.8	75.1
Federal - Indian Health	22	8.4	8.4	83.5
Tribal	2	0.8	0.8	83.3
Rural Health	24	9.2	9.2	93.5
Other	17	6.5	6.5	100.0
Total	261	100.0	100.0	

Table 13.

Rank and Frequency (%) of Respondents (N = 261) Reporting Availability of Selected Facilitators to Immunization

Rank/Facilitator	Frequency[a]	(%)
1. Immunization schedule poster or wall chart	249	95.4
2. Patient immunization education materials	230	88.1
3. Immunization level audits	157	60.2
4. Specific immunization goals	146	55.9
5. Immunization tracking system	131	50.2
6. Immunization standing orders	129	49.4
7. Standards for Pediatric Immunization Practices	120	46.0
8. Written immunization policies	113	43.3
9. Patient reminder system	94	36.0
10. Local immunization coalition or partnership	79	30.3
11. Charting reminders	76	29.1
12. American Academy of Pediatrics "Red Book"	68	26.1
13. Immunization/WIC[b] co-scheduling	55	21.1

[a]Number of respondents reporting the facilitator was present at their work site. [b]Women, Infant and Children food program.

Table 14.

Summary Statistics on Frequency of Respondents (N = 261) Performing Selected Immunization Activities

Activity[a]	Mean	(SD)	Median
1. Assessing immunization status	4.40	(.89)	5.0
2. Deciding which immunizations to give	4.24	(.98)	5.0
3. Administering vaccinations	4.43	(.88)	5.0
4. Making an immunization nursing diagnosis	3.40	(1.48)	4.0

[a]Possible and obtained minimum of 1 and maximum of 5 for each activity.

Table 15.

Initial Summary Statistics on Questionnaire Scale Components

(Questionnaire Section/Part) Scale (item numbers)	Mean (SD) Median	Obtained Range (Possible Range)
(Part 1)		
Attitude toward behavior (1-4)	25.35 (2.74) 26	4-28 (4-28)
Outcome evaluation (5-16)	45.44 (6.56) 46	28-66 (12-84)
Behavioral beliefs (17-28)	62.61 (6.81) 63	23-79 (12-84)
(Part 3)		
Subjective Norms (1-5)	28.41 (3.62) 29	11-35 (5-35)
Normative beliefs (6-14)	53.04 (5.31) 54	36-63 (9-63)
Motivation to comply (15-23)	55.01 (4.65) 55	36-63 (9-63)
(Part 4)		
Perceived Behavioral Control (1-5)	28.28 (5.30) 29	10-35 (5-35)
Control beliefs (6-9)	24.65 (3.02) 25	13-28 (4-28)
Perceived control (10-13)	24.22 (2.86) 24	12-28 (4-28)

(table continues)

(Questionnaire Section/Part) Variable (item numbers)	Mean (SD) Median	Obtained Range (Possible Range)
(Part 2)		
Behavioral Intention		
Case 1 - Knowledge (2)	6.91 (0.50) 7	3-7 (0-7)
Intention (3-7)	30.34 (4.54) 31	14-35 (5-35)
Case 2 - Knowledge (2)	6.23 (1.12) 7	3-7 (0-7)
Intention (3-7)	22.64 (6.73) 22	8-35 (5-35)
(Part 5)		
Behavior		
Case 1 - Knowledge (2)	6.52 (0.75) 7	3-7 (0-7)
Behavior (3-7)	31.11 (4.20) 32	19-35 (5-35)
Case 2 - Knowledge (2)	5.60 (1.24) 6	1-7 (0-7)
Behavior (3-7)	25.15 (6.97) 25	9-35 (5-35)

Table 16.

Model Component Initial Scale Reliability Coefficients (Cronbach's Alpha)

Component (Abbreviation)	Number of Items	Alpha
Attitudes (A)	4	.44
Outcome evaluation (OE)	12	.69
Behavioral beliefs (BB)	12	.47
OE + BB	24	.48
A + OE + BB	28	.51
Subjective Norms (SN)	5	.28
Normative beliefs (NB)	9	.61
Motivation to comply (MC)	9	.70
NB + MC	24	.78
SN + NB + MC	23	.74
Perceived Behavioral Control (PBC)	5	.62
Control beliefs (CB)	4	.62
Perceived control (PC)	4	.73
CB+ PC	8	.78
PBC + CB + PC	13	.79
Intention	10	.68
Behavior	10	.74

Table 17.

Summary Statistics on Revised Variable Scales for Model Testing

Variable (Number of Items)	Mean (SD) Median	Obtained Range (Possible Range)	Cronbach's alpha Coefficient
Direct Measures			
Behavior (10)	56.26 (9.78) 56	31 - 70 (10 - 70)	.74
Intention (10)	52.99 (9.49) 52	22 - 70 (10 - 70)	.68
Attitudes (1)	6.62 (0.98) 7	2 - 7 (1 - 7)	--
SN[a] (2)	13.34 (1.29) 14	2 - 14 (2 - 14)	.66
PBC[b] (5)	28.28 (5.30) 29	10 - 35 (5 - 35)	.62
Belief-based Determinants (Summed Product Scores)			
Attitude (12)	70.38 (19.95) 70	26 - 148 (6 - 294)	.62/.76[c]
SN[a] (18)	331.63 (51.40) 337	144 - 441 (9 - 441)	.61/.70[d]
PBC[b] (8)	151.80 (29.70 156	48 - 196 (4 - 196)	.62/.73[e]

[a]Subjective Norms. [b]Perceived Behavioral Control. [c]Behavioral Belief/Outcome Evaluation subscales. [d]Normative Belief/Motivation to Comply subscales. [e]Control Beliefs/Perceived Control subscales.

Table 18.

Pearson Correlation Coefficients Between Study Variables (N = 261)

Variables	B^a	I^b	A^c	SN^d	PBC^e	A^c	SN^d	PBC^e
	Variables					Belief-based Determinants		
B^a	1.000							
I^b	.648***	1.000						
A^c	.176**	.226***	1.000					
SN^d	.004	-.012	.283***	1.000				
PBC^e	.427**	.319***	.207**	.104	1.000			
Belief-based Determinants								
A^c	.062	.001	.164**	.038	.123*	1.000		
SN^d	.193**	.172**	.155*	.206**	.226***	.005	1.000	
PBC^e	.404***	.305***	.188**	.179**	.516***	.085	.281***	1.000

[a]Behavior. [b]Behavioral Intention. [c]Attitude. [d]Subjective Norms. [e]Perceived Behavioral Control. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 19.

T- test Results Comparing Scale Sum Score Means for Behavioral Intention and Behavior Between Respondents in Public and Private Employment Settings

Variable	n	Mean (SD)	t-value (df)	2-tailed probability
Intention				
Private	161	51.19 (8.89)	-3.989 (259)	.000
Public	100	55.88 (9.83)		
Behavior				
Private	161	54.73 (9.46)	-3.261 (259)	.001
Public	100	58.72 (9.83)		

Table 20.

T-test Results Comparing Behavioral Intention Scale Sum Score Means and Availability of Selected Facilitators to Immunization Between Groups (No and Yes)

Variable (availability)		n	Mean (SD)	t-value (df)	2-tailed probability
Immunization goals	(no)	113	51.78 (8.76)	-1.965 (257)	.050
	(yes)	146	54.09 (9.90)		
Immunization audits[a]	(no)	102	51.09 (8.49)	-2.848 (238)	.005
	(yes)	157	54.37 (9.87)		
Poster/Wall chart[a]	(no)	10	55.50(13.13)	0.601 (9)	.562 n.s.
	(yes)	249	52.98 (9.32)		
Standing orders	(no)	130	51.39 (9.03)	-2.915 (257)	.004
	(yes)	129	54.78 (9.64)		
Reminder system	(no)	165	52.60 (9.50)	-1.075 (257)	.284 n.s.
	(yes)	94	53.91 (9.42)		
Tracking system	(no)	128	52.20 (9.84)	-1.471 (257)	.142 n.s.
	(yes)	131	53.93 (9.05)		
Charting reminders	(no)	183	52.91 (9.36)	-0.448 (257)	.655 n.s.
	(yes)	76	53.49 (9.79)		
WIC[b] linkage	(no)	204	52.67 (9.20)	-1.329 (257)	.185 n.s.
	(yes)	55	54.58 (10.37)		

(table continues)

Variable		n	Mean (SD)	t-value (df)	2-tailed probability
AAP[c] "Red Book"	(no)	191	52.18 (9.23)	-2.651 (257)	.009
	(yes)	68	55.66 (9.73)		
SPIP[d]	(no)	139	51.84 (9.40)	-2.278 (257)	.024
	(yes)	120	54.51 (9.39)		
Policies	(no)	146	52.41 (9.68)	-1.288 (257)	.199 n.s.
	(yes)	113	53.93 (9.17)		
Patient ed materials	(no)	29	50.62 (8.69)	-1.486 (257)	.139 n.s.
	(yes)	230	53.39 (9.54)		
Partnerships	(no)	179	52.69 (9.61)	-1.113 (257)	.267 n.s.
	(yes)	79	54.11 (9.07)		

[a]Equal variances not assumed ($p < .05$). [b]Women, Infants, and Children food program. [c]American Academy of Pediatrics. [d]Standards for Pediatric Immunization Practices.

Table 21.

T-test Results Comparing Behavior Scale Sum Score Means and Availability of Selected Facilitators to Immunization Between Groups (No and Yes)

Variable (availability)	n	Mean (SD)	t-value (df)	2-tailed probability
Immunization goals (no)	113	55.86 (9.60)	-0.664 (257)	.507 n.s.
(yes)	146	56.67 (9.91)		
Immunization audits (no)	102	54.39 (10.37)	-2.585 (257)	.010
(yes)	157	56.57 (9.17)		
Poster/Wall chart[a] (no)	10	54.80 (13.83)	-0.357 (9)	.729 n.s.
(yes)	249	56.38 (9.60)		
Standing orders (no)	130	54.20 (9.71)	-3.581 (257)	.000
(yes)	129	58.44 (9.38)		
Reminder system (no)	165	56.37 (9.89)	0.129 (257)	.898 n.s.
(yes)	94	56.21 (9.59)		
Tracking system (no)	128	55.45 (10.17)	-1.409 (257)	.160 n.s.
(yes)	131	57.16 (9.31)		
Charting reminders (no)	183	56.45 (9.44)	0.336 (257)	.737 n.s.
(yes)	76	56.00 (10.55)		
WIC[b] linkage (no)	204	55.68 (9.79)	-2.029 (257)	.044
(yes)	55	58.67 (9.40)		

(table continues)

Variable		n	Mean (SD)	t-value (df)	2-tailed probability
AAP[c] "Red Book"	(no)	191	55.20 (9.82)	-3.14 (257)	.002
	(yes)	68	59.46 (8.96)		
SPIP[d]	(no)	139	54.88 (9.26)	-2.580 (257)	.010
	(yes)	120	57.98 (10.10)		
Policies	(no)	146	56.39 (9.25)	0.138 (257)	.890 n.s.
	(yes)	113	56.22 (10.43)		
Patient ed materials[a]	(no)	29	55.24 (8.51)	-.708 (38)	.483 n.s.
	(yes)	230	56.45 (9.92)		
Partnerships	(no)	179	54.04 (9.70)	-0.895 (257)	.372 n.s.
	(yes)	79	57.22 (9.65)		

[a]Equal variances not assumed ($p < .05$). [b]Women, Infants, and Children food program. [c]American Academy of Pediatrics. [d]Standards for Pediatric Immunization Practices.

Table 22.

Path Analysis (Hypothesis Testing) for Behavioral Intention to Immunize Using Multiple Regression (N = 261)

Dependent Variable Independent Variable	Beta	R^2 (Adjusted)
Intention		.127
Attitudes	.194**	
Subjective Norms	-.097	
Perceived Behavioral Control	.289***	
Attitudes		.023
Belief-based Attitudes	.164**	
Subjective Norms		.043
Belief-based Norms	.206***	
Perceived Behavioral Control		.264
Belief-based Control	.516***	

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 23.

Rankings and Frequencies (%) of Selected Categories of Interventions to Reduce Discomfort Before and After Vaccination

Before Vaccination		After Vaccination	
Category Ranking	Frequency (%)	Category Ranking	Frequency (%)
1. Specific techniques	135 (28.1)	1. Distraction	146 (26.3)
2. Pharmacological	131 (27.2)	2. "TLC"	129 (23.2)
3. Cognitive	97 (20.2)	3. Pharmacological	122 (22.0)
4. "TLC"	74 (15.9)	4. Specific techniques	107 (19.3)
5. Distraction	44 (9.1)	5. Cognitive	51 (9.2)
Total	481 (100.5[a])		555 (100.0)

[a]Exceeds 100% due to rounding.

Table 24.

Frequency (%) of Scores for Correct Identification of Age-Appropriate Vaccines in Four Case Scenarios

	Intention		Behavior	
Score	Case 1 (%)	Case 2 (%)	Case 1 (%)	Case 2 (%)
	(n = 260)	(n = 259)	(n = 260)	(n = 257)
1	0	0	0	2 (0.8)
2	0	0	0	0
3	1 (1.2)	17 (6.6)	1 (0.4)	16 (6.2)
4	1 (0.4)	4 (1.5)	3 (1.2)	25 (9.7)
5	1 (0.4)	24 (9.3)	25 (9.6)	69 (26.8)
6	7 (2.7)	72 (27.8)	61 (23.5)	71 (27.6)
7	248 (95.4)	142 (54.8)	170 (65.4)	74 (28.8)

Note. Higher scores indicate increased correct identification of age-appropriate vaccines.

Table 25.

Frequency (%) of Respondent's (N = 261) Combined Correct Scores in Four Case Scenarios

Score		Frequency	(%)
6		1	0.4
13		1	0.4
16		1	0.4
17		2	0.8
19		5	1.9
20		9	3.4
21		5	1.9
22		6	2.3
23		22	8.4
24		29	11.1
25		40	15.3
26		54	20.7
27		51	19.5
28		35	13.4
	Total	261	99.9[a]

[a]Less than 100% due to rounding.

Table 26.

Frequency (%) of Respondent's (N = 261) Identification of Inappropriate Vaccines in Four Case Scenarios.

	Intention		Behavior	
Vaccine	Case 1 (%)	Case 2 (%)	Case 1 (%)	Case 2 (%)
	(n = 260)	(n = 259)	(n = 260)	(n = 257)
DTaP	*	*	*	36 (13.8)
HepA	3 (1.2)	2 (0.8)	1 (0.4)	13 (5.0)
Hib	*	*	9 (3.4)	*
HepB	*	*	*	7 (2.7)
MMR	2 (0.8)	*	*	*
Var	2 (0.8)	14 (5.4)	*	*
Polio	*	18 (6.9)	28 (10.7)	*

Note. * Indicates the vaccine is appropriate.

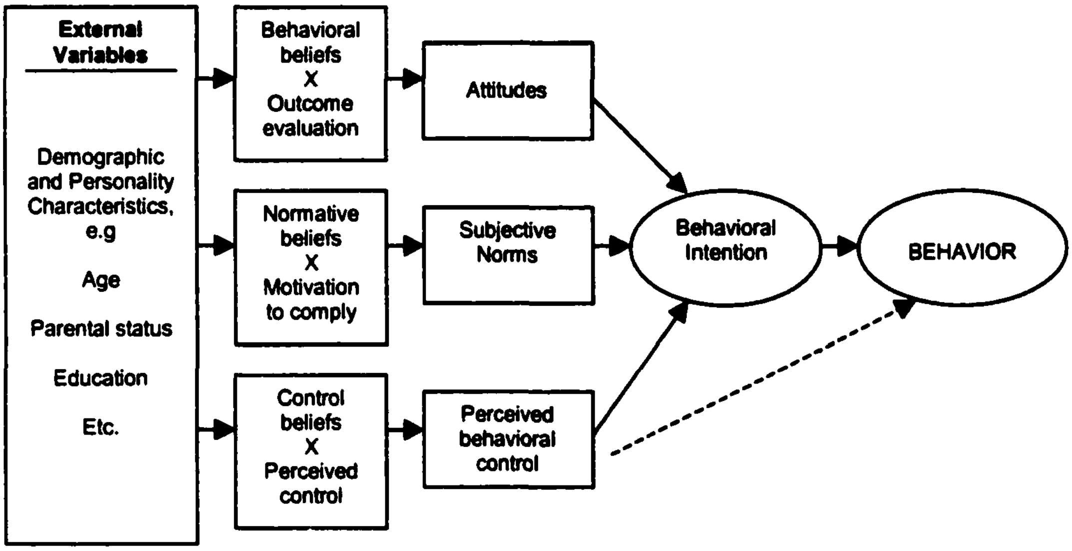

Figure 1. Structural model of the theory of planned behavior. (Adapted from Ajzen & Fishbein, 1980).

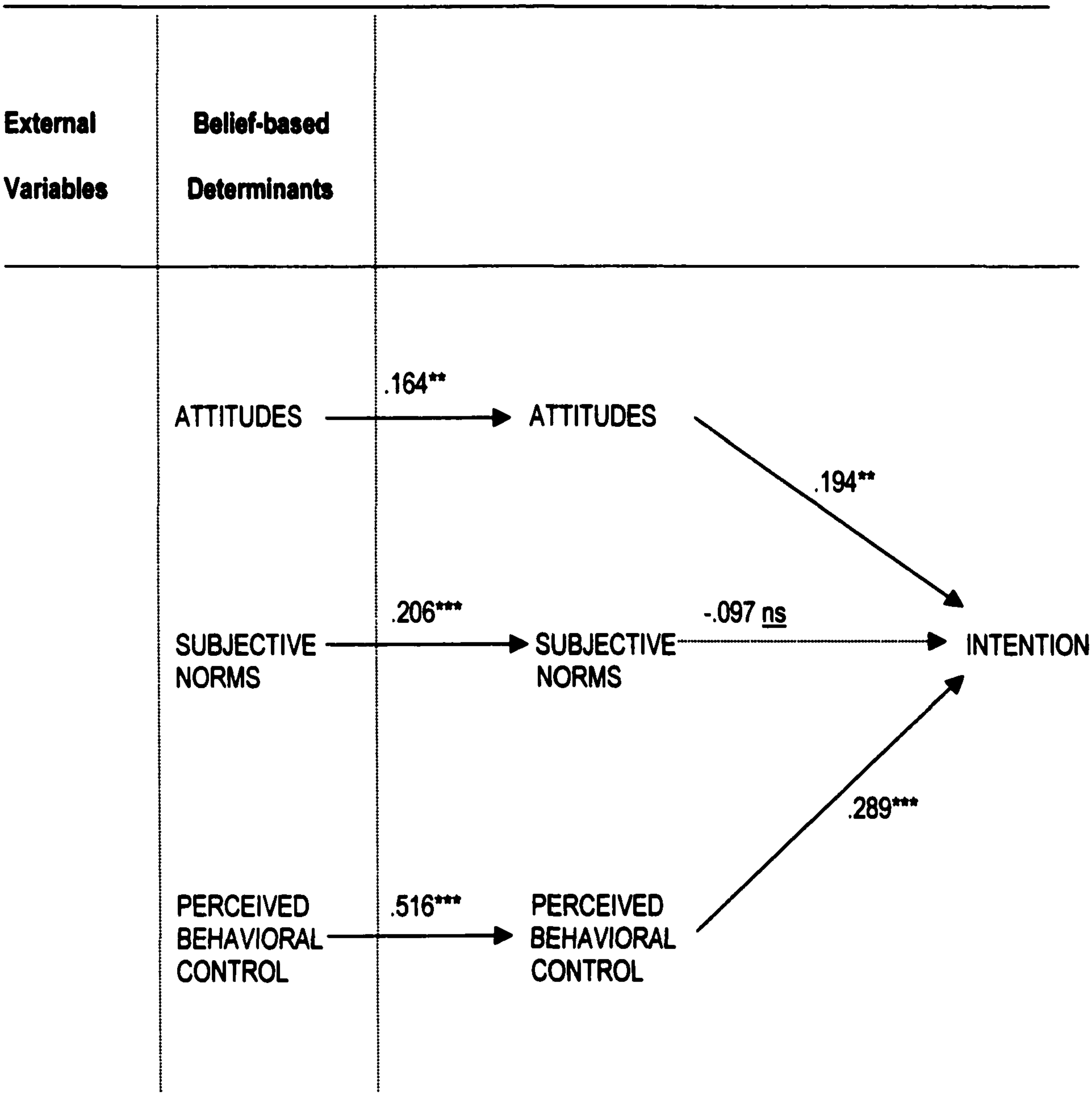

Figure 2. Path coefficients (adjusted beta weights) for a predictive model of nurses' behavioral intention to immunize based on the theory of planned behavior ($N = 261$). *$p < .05$. **$p < .01$. ***$p < .001$.

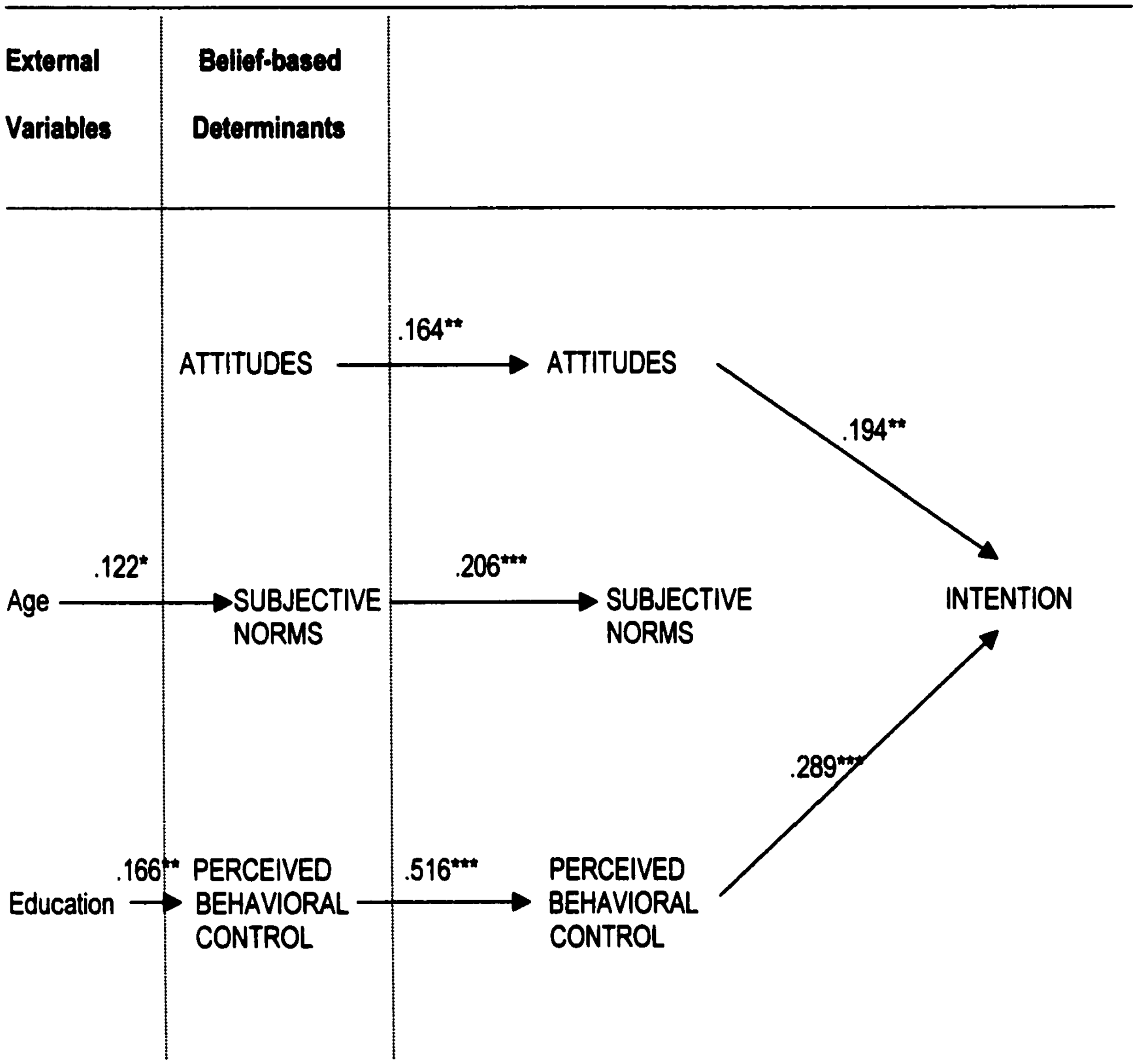

Figure 3. Path coefficients (adjusted beta weights) for a predictive model of nurses' behavioral intention to immunize based on the theory of planned behavior including age and educational level as external variables (N = 261). *$p < .05$. **$p < .01$. ***$p < .001$.