To the Graduate Council:

I am submitting herewith a dissertation written by Karen Adele Rasnake Lowry entitled "Tennessee Healthcare Provider Childhood Lead Poisoning Attitude, Belief, and Practice Survey." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Susan M. Smith, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Vice Provost and
Dean of Graduate Studies

TENNESSEE HEALTHCARE PROVIDER CHILDHOOD LEAD POISOINING ATTITUDE, BELIEF, AND PRACTICE SURVEY

A Dissertation
Present for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Karen Adele Rasnake Lowry
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DEDICATION

This dissertation is dedicated to the memory of my cousin Christine Ball, who never had to opportunity to realize her full potential. I will always remember the friendship we shared as children. Your belief in me gave me so much confidence in myself. I wish you were here to share this with me. I know you are somewhere out there cheering for me, and I will never forget you.

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I would also like to thank Dr. Priscilla Blanton from Child and Family Studies at The University of Tennessee for all of the help she has given me throughout this effort.

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ABSTRACT

Childhood lead poisoning is a serious but preventable condition. It has been estimated by the Tennessee Department of Health that as many as one in eleven children in the state may be affected in some manner by lead poisoning. Lead poisoning can result in lifelong learning and neurological problems for a child. For these reasons it is imperative the healthcare provider be able to recognize risk factors associated with lead poisoning in the child's environment. Recognition of these risk factors is done through asking a series of screening questions designed to assess areas of risk. Follow up blood testing to determine the extent of lead poisoning is a necessary measure once risk of lead poisoning to the child has been determined.

The decision to ask appropriate screening questions and follow up with lead blood testing is often influenced by healthcare provider attitude. If the healthcare provider does not deem lead an important issue, then lead screening and testing may not be done as recommended by the Tennessee Department of Health, Centers for Disease Control and Prevention, and other governmental agencies.

The purpose of this study was to investigate the relationship of the healthcare providers' beliefs and attitudes toward childhood lead screening and testing practices in the state of Tennessee. The Health Belief Model and self-efficacy constructs were used as the theoretical foundation for this research. To assess the relationships represented in this research, a survey instrument was developed, validated, and pilot tested for use. It was then mailed to a population of pediatricians, family practice physicians, general practice physician, and selected nurse practitioners (family practice and pediatric nurse

clinicians) in the state of Tennessee listed as licensed to practice by the Tennessee Bureau of Health Statistics for 2001.

Data for this study were then analyzed using chi-square testing, cross tabulation residual analysis, MANOVA, and Tukey's post-hoc when appropriate. The following major conclusions were drawn from this study: The number of years a healthcare provider had been practicing was negatively associated with number of Tennessee Department of Health's required questions asked as part of the lead screening protocol and percentage of the children being tested for lead, indicating providers practicing the longest were doing the least thorough screenings and least amount of testing for lead.

The number of screening questions asked was associated with the percentage of children tested for lead. Healthcare providers asking more of the required questions as part of the screening protocol were testing more children for lead poisoning.

Provider location (urban, suburban, or rural) did not significantly influence the number of required screening questions asked and was not significantly associated with the Health Belief Model constructs.

Developing health education efforts to target healthcare providers in practice for more than 20 years, and providing the healthcare providers with a clear indication of the guidelines that are required by state and federal agencies would be an important next step in addressing childhood lead poisoning in the state of Tennessee. Further research into the risk posed to specific demographic groups of children in Tennessee would be useful for targeting prevention measures for groups most at risk.

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Chapter I

FORMULATION AND DEFINITION OF THE PROBLEM

Introduction

Although lead poisoning risk in children has been significantly reduced since lead removal from gasoline in 1995, the Centers for Disease Control and Prevention (CDC) still estimates that 890,000 children are still exposed to lead in sufficient amounts to cause health problems (CDC, 1997). Lead poisoning has been defined by the CDC as the number one environmental health threat facing children in the United States. Lead poisoning affects almost every body system, can occur with no significant visible symptoms and, for this reason, diagnosis of lead poisoning is often difficult, particularly low level lead poisoning (Krowchuk, 1995).

The Tennessee Department of Health (TDH) estimates as many as one in eleven children in Tennessee may have harmful levels of lead in their blood (TDH, 2002a). Healthcare provider perception of the risk imposed by lead poisoning hazards is reflected by the health beliefs of the provider community, knowledge possessed by the healthcare provider and attitudes toward recommending appropriate healthcare diagnostic tests for patients seen. These health beliefs are reflected in the Health Belief Model (HBM), originally constructed by Rosenstock in 1974 and updated by Strecher and Rosenstock in 1997 includes the individual constructs of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy. No previously reported juried research was found by this researcher regarding healthcare provider beliefs, screening protocol, or testing practices (hereafter referred to as lead blood testing practices) used to assess risks of lead exposure for children in of Tennessee. The development of a survey instrument to be used as a tool in assessing a baseline of prevention, screening (hereafter referred to as lead screening protocol), and lead blood testing practices in Tennessee could provide preliminary information for policy makers to use in assessing the current status of childhood lead poisoning prevention in this state.

The Purpose of the Study

The purpose of this study was to investigate the health beliefs as measured by the Health Belief Model constructs of perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action and self-efficacy and attitudes as related to childhood lead screening protocol followed and blood testing practices of healthcare providers in Tennessee. The groups of healthcare providers chosen for inclusion in the study were: family practice physicians, general practice physicians, pediatricians, family nurse practitioners, and pediatric nurse clinicians listed as licensed to practice with the Tennessee Bureau of Health Statistics (TBHS) for 2001-2002 and responding to a survey administered in 2002.

Research Hypotheses

In order to address the purpose of this study the following null research hypotheses were formulated:

1: There is no difference between the healthcare providers' self-reported childhood lead testing practice and the self-reported location of the practice (urban, suburban, or rural).

2: There is no difference between the healthcare providers' self-reported lead testing practice and the self-reported number of years they have practiced.

3: There is no relationship between the healthcare providers' self-reported lead testing practice, the providers' health beliefs concerning childhood lead testing (including perceived susceptibility, perceived severity, benefits of testing, barriers to testing, cues to action, and self-efficacy related to lead testing in children) by provider self-reported gender or self-reported location of practice (urban, suburban, or rural).

4: There is no difference between the self-reported number of required (TDH) screening questions asked by the healthcare provider as part of the lead screening protocol followed and the location of the practice (urban, suburban, or rural) or self-reported number of years the provider had been practicing.

5: There is no difference between the healthcare providers' self-reported childhood lead testing practice and the self-reported number of required (by TDH) screening questions asked by the healthcare provider as part of the screening protocol followed.

6: There is no difference between the healthcare providers' self-reported childhood lead testing practices and the self-reported acceptance of TennCare (Medicaid) reimbursements.

Need for the Study

A review of current literature focusing on pediatric lead blood testing reveals very little research focusing on healthcare providers' health beliefs and practices including lead screening protocol (questions which are asked it assess need for lead blood testing) and lead testing practices in children. There was no published and juried information specifically referencing the approach of Tennessee healthcare providers and the rate of lead blood testing in children of Tennessee found by the researcher. According to the

HBM, if the provider fails to order testing, this can present a barrier in lead poisoning being detected and bars subsequent treatment for lead poisoning. One recent study of pediatricians in Alameda and San Francisco Counties, CA showed that following the CDC testing recommendations was associated with certain physician characteristics such as number of years in practice, gender of practitioner, and type of practitioner.

Researchers noted that healthcare providers with less information or providers practicing the longest were least likely to follow the testing guidelines recommended by the CDC (Ferguson & Lieu, 1997). Determination of what provider characteristics and beliefs are associated with more rigid screening and testing practices for childhood lead poisoning can be an important tool in helping "target" specific provider groups for health promotion and educational efforts.

Assumptions

The following basic assumptions were made in addressing this research:

1. All subjects understood and responded truthfully to the questions posed in the self-reporting questionnaire.
2. The appropriate persons at the healthcare provider offices, namely the nurse practitioner (clinician) or physician to whom the survey was addressed, filled out the questionnaire.
3. Respondents were aware of the confidentiality of their responses. The participants were assured of confidentiality in the cover letter and study information sheet, accompanying the questionnaire in the mailing packet.
4. The instrument used to collect data was valid and reliable. Data supporting the

instrument reliability and validation will be presented in Chapter III.

5. Respondents understood the questions posed by the survey. The validity of the instrument was established by a panel of experts presented in Chapter III of this document.
6. Respondents' chosen were representative of the entire population of healthcare providers in Tennessee providing primary care to children.
7. Healthcare providers chosen for inclusion in this study were all in "good" standing with the TBHS and were licensed to practice medicine in the state of Tennessee.

Delimitations

For the purpose of this study the following delimitations were made:

This study was delimited to family practice, general practice and pediatric physicians, and family practice nurse practitioners and pediatric nurse clinicians in Tennessee listed as licensed to practice in Tennessee by the TBHS in 2001-02. These individuals were chosen because these provider groups were believed to represent the population of healthcare providers in Tennessee providing primary care services to children.

Limitations

This study was limited in the following ways:

1. Healthcare providers were self-reporting responses to questions regarding what was known, believed, and practiced concerning childhood lead screening protocol and blood testing within the provider's practice. No effort was made to ascertain the reliability of what was self-reported.

2. Results from this study are only applicable to healthcare provider groups specified in this study for the state of Tennessee.
3. There was only sufficient funding available for one mailing of the questionnaire with follow up telephone calls to 10% of the healthcare providers included in the mailing. As a result, some sample bias may be introduced due to lower response rates.

Definition of Terms

Specific terms defined for the purpose of this study are as follows:

Cues-to Action construct (from HBM): Outside stimuli which active the healthcare provider to act on behalf of his/her patient (Shillitoe & Christie, 1989). For the purpose of this study these are directed toward actions the healthcare provider initiates in the prevention and treatment of childhood lead poisoning.

Family and General Practice Physicians: Physician trained to administer medical care to all ages of patients and can provide medical care to the entire family.

Family Nurse Practitioner: Registered nurse with advanced training in family medical practices capable of making certain medical decisions without direct supervision of the physician.

Lead Blood Testing Practice: Practice followed when a healthcare provider determines sufficient risk exists in the child's environment or if the healthcare provider is required by state or federal mandate to order lead blood testing.

Lead Screening Protocol :The screening questions required by TDH to be asked by the healthcare provider in order to assess risk of lead poisoning in the environment of the child. These are then used to determine the need for following up with lead blood testing of the child.

Location of Practice: For the purposes of this research the location of the practice (rural, suburban, or urban) was self-determined by the responding healthcare provider. No formal definition of these terms was given to the healthcare provider.

Pediatrician: Physician trained specifically in ailments and conditions relating to children, primarily responsible for providing medical care to children.

Pediatric Nurse Clinician: Registered nurse with advance training in pediatric medical practices and conditions, who is capable of making certain medical decisions without direct supervision of a physician.

Perceived barriers construct (from the HBM): Cognitive recognition of obstacles which are perceived by the healthcare provider as preventing testing or screening for lead poisoning in children (Strecher & Rosenstock, 1997).

Perceived benefits construct (from the HBM): Positive gains perceived by the healthcare provider in the detection or prevention of lead poisoning in children (Rosenstock, 1974).

Perceived severity construct (from the HBM): A personal measure of the healthcare providers' perception of the consequences of not screening or testing children for lead (Rosenstock, 1974).

Perceived susceptibility construct (from the HBM): Personal risk assessment by the healthcare provider of the risk involve if the child is not screened or tested for lead (Shillitoe & Christie, 1989).

Self-efficacy construct (from the HBM): A personal judgment by the healthcare provider of his/her ability to provide needed preventative care and treatment for childhood lead poisoning (Bandura, 1986).

Summary

This chapter has presented an introduction to the research problem, which was to investigate the relationship between the health beliefs of selected healthcare providers in the state of Tennessee to childhood lead testing practices including screening protocols followed and testing practices. The purpose and the research questions guiding the study were presented in addressing the problems with specific emphasis on beliefs as they related to lead testing practices and screening protocol in children. Also presented was the need for the study to specifically address what healthcare providers believe about lead testing in children and to determine what factors may relate to healthcare providers screening and testing practices for lead in Tennessee. It was assumed the physicians family nurse practitioners and pediatric nurse clinicians chosen from the TBHS were representative of the population of Tennessee healthcare providers providing primary healthcare services to children.

It was also assumed the respondents answering the self-reported questionnaire were truthful and respondents were assured that the responses were completely confidential. Delimitations and limitations regarding the availability of the sample and representation of the population were also listed in this chapter. This project was taken on in order to ascertain the healthcare providers' beliefs and approaches concerning childhood lead blood screening and testing specifically in Tennessee.

Chapter II will present the theoretical framework for the study, the Health Belief Model. Chapter II will also present literature reviews in relationship to content, methodology, and content and methodology, specifically relating these to childhood lead screening and testing practices. In Chapter III instrumentation and analysis methods are introduced in relation to the research questions analyzed. Chapter IV contains the data and data analysis. Chapter V contains the results and conclusions drawn from this study as well as recommendations for future research. Chapter VI contains the study in retrospect, including the importance of the study, observations, and implications of the study.

Chapter II

REVIEW OF LITERATURE

Introduction

The purpose of this study was to investigate Tennessee healthcare providers' attitudes, beliefs, and practices toward childhood lead screening protocol followed and lead blood testing practices. The conceptual basis for this investigation is the Health Belief Model (HBM) which includes the constructs of perceived severity, perceived susceptibility, perceived benefits, barriers, cues to action, and self-efficacy. A review of literature was conducted to determine the detrimental effects of lead poisoning in children, healthcare provider demographics that place children at risk, healthcare provider characteristics such as number of years in practice and gender that may influence the determination of when a child is screened or tested for lead poisoning, and federal/state recommendations in assessing children at risk for lead poisoning. Information on health standards and lead risk questionnaire assessments relating to Tennessee are presented in this chapter, with specific requirements for children from the TDH concerning what questions must be asked in the lead screening protocol and when follow up blood testing should be performed.

Sections are also included in this chapter to relate the foundation from scholarly literature of the methodology, including similar studies conducted to assess how healthcare provider's attitude and beliefs may affect other healthcare provider practices.

The final section of this chapter will discuss the methodology as related specifically to the content and the population under study and lead screening/testing practices in children.

Conceptual Basis: The Health Belief Model

Health Belief Model

Introduction to Health Belief Model

A theoretical framework for the study must first be established in order to frame the study to follow. The Health Belief Model (HBM) was selected as the framework to explore the relationship between health beliefs, barriers presented to obtaining healthcare, and other factors, including healthcare providers' attitudes that may affect the ability of the individual as related to seeking treatment or screening (and testing) measures (Cameron, 1996).

Constructs of the HBM shown to effect health outcomes are: (a) perceived susceptibility to adverse outcomes, (b) perceived severity of such outcomes, (c) perceived benefits, (d) barriers to actions, (e) cues to action that need to be taken, and (f) self-efficacy skills (Becker & Rosenstock, 1984; Strecher & Rosenstock, 1997).

Perceived Susceptibility

Perceived susceptibility will be use to measure a healthcare provider's personal assessment of the risk involved if blood testing and screening measures are not followed. The perceived susceptibility construct represents the level of perceived vulnerability to negative outcomes associated with the illness along with the level of knowledge concerning risk factors (Shillitoe & Christie, 1989). This is a cognitive assessment as to how possible the perceived negative outcomes are if CDC screening recommendations (as related to when, whom to screen or test, and how often to screen or test for lead poisoning in a patient population of children) are not followed (Strecher & Rosenstock, 1997).

Perceived Severity

Perceived severity of outcomes is the construct used to measure the perception of the healthcare provider about the seriousness the consequences of not screening and testing are, i.e. perceived seriousness of developing the negative outcomes (Rosenstock, 1974). Shillitoe and Christie (1989) found that low levels of perceived severity might not sufficiently motivate a person to action, whereas high levels could actually impede action, causing the person to feel helpless. Thus perception about severity of lead poisoning to either extreme could lead to a lessened ability of the healthcare provider to discriminate on what should be done in his/her patient population.

Perceived Benefits

Perceived benefits to a healthcare provider are the positive gains made when lead poisoning is prevented or detected early in a patient. Benefits may include such things as improved overall health and quality of life for the patient. Perceived benefit represents a decision balancing the negative outcomes against the positive benefits received in exchange for following screening guidelines and blood testing recommendations (Rosenstock, 1974).

Perceived Barriers

Perceived barriers to the healthcare providers include both tangible and psychological barriers. The tangible barriers would include determining payment for lead blood testing when it is ordered, where the patient goes to have lead testing done, and what follow up measures are necessary if lead poisoning is detected. These barriers might work against initiation or continuation of the blood testing activity (Shillitoe & Christie, 1989). Psychological barriers would include support mechanisms and abilities of the healthcare provider as related to following screening and blood testing recommendations, including referrals for positive cases of lead poisoning. These psychological barriers represent a cognitive assessment of the obstacles, which may interfere with a provider's participation in lead screening and testing process (Strecher & Rosenstock, 1997).

Cues to Action

Cues or stimulus to action are the outside strategies, activating a healthcare provider's following through with educational efforts by making the parent or child caregiver aware of the health consequences of high lead levels (Shillitoe & Christie, 1989). These cues can come in the form of support from governmental agencies, continuing education efforts, and fellow healthcare provider support from the medical establishment including information regarding the illness and how to care for patients with the illness (Strecher & Rosenstock, 1997; Rourke, 1991).

Self-Efficacy

Perceived self-efficacy, according to Bandura (1986) is defined as "a person's judgments of their capabilities to organize and execute courses of action required to attain designated types of healthcare practice". The self-efficacy construct is used to measure the self-empowerment strategy, whereby the healthcare provider is trained and presented with the knowledge of how to care for the patient, and then chooses whether or not to supply needed care based on the information received. Self-efficacy involves combining the knowledge of what lead screening questions are necessary, the procedure for following up with testing for lead poisoning, along with the social and medical skills involved in carrying through with this action. Self-efficacy measures are designed to determine the influence of self-empowerment of the healthcare provider on the outcome of the illness prevention and management.

Application of Health Belief Model

The HBM was originally applied to programs in health to explain what individual motivations were regarding healthcare activities and abilities to participate in life-saving preventive and detection programs offered (Strecher & Rosenstock, 1997; Houthrow & Carlson, 1993). From its initial development it was used to explain people's behaviors as they related to following recommended medical care (Becker, 1974). The HBM has been used successfully in the past for explaining adolescent HIV prevention behaviors (Lux & Pestosa, 1994) and preventative health actions of caregivers (Kegles, 1980). In early studies the theory was used to explain "readiness" of individuals to obtain tuberculosis detection services offered such as X-rays, and determination of the beliefs of the respondents in terms of susceptibility to tuberculosis (Hochbaum, 1958).

Healthcare provider perception of susceptibility, severity of consequences, benefits, cues to action, and self-efficacy are considered to be the determining factors influencing the decision making process. Healthcare providers' beliefs about abilities to control situations often function as one set of determinants of how healthcare providers behave, with thought patterns and emotions influencing how behaviors may alter when placed in stressful situations (Bandura, 1986). There has also been some indication that individual ability to act in a knowledge-consistent way is largely a function of beliefs in

Table 2.1

Health Belief Model Constructs and Definitions

Concept	Definition	Application
Perceived Susceptibility	One's opinion of chances of getting a condition.	Define population(s) at risk, risk level. Risk based on person's characteristics.
Perceived Severity	One's opinion of how serious a condition and its sequel are.	Specify consequences of the risk and the condition.
Perceived Benefits	One's opinion of the efficacy of the advised action to reduce risk or seriousness of impact.	Define action to take; how, where, when; clarify the positive effects to be expected
Perceived Barriers	One's opinion of the tangible and psychological cost of the advised action.	Identify and reduce perceived barriers through reassurance, correction of misin-formation, incentives, assistance.
Cues to Action	Strategies to activate one's "readiness".	Provide how-to infor-mation, promote awareness, employ re-minder systems.
Self-efficacy	One's confidence in one's ability to take action.	Provide training, guidance, in perform-ing action. Demonstrate desired behaviors. Reduce anxiety.

Note. Adopted from: Health behavior and health education theory, research and practice (2nd ed.) Strecher & Rosenstock 1997 [Glanz, Lewis & Rimer,(Eds)]. San Francisco: Jossey-Bass.

the abilities possessed (Rimal, 2000). According to Rimal, knowing what to do, how often it needs to be done, and what results are significant are often issues involved in lead screening and testing that are explained in part by the healthcare provider's perception.

In order to address the unique needs of integrating healthcare provider's knowledge and beliefs as related to childhood lead blood testing practices, the HBM represents constructs of a healthcare provider's beliefs which are thought to present a significant barrier to the parent who might, in an informed situation, seek lead blood testing for the child. The HBM explains the focus of this study and the importance of this study in determining if these barriers do exist and what influences may be present which affect a healthcare provider's beliefs and attitudes toward testing for lead poisoning. These constructs are further defined in Table 2.1 (Strecher & Rosenstock, 1997).

Research and Literature Related to Content

Lead Poisoning Explained

Lead Poisoning Defined

The purpose of this section is to review the scholarly literature available on childhood lead poisoning. Since the complete removal of lead from gasoline in the U.S. around 1995, lead poisoning in children has dropped by 80% (National Health and Nutrition Examination Survey, 1994; Shannon, 1996). Despite the overall decline in lead poisoning, the Childhood Lead Blood Surveillance program indicates the levels of lead in children vary widely within states and still remains high in some counties, particularly in urban areas and extremely rural areas where sources of lead remain unremediated (CDC, 2000a). As a result of the overall decline in lead poisoning, many healthcare providers believe lead poisoning is no longer a significant health problem for children (CDC, 2000a). This assumption may be true for the majority of children in the population but elevated blood lead levels greater than 10 micrograms per deciliter (> 10μg/dl) still remain a significant problem for low income and minority children (CDC, 2000b). The CDC (1997) estimates that approximately 890,000 children in the U.S. still are affected by lead poisoning. Exact figures for childhood lead poisoning in Tennessee are still being tabulated, but figures for neighboring states range from 5-10% of children less than six years of age may still be affected (CDC, 2000a). As stated earlier, North Carolina reports that only 33% of children ages one and two years old are being tested. Among these young children approximately five percent had blood lead levels > 10 μg/dl, considered the threshold level for lead poisoning diagnosis (Norman, 2001).

Prevalence of Lead

Since lead has been removed from gasoline, the major method of lead exposure is now lead paint ingestion and inhalation. Lead paint was used in approximately 60% of the homes built prior to 1960 (CDC, 2001b). Approximately 20 million homes built before 1950 are also still inhabited (Committee on Measuring Lead in Critical Populations, Board on Environmental Toxicology, & Commission on Life Sciences, 1993). It is estimated that 4.4 million of these have at least one child under the age of six (U.S. Department of Housing and Urban Development, 1995). It is also estimated that one-fifth of African-American children living in housing built before 1946 have elevated blood lead levels (CDC, 2000a).

Another source of lead exposure for children is water. Indoor plumbing installed prior to 1970 can contain lead soldering, which leaches lead when heated via having hot water run through the pipes (Committee on Measuring Lead Poisoning in Critical Populations, et al., 1993; Florini, Krumblaun, Silbergeld, 1990). In fact, water lead contamination is not only a residential hazard; it is also a public health hazard and can present problems for children with no other significant risk factors identifiable. In Utah in 1996, a public elementary school were found to have elevated levels of lead in the drinking water supply (Costa, Nuttal, Schaffer, Peterson, & Ash, 1997). Although the blood lead levels in the children tested did not show significant elevations related to the drinking water supply, community concern and awareness was heightened. Lead can also be found in contaminated house dust and soil. It can be found in particulate form, particularly in industrial areas and residential areas near industries producing lead dust particulate (Agency for Toxic Substances and Disease Registry, 1988; Committee on Measuring Lead in Critical Populations et al., 1993). Ingestion is the major route of exposure in cases where lead poisoning is linked to household soil and dust.

Lanphear, Matte, Rogers, Clickner, Dietz, Bornschein, Succop, Mahaffrey, Dixon, Warren, Rabinowitz, Farfel, Rohde, Schwartz, Ashley, and Jacobs (1998b) found that a child's age, race, mouthing behaviors, as well as environmental proximity to hazardous industrial or residential dust, influenced the predicted blood lead level and could be used to determine the potential health hazard. Children ingest more lead dust than adults with an average two year old consuming around 21 μg of lead dust daily as compared to the adult ingestion of only 4.5 μg/day (Environmental Protection Agency, 1986).

In addition to these sources, lead may also be found in varnishes, ceramic glazes, candle wicks, jewelry, vinyl mini blinds, and even in food sources imported from other countries (CDC, 2000b; Committee on Measuring Lead in Critical Populations et al., 1993). Lead exposure is inescapable; therefore, prevention and screening are of utmost importance in the early diagnosis and treatment of the illness (Tong, Von Schirnding, & Prapamontol, 2000).

Effects of Lead Poisoning on Health

Lead poisoning is a preventable health problem (CDC,1991). High levels ($\geq$ 70 μg/dl) can cause seizures, coma, and even death (Committee on Measuring Lead Poisoning in Critical Populations et al., 1993). High levels of lead exposure in children produces effects which are detrimental to every body system often resulting in mental retardation, altered iron uptake by the body and encephalopathy, even leading to death in some cases (Chisholm, 1971). In a recently reported lead poisoning case of a two-year-old girl in New Hampshire residing in homes built prior to 1920, the child had been ingesting plaster from holes in the walls (CDC, 2001b). The child's lead blood levels were found to be 391 μg/dl. Despite chelation therapy the child developed cerebral edema (encephalopathy), which ultimately led to death. In Wisconsin a similar incident occurred in 1990 and a two-year old boy died as a result of ingesting lead paint chips, with a lead blood level of 134 μg/dl (Schirmer, Anderson, & Peterson, 1991).

Neurological and Cognitive Effects of Lead Poisoning

Lead poisoning affects almost every body system, and can occur with no significant visible symptoms. According to Krowchuk (1995), in the majority of lead poisoning cases there are no symptoms. Even at lower levels of lead in the body (less than 20µg/dl) can damage the nervous system causing irreversible brain damage and mental retardation (CDC, 2001a; Holmes, Drutz, Biffone, & Rice, 1997). In low levels, lead can cause decreased intellectual function, with lower IQ's being reported, ultimately leading to a lifelong struggle in learning and knowledge retention (Needleman, 1995; Baghurst, McMichael, Wigg, Vimpani, Robertson, Roberts, & Tong, 1992). Attention deficit, decreased growth, and impaired kidney function are associated with low levels of lead poisoning (CDC, 2001a; Tuthill, 1996). Effects of lead poisoning in children appear largely irreversible due to permanent brain damage that may result from lead poisoning (Needleman & Bellinger, 1991; Tong et al., 1998).

Residual cognitive effects of low to moderate levels of childhood lead exposure can be seen in adults, years later, manifesting as higher drop-out rates in high school, lower class standings, lower vocabulary test scores, reduced eye-hand coordination, and reduced motor functioning (White, Diamond, Proctor, Morey, & Hu, 1993). In a retrospective study of adults from the Bunker Hill experience (1974-5), childhood exposure resulted in significant neurological effects 20 years after exposure when compared to non-exposed control subjects (Stokes, Letz, Gerr, Kolczak, McNeill, Chettle, & Kaye, 1998). In this instance, a cohort of n=917 young adults residing in Silver Valley, Idaho as children in 1974-5 were chosen for study. Silver Valley was known to have an operational smeltering plant during those years, so the industrial exposure to lead dust was an ever-present health hazard for the children. After extensive neurological testing on these adults, it was found there was reduced motor functioning and reaction times, reduced eye-hand coordination and the subjects were seven times more likely not to graduate from high school than the control group chosen from a neighboring town without a smelter (Stokes et al., 1998).

Progress in controlling low levels of lead poisoning in children has been slowed due to the fact that lead poisoning at low levels is often asymptomatic and produces no dramatic effects. The perception of lead poisoning being associated primarily with the minority poor has led to a general level of disregard within the healthcare community (Needleman, 1995). As a result few children outside minority populations are being tested for lead poisoning.

Relationship of Healthcare Provider Demographics

Gender of Provider

Results from a national survey of 3000 randomly selected pediatricians conducted in 1994 revealed that only 53% of pediatricians were testing all patients for lead poisoning (Campbell, Schaffer, Szilagyi, O'Connor, Briss, & Weitzman, 1996). In this survey, universal testing was found to be related to provider characteristics, specifically universal blood testing was more likely to occur if the provider was a female practicing in an urban (within a metropolitan area) location who had graduated from medical school in the past 10 years. Mehta and Binns (1998) found that female healthcare providers also had higher levels of knowledge, disseminated more information to parent concerning sources and potential dangers of lead in the environment, and were more concerned over possible ill effects of lead poisoning.

Location (Urban, Suburban, or Rural)

A community assessment study conducted in Monroe County, New York (1994) found community characteristics associated with higher childhood lead levels in communities where the percent of the Black or Hispanic population is higher (Lanphear, Byrd, Auinger, & Schaffer, 1997; Lanphear, Burgoon, Rust, Eberly, & Warren, 1998a). Increased crowding (associated with urban dwelling), living at poverty level, as well as older age of homes were significantly related to higher blood lead levels of the children within the population (Lanphear et al., 1997; Lanphear et al., 1998b). Inversely related community factors, from this study, included: level of parental education, income level and home ownership.

Schaffer, Kincaid, Endres, and Weitzman (1996) studied a rural county in upstate New York (n= 705) and reported that greater than eight percent of the children had blood lead levels > 10 μg/dl with more than two percent having levels 15 μg/dl or higher. In this study the specific community risk factor identified was living in homes built before 1960. Other community risk factors identified in this study included farm equipment operation, being migrant workers, and location of the farm (Schaffer et al., 1996).

Number of Years Practicing

Ferguson and Lieu (1997) found physician skills in screening children for lead poisoning are often less thorough if the physician has been out of residency for more than 10 years. Residency typically offers the opportunity for pediatricians to develop practice habits and attitudes.

A nation-wide, cross sectional study of pediatric residents (n=143) was recently completed to determine lead-testing and screening practices followed (Schaffer, Campbell, Szilagyi, & Weitzman, 1998). Seventy five percent of the responding residents reported testing the blood of all patients less than six years of age for lead. Responses to the survey indicated the reason universal lead blood testing was done was because the benefits outweighed the cost of testing in the long-run. Of the residents reportedly ordering lead blood tests 88% reported providing information to parents about the dangers posed by childhood lead poisoning and ways to prevent exposure in the child's environment.

Screening Protocol Recommendations and Requirements

Centers for Disease Control and Prevention Screening Protocols

The CDC (1991) has established a set of suggested questions for the provider to ask the primary caregiver of the child either in personal interview or in a questionnaire format. These are to be used in the initial evaluation (screening) of all pediatric patients less than six years old. The <u>suggested</u> lead screening questions from this agency include:

- Does your child live in or regularly visit houses with peeling or chipping paint built before 1960? (This includes daycare, preschool or the home of a sitter or relative.)
- Does your child live in or regularly visit a house built before 1960 with recent or planned renovations or remodeling?
- Does your child have a brother or sister, housemate or playmate being followed up or treated for lead poisoning (levels $\geq$ 15 μg/dl)?
- Does your child live with an adult whose job or hobby involves exposure to lead?
- Does your child live near a lead smeltering or battery recycling plant that may release lead?

Tennessee Department of Health Screening Protocol

The TDH has determined that certain questions to assess the risk of lead poisoning in children must be asked or included as part of the screening process followed at every well child visit between the ages of six months and six years. TDH requires the following questions be included as part of the lead screening protocol used to assess the risk of childhood lead poisoning (i.e. screening protocol followed): (TDH, 2002b)

- Does your child live in or regularly visit a house built before 1950? (This includes a daycare center, home of a babysitter, or relative.)
- Does your child live in or regularly visit a house built before 1978 with recent, ongoing, or planned renovations or remodeling (within the past six months)?
- Does your child have a sibling or playmate that has or did have lead poisoning?

The following questions are recommended by the TDH but are not required (referred to in this study as "optional" screening questions) for inclusion as part of the lead screening protocol followed:

- Does you child frequently come in contact with an adult who works with lead?
- Does your home contain any plastic or vinyl mini blinds?
- Have you ever been told that your child has low iron?
- Does you child live near or visit someone who lives near a lead smelter, battery recycling plant or other industry that could release lead?
- Do you give you child any home or folk remedies that may contain lead?
- Does your child live within 80 feet (or one block) of a heavily traveled road or street?
- Does your home's plumbing have lead pipes or copper pipes with lead solder joints?
- Does your family use pottery ware or leaded crystal for cooking, eating, or drinking?

If the parent or guardian answers "yes" or "don't know" to any of the questions, the child is considered at "risk" and should, according to the TDH , have a subsequent follow up lead blood level done to ascertain if lead poisoning exists. No effort to date has been made to report of attempts to ascertain which of these questions are routinely being included as part of the risk assessment for lead poisoning in children in Tennessee.

Lead Blood Testing Practices and Recommendations

Centers for Disease Control and Prevention Testing Requirements and Recommendations

As a guideline to help practitioners determine when blood testing follow up should be done, the CDC has created the following checklist for the practitioner to utilize. The childhood lead blood testing guidelines recommended by the CDC (1997 & 2000b):

- An initial screening by questionnaire (protocol) to determine risk factors within the environment of the child.
- Universal lead blood testing between the ages of 12-15 months (at the discrimination of each state). If the state chooses, a policy to test only those communities considered to have a high prevalence may be adopted.
- Those with lead blood level $\leq$ 10 µg/dl should be tested again at two years if risk is seen in the initial questionnaire.
- Children with levels between 10-19 µg/dl should be blood tested every three to four months until two consecutive measures are < 10µg/dl.
- If the level is $\geq$ 20µg/dl follow-up should occur more frequently (every one to two months) and environmental investigation is recommended.
- High "risk" children (determined from the screening questions) should have blood testing at 6 months of age, with repeated levels done every six months even if $\leq$ 10 µg/dl.
- Children between the ages of three and six years old not tested previously should be tested if the initial questionnaire indicates high risk is present, with follow-up testing for high "risk" children to occur once a year until the child is six years old.

In an effort to insure all children living in substandard housing conditions are tested for lead, the federal government has required that all Medicaid recipients must be tested at ages one and two years old. All children receiving Medicaid ages three to six years old without a previous blood tested for lead must be tested. (HCFA, part 5, Federal

Medicaid regulation, 1998). These requirements extend to include recipients of TennCare, as it is Tennessee's official Medicaid carrier.

Tennessee Standards for Childhood Lead Blood Testing

Current health standards from TDH require a blood lead level be taken on every child at (or by) 12 months of age and again at approximately 24 months of age if the child is a TennCare or Medicaid recipient (TDH, 2002b). In addition to this all children aged 36-72 months receiving TennCare/Medicaid not previously tested must be tested for lead. The TDH also requires a lead screening questionnaire be completed by every parent or guardian at every well child visit from six month to six years of age. The purpose of the lead screening (as part of the screening protocol) questionnaire is to aid the healthcare provider in determination of children at the most "risk" for lead poisoning, so more frequent blood lead testing and complete evaluation can be done on these children.

Insurance status

Medicaid Recipient Status

In 1997, the CDC issued new guidelines for the lead screening protocol of pediatric patients, which includes targeting specific "at risk" groups for increased surveillance and screening activities. "At risk" groups included minority children, children enrolled in Medicaid, children who dwell in older homes (circa 1970 or before), children living in homes with lead soldered pipes, or children with noted developmental delays or hyperactivity (CDC, 2000a; Linakis, Anderson, & Pueschel, 1996). According to estimates from the National Health and Nutrition Examination Survey (NHANES I)

1991-1994, although children ages one to five years old enrolled in Medicaid account for approximately 83% of the cases (approximately 535,000 children) of lead poisoning (having levels ≥ 20 μg/dl), these children were only tested for lead 19% of the time (CDC, 2000b). In light of recent changes (i.e. reduction in incidence of childhood lead poisoning in the general population), the CDC has changed its testing recommendations from universal blood testing to targeting specific at "risk" groups. It has also been recommended that public health authorities within each stated be empowered to make recommendations on lead blood testing, based on the data specific for the population.

As stated earlier it is required by TDH that children receiving TennCare benefits be tested for lead at ages one and two years (and children three to six years old who have not previously been tested for lead be tested). Children who are not recipients of TennCare benefits are tested for lead based upon lead screening questions which assess the risk of lead poisoning to the child. If lead hazards are determined to be present in the child's environment from this assessment, then the healthcare provider should order subsequent lead blood testing to be done on the child. In order to improve the application of these recommendations within Tennessee, population prevalence estimates and information pertaining to healthcare provider attitude and beliefs concerning childhood blood lead testing need to be obtained for the state.

Interpretation of Lead Blood Data and Suggested Treatment Measures

Centers for Disease Control and Prevention Management Recommendations

According to the CDC (2000a), interpretation of blood lead levels should be done as follows: Blood lead levels ≤ 10μg/dl are considered non-toxic (negative result), posing no risk to the child and requiring no follow-up unless risk factors are present. Levels between 10-14 μg/dl suggest a low-level of exposure and follow-up testing should occur as suggested above to detect further increases in levels. Levels of 15-19 μg/dl indicate mild lead poisoning in children and suggesting there is significant risk for developmental and other problems in the child. Parents of children with blood lead levels in this range should receive education about ways to prevent further environmental exposure to lead (Kimbrough, Levois, & Webb; 1994). Children with levels greater than 20 μg/dl should undergo follow-up confirmation testing along with a complete medical evaluation. Environmental investigation should also occur in these cases and suggested remediation of the environment should happen.

Chelation therapy may be done in severe cases of lead poisoning $\geq$ 45 μg/dl. It is done using a solutions of succimer (2,3 dimercaptosuccinic acid), $CaNa_2EDTA$, or dimercaprol (BAL) either alone or in combinations (Schaffer & Campbell, 1994). Chelation therapy was once thought to be effective for severe lead poisoning, but is not generally recommended unless the blood lead levels are extremely high (> 45 μg/dl) [CDC, 2000b], as the therapy can cause severe side effects. Since the removal of gasoline has significantly decreased the total lead absorption of children in the U.S., this extreme therapy is very rarely needed.

Tennessee Standards for Clinical Management

According to TDH (2002b), initial blood lead evaluations can be done using a finger stick specimen. The TDH standards for clinical management do, however, require all positive lead blood levels ($\geq$10μg/dl) be confirmed via a venous blood sampling. A venous sampling is also required if comprehensive case management and environmental

Table 2.2

Tennessee Department of Health requirements for clinical management and environmental investigation

BLOOD LEAD LEVEL (μg/dl)	ACTIONS
>69	Refer immediately for complete medical evaluation. Establish plan for intervention and follow up based upon physician's evaluation, refer for environmental investigation and lead-hazard control. Test siblings 6-72 months of age.
45-69	Within 48 hours, refer for complete medical evaluation. Establish a plan for intervention and follow up based upon physician's evaluation. Refer for environmental investigation and lead hazard control. Test siblings 6-72 months of age.
20-44	Within 1 week, refer for complete medical evaluation. Establish a plan for intervention based upon physicians evaluation. Refer for environmental investigation and lead hazard control. Test siblings 6-72 months of age.
15-19	Provide family lead poisoning prevention education, follow up testing within 3 months; Refer for social services, if necessary.
10-14	Provide family lead poisoning prevention education, follow up testing within 3 months; Refer for social services , if necessary.
<10	Reassess or retest in 1 year (if the child is less than 24 months old). No additional action necessary unless exposure sources change.

TDH (2002b).

investigation is necessary. If initial finger stick blood test shows a lead level of 10-19 μg/dl, follow up venous lead blood testing should occur by one month; if initial lead blood test shows levels of 20-44 μg/dl, follow up should be done within a week; if initial lead blood test shows 45-59 μg/dl, follow up should occur within 48 hours; if initial lead blood test shows levels between 60-69 μg/dl, follow up should occur within 24 hours; and if the initial lead blood test yielded levels >69 μg/dl, a medical emergency exists, and immediate follow up blood testing should be performed. Requirements for clinical management and environmental investigation are listed in Table 2.2.

Summary

Children are at the greatest risk overall to lead toxicity. The adverse effects of childhood lead exposure often extend into adulthood for this reason it is very important for the healthcare provider to recognize children "at risk" and follow up with lead blood testing when these children are seen as patients. Mahon (1997) found the overall perceived threat of lead poisoning was related to the healthcare providers' interpretation of risk posed by lead poisoning to children of the community.

The CDC has set guidelines for healthcare providers to utilize in the screening of children for lead poisoning. Overall, the guidelines do seem to provide a good source of initial assessment, according to the literature reviewed. Since the removal of lead in gasoline there has been a significant reduction in the percentage of childhood lead toxicity. The next major contributors to lead poisoning in children are the lead-based paints still in many homes built prior to 1970, lead-soldering used in water pipes (also found in older homes), and soil/dust industrial contamination. Location of a child's residence (urban vs. rural) alone may not be the most important factor in household lead exposure, but more importantly the age and condition of the residence. As a result of all of these factors, a multi-tier approach is recommended to follow up on suspected cases of childhood lead poisoning. Included in this multidisciplinary approach is health education, nutritional analysis of the child, and counseling (education) of the parents on abatement of lead sources (Norman & Bordley, 1995).

Research and Literature Related to Methodology

Introduction

This section focuses specifically on the literature related in methodology and the analysis of similar research. Specifically, methodology and instrumentation used in the measurement of healthcare provider beliefs and attitudes are examined. Healthcare provider [i.e. nurse practitioners (clinicians) and physicians] attitudes toward dissemination of information to parents often plays a significant role in determining if the parent receives all of the information needed in order to make an informed healthcare decision concerning a child. An informed healthcare choice is one in which areas of hazards presented, health risk posed, and prevention measures to take are known by the parent.

The healthcare provider/ parent relationship is one of trust and, if the parent is dissatisfied with this relationship or for some reason mistrusts the provider, compliance (or adherence) to prevention measures can be reduced (Gordon & Edwards, 1995). A reported 50% of adults leave a physician's office without receiving all of the information needed to care for medical problems (Gordon & Edwards, 1995). The parent believes the healthcare provider is a trusted source of information and assumes the provider will give them information as the condition warrants (Green, 1985).

Healthcare Provider Attitudes, Beliefs, and Practices

Attitude of Healthcare Provider

In a study to determine if administration of the emergency contraceptive pill (ECP) among adolescent patients is associated with physician knowledge and attitudes toward effectiveness, side effects, and usage information; pediatricians (n= 236) in the metropolitan District of Columbia area were mailed a two-page questionnaire (Sills, Chamberlain, & Teach, 2000). This study was done to assess if the healthcare providers were administering the ECP in cases of rape, incest, etc… where an unintended pregnancy may occur in an adolescent female. Important in the study was the assessment of the attitudes toward using the information the healthcare provider had in relationship to the administration of the drug. Results of the study indicated knowledge deficiencies versus attitude were key factors preventing drug administration.

Hudak, O'Donnell, and Mazyrka (1995) mailed out a 23-question self-administered survey to n=149 pediatricians treating newborns in Western New York in order to determine healthcare provider attitudes toward following American Academy of Pediatrics' (AAP) recommendations and the advice given to parents regarding sleep positions in newborns. Ninety-eight percent of the physicians responding were unaware the AAP recommended newborns be placed on the side or back while sleeping. Seventy-nine percent of the respondents did agree with the recommendation. Lack of information concerning recommended sleeping positions, potential adverse consequences of not using recommended sleep positions, and provider's own experiences relating to newborn sleep positions were noted as reasons for not following the recommendation. It was shown, moreover, once the physician was educated about the reasons behind the recommendation, it was more likely that the recommendations would be followed ($p<0.001$). Physicians recommending the prone (face-down) position after education decreased from 57% to 7% ($p<0.001$). Physicians were also more likely to discuss sleep position with new parents after reviewing the recommendations ($p<0.02$) [Hudak et al., 1995].

Beliefs of Healthcare Provider

Healthcare provider belief in the importance of fluoride supplements in children's health was assessed in a study done by Dillenberg, Levy, Schroeder, Gerston, and Andersen (1992). In this study, a mailed questionnaire was sent to family practice physicians, pediatricians, dentists, and pharmacist in Arizona (n= 1069) to assess if these healthcare provider groups had sufficient knowledge of fluoride recommended dosages in children and what the providers believed to be true about the effectiveness of fluoride delivery methods available (Dillenberg et al., 1992) . Conclusions of this study indicated the recommended dosage methods and concentrations were found to vary widely within the provider community and by provider type. In general it was determined that pediatricians were better informed on the issue and were more likely to prescribe dietary fluoride supplements to their patients than other healthcare providers.

Healthcare Provider Practices

In another study to assess fever treatment, May and Bauchner (1992) determined most pediatricians did believe it was important to educate parents concerning the implication of elevated fevers in children. Most pediatricians believed fevers in excess of 104° could lead to severe complications ($p<0.001$). This five-page self-administered questionnaire was answered by n=172 pediatricians in Massachusetts, all members of the American Academy of Pediatrics (AAP). Beliefs and practices regarding pediatric fever were assessed to determine how and if the parents were educated (given information) by the physician about fever treatment. Outcomes of the study indicated most physicians were educating parents (62%), particularly during child-sick visits, about the complications (namely seizures and dehydration) and fever control measures to take. It was noted in most cases where the parents were not educated (in the office), the barrier most often noted was lack of time on the part of the physician.

Barriers to and Awareness of Procedural Recommendations

Barriers as Perceived by Providers

A recent mailed survey was sent to community pediatricians and family practitioners in Ohio (n= 310) to determine the barriers they perceived in following AAP recommendations on Domestic Violence Screening. Practitioners answered 22 questions concerning healthcare provider attitude, training, knowledge of screening in domestic violence cases, and domestic violence screening practices followed (Erickson, Hill, & Siegel, 2001). Although the majority (64%) of the practitioners in this study were unaware of the recommendations, at least half were screening high-risk families for domestic violence. Although the physicians were unaware of the specific recommendations, about half of the providers used "common sense" and knew some measures needed to be taken to protect children. The most common barriers to asking screening questions (as noted by providers) were the lack of provider education about domestic violence signs and indications (61%), no official protocols to follow if screening showed domestic violence was present in the home (60%), the lack of time for the provider to properly interview families (59%), and the lack of a support network to uphold decisions made (55%) [Erickson et al., 2001].

Perceived barriers to obtaining pneumococcal vaccinations were studied by Noe and Markson (1998). In this study, 405 randomly selected primary care physicians in Massachusetts were surveyed to determine knowledge on current vaccination guidelines. A self-report questionnaire determined that although 79% of the physicians considered themselves knowledgeable about the clinical importance of the vaccinations and reported high immunization rates among patients seen, in reality only a small portion of the patient populations were actually getting the vaccinations. Oversight and failure of the physician to stress the vaccination recommendations often resulted in the patient having the impression the vaccination was not important. Hence, inaction on the part of the physician acted as a barrier to the patient receiving needed medical care (Noe & Markson, 1998).

Policy and Procedure Awareness

In 1997, the Department of Internal and Preventive Medicine at the University of Kansas School of Medicine conducted a study to determine if the low use of preventive medical practices was related to a lack of knowledge concerning recommended practices (Meyers & Steinle, 1997). Three hundred twenty six randomly selected Kansas physicians (composed of family practice, pediatrics, gynecology, and internal medicine practitioners) were surveyed via a questionnaire composed of 11 specific knowledge-based questions based on published recommendations regarding prevention measures used in family practice. In this study, 79% of physicians were aware of the recommendations. A chi-square analysis showed no significant difference between the medical specialties in the overall correct response rates ($p < 0.001$), indicating no one group of physicians was more knowledgeable about the recommendations. Overall the study concluded the low use of preventive medical practices by practitioners was not due to lack of physician awareness of published recommendations, but was due to other factors such as lack of time, lack of personnel, and low reimbursement rates.

Non-response Bias in Healthcare Provider Studies

Physician (or healthcare provider) specific studies are often used as a tool in health research to discover where gaps exist between healthcare provider information and what services are rendered to patients they serve. Attempts to ensure adequate response rates are rarely reported. Mandel-Hanszel tests, Pearson's Chi-squares tests, and regression analysis are often employed in an attempt to compare responder results to non-responder results to determine response bias. Some reported attempts at quantification of non-response are further discussed: Hill, Roberts, Ewing, and Gunnell (1997) suggested that analysis should be done using a small number of the more important questions from a lifestyle survey and randomly calling non-responders, identified through coding of surveys. Barclay, Todd, Finlay, Grande, and Wyatt (2002) reported several differences between non-responders and responders on with a mailed survey to general practice physicians in Wales concerning their training, knowledge, and palliative care abilities. An analysis of non-responder bias was done by coding and identifying non-responders, then comparing non-responders and responders through use logistic regression with medical school qualifications and current membership in the College of General Practitioners. Results of this study indicated that there were few predictors that could be used to determine which individuals would respond and which would not respond.

A health related study was mailed by Nakai, Hasimoto, Murakami, Hayashi, Manabe, and Noda (1997) to 3,000 Japanese persons ages 40-64 years, divided into two groups, one group receiving a lengthy questionnaire and the other group received a shortened version of the questionnaire. Finding of this study indicate that length of questionnaire did not affect response rates. Age of respondent was found to be a better predictor of response, with older persons more likely to respond than younger persons (by 15%). Non-response bias in this study was investigated by comparing late responders to early responders. This study also found that the odds ratio between the current health status and several of the health-related questions was not biased by late response, indicating the non-response bias was not a significant factor in the study findings.

Summary

Healthcare provider attitude assessment questionnaires indicate there are barriers to whether the provider is able or willing to take the time to follow screening and testing recommendations in the treatment of pediatric patients. There are noticeable differences in the beliefs, attitudes and practices within the healthcare community.

Treatment of pediatric patients within the provider community also varies widely. Several factors could contribute to this variation. These factors include, but are not limited to: information received by the provider concerning the recommended protocols for screening and testing, number of years the provider had been practicing, and the importance placed on the illness/treatment by the healthcare provider (often based upon prior experience or information).

Non-responder bias can significantly hinder study outcomes. Responders may be only the persons who actually know or are concerned with the study material, and as a result findings may reflect only responses of knowledgeable, skilled, or well-informed individuals and thereby not be reflective of actual population values. A researcher must be aware that this bias may exist.

Research and Literature Related to Content and Methodology

Introduction

In this section literature was reviewed with emphasis on the relationship between content and methodology, which can be applied specifically to the study purpose stated in Chapter I. As was discussed in the content section, parental knowledge of lead sources might have a large influence on parental concern with the risk presented by lead poisoning in children. Healthcare providers should focus on determining which children are at risk of lead poisoning and use follow up testing to determine what needs to be done next, rather than focusing solely on the adverse outcomes of lead poisoning in children (Porter & Severtson, 2000). This section will focus specifically on literature and research relating healthcare provider's attitudes and beliefs toward screening and testing for childhood lead poisoning.

Practitioner Attitudes

From the use of a physician and nurse practitioner (clinicians) self-report attitude questionnaire administered in Ohio, the most common reasons given for not offering lead screening and blood testing to patients were the office was "too busy," they "forgot," or the child was presented for a "sick" visit and thus did not need routine lead testing (Striph, 1995). Both medical personnel and parents in this study (n=232 children presented at Family Physicians Associates, Flower Hospital, Savannah, Ohio) indicated the CDC guidelines for screening protocols and blood testing were merely "recommendations" and not mandatory, thus screening was not necessary in all cases (Striph, 1995).

In another Ohio study (Choate & Polivka, 2000), advanced nurse practitioners (ANP) registered with the Ohio Board of Nursing (n=1,043), answered a mailed 32-item questionnaire to assess the attitude of these healthcare providers toward lead poisoning prevention and the practices observed. This group of providers is responsible in most Ohio practices for providing lead screening follow-up. Results of this study showed that the responding ANPs overall correctly answered 80% of the 15 questions on knowledge, with a mean of 12.3 correct answers. It was noted that the knowledge questions most often missed by the ANPs were whether hot water could have more lead than cold water and if lead paint was still used for some things. Only 35% of the nurse practitioners answered these questions correctly. An analysis of variance (ANOVA) of the a demographic breakdown of nurse practitioners by specialty type showed there were significant differences in practices followed between specialty groups and number of

Medicaid patients served, with pediatric ANPs indicating believing testing was necessary more often, particularly if the child was a Medicaid recipient ($p<0.001$). Another interesting finding of this study was that 16% of the respondents indicated no one in the office could provide any lead education to the patients.

Physician Beliefs on Prevalence Rates

Physician attitudes and beliefs concerning risk and prevalence of lead poisoning in the area are of utmost importance in determining if the parent receives the information needed for blood testing. In a study of physician belief concerning the prevalence of lead poisoning within a suburban practice in Virginia (n=544) it was found pediatricians believed there was low-lead risk in the area, even when confronted with evidence suggesting the contrary (Bar-On & Boyle, 1994). In this study, a 22-item mailed questionnaire was developed to assess the knowledge of literature concerning childhood lead poisoning, screening, and testing practices observed by the physicians. Three hundred ninety-one primary care pediatricians and 153 sub-specialists physicians responded to the questionnaire. Sixty–two percent of the pediatricians reported asking some (screening) questions to assess risk of lead poisoning. Only 11.7% of the pediatricians indicated universally testing (the blood) of all pediatric patients for lead poisoning while 63% of the pediatricians indicated testing (the blood) of at least some of the patients.

Lead Screening and Blood Testing Practices

Screening and Testing

Physician lead blood testing practices were assessed in a study done by Goldman, Demissie, DiStefano, Ty, McNally, and Rhoads in 1998. A two-page self-administered multiple choice questionnaire on Childhood Lead Screening Knowledge and Practice was developed by an expert panel of New Jersey childhood lead poisoning clinicians and researchers in conjunction with the Childhood Lead Poisoning Prevention Program of New Jersey. The 17-item questionnaire was comprised of four sections: a) physician practice characteristics; b) CDC guidelines and compliance; c) risk assessment, testing and screening protocol, and education practices; and d) barriers to blood testing . A cross-sectional survey of 333 physicians (pediatricians and family practitioners) was conducted to determine the baseline practices followed concerning lead blood testing in children. More than 20% of the physicians indicated there was no lead screening protocol in place when examining a child (i.e. did not ask any questions concerning risk), with an additional 20% only asking lead screening questions about one-quarter of the time. Almost half (49%) of the physicians indicated the office never or rarely educated parents with children less than six years old concerning lead hazards in the environment. Perceived barriers to lead blood testing in children as noted by physicians were: parental resistance or refusal, perceived low-risk of lead poisoning to patients, cost of lead blood testing, and absence of legal mandates forcing lead testing in children (Goldman et al., 1998).

In an effort to conduct a similar survey, an instrument was recently developed by two pediatricians in South Carolina for the Childhood Lead Poisoning Prevention

Program (SCCLPPP). The SCCLPPP is currently in the process of administering the self-reporting (mailed) questionnaire containing 22 general short answer ("Yes" or "No" and numerical choices) testing, screening, and demographic questions along with 14 knowledge/belief-based questions, which have answers on a five-point Likert-type scale (Strongly agree to Strongly disagree) concerning childhood lead poisoning practices among healthcare providers. Results from this survey are unavailable at this time. (SCCLPPP, 2002).

Provider Demographics in Relationship to Screening and Testing

In a study of pediatricians (n= 155) in San Francisco and Alameda counties in California via mailed questionnaire concerning knowledge of the CDC blood testing guidelines and the attitude toward application of these guidelines, only 27% of the respondents actually acknowledged adhering to the CDC blood testing guidelines (Ferguson & Lieu, 1997). Most of the respondents not adhering to the guidelines reasoned that the guidelines were merely "recommendations" and not mandatory. This study also found certain physician characteristics (from the demographic information) significantly influenced whether the guidelines were followed. Physicians with less factual knowledge or out of residency for 20 years or more (49% of the physicians) were less likely to follow the blood testing guidelines (following guidelines only17% of the time). Adherence to the blood testing guidelines also seemed to follow financial incentives for 36 % of the physicians; if the physician thought reimbursement was not available (in this case Medicaid, private pay or HMO pay) then lead blood testing was less likely.

Summary

In a 1994 national telephone survey (n=1604) of parents only about 24% of the children ages one to six years old were reported to have been tested for lead (Binder, Matte, Kresnow, Houston, & Sacks, 1996). The consequences of lead poisoning in children can be devastating. Even low-level exposure can cause developmental delays and deficits in cognitive behaviors in children that may follow the child throughout the child's life (Baghurst et al., 1992; Needleman & Bellinger, 1991). Education of parents concerning the risk presented by lead poisoning and the methods of prevention, as well as early intervention via screening for risk and following up with lead blood testing for those "at risk" are the most promising means of effectively reducing the cases of lead poisoning in children in Tennessee. The healthcare provider's role is to recognize lead poisoning risks, provide the parents with information needed to help make informed decisions regarding the health of the child. In order to effectively do this, healthcare providers must possess knowledge of what actions need to be taken in the detection of lead sources, screening protocols to follow in assessing risk, and when blood testing should be ordered to detect lead poisoning. Key to the dissemination of this information are the beliefs and attitudes of the providers toward screening and blood testing for childhood lead poisoning.

Chapter Summation

Physician and nurse practitioner (clinician) beliefs and practices are often reflected in the type of care that a pediatric patient receives. Screening for childhood ailments is essential to prevention and control efforts. In order to assess the degree of risk presented to the pediatric population in Tennessee by lead poisoning, it is necessary to assess what level of information, as well as beliefs and practices, the healthcare providers in the state are providing to the parents and caregivers of children.

In this chapter the HBM was used to explain the relationship of healthcare provider beliefs to practices including screening protocol and testing of children for lead poisoning. This model was also used to assess how individual provider characteristics may influence these factors. Chapter II contributed to this study by providing information available in the literature concerning lead poisoning, as seen in the content section of this chapter. The methodology section reflected the overall healthcare provider beliefs toward screening and blood testing practices. The content and methodology section presented information from similar studies of healthcare provider attitude/belief as well as information regarding lead testing and screening practices followed by healthcare providers in other states. The researcher found no specific information referencing healthcare provider belief or practices toward lead testing in children and screening protocols for the state of Tennessee.

In the next chapter, Chapter III, specific methodology will be discussed along with the instrumentation chosen for this study. Chapter IV will follow with an in-depth analysis of data collected. Then Chapter V will follow with results and conclusions specifically drawn from this study. Then Chapter VI will follow in retrospect of the study.

Chapter III

METHODOLOGY

Introduction

The Health Belief Model (HBM) with the constructs of perceived severity, perceived susceptibility, perceived benefits, barriers, cues to action, and self-efficacy was used in the development of the theoretical foundation of this research to relate physician and nurse practitioner (clinician) beliefs as influencing the parents in seeking needed preventative and diagnostic lead blood testing for their children. Data and information were gathered to determine the association between healthcare provider beliefs, type of practice (family practice, general practice, pediatrics, or nurse practitioner), if the provider accepted Medicaid (TennCare) children as patients, and provider practices including screening protocol and lead blood testing of children. These data were gathered from a group of physicians and nurse practitioners (clinicians) listed with the TBHS as practicing in Tennessee. This chapter represents a description of the characteristics of the population used in the study, the sampling methodologies, and the instrumentation necessary to collect and analyze the data. This addresses the purpose of the study and research questions introduced in Chapter I of this document.

Population under Study

The target population for this study was the population of general practice physicians, family practice physicians, pediatricians, and selected nurse practitioners (and clinicians) practicing in Tennessee. These healthcare providers were listed with the TBHS as licensed to practice medicine Tennessee. These groups of healthcare provider were chosen because they are presumed to be the most likely healthcare provider groups providing primary healthcare services to children less than six years of age. Provider beliefs, screening protocol followed, and lead blood testing in children is important in the prevention and detection of the disease. The information received from this questionnaire will play an important role in determining what steps should be taken next in the assessing the risk posed by lead poisoning and prevention of childhood lead poisoning within the state of Tennessee.

Population Selection

The TBHS was contacted for information on licensure listings for pediatricians, family practice physicians, general practice physicians, family nurse practitioners, and pediatric nurse clinicians within the state of Tennessee for 2001-2. Three thousand, one hundred and seven (N=3,107) healthcare providers were invited to participate from these groups. A breakdown of this population was: 176 pediatric nurse clinicians, 162 family practice nurse practitioners, 1,041 pediatricians, 1,462 family practice physicians, and 266 general practice physicians were surveyed. Healthcare providers with addresses outside of Tennessee were excluded from the sample, assuming these providers did not provide primary healthcare services to children in Tennessee. The TBHS agreed to provide the researcher with complete mailing labels and telephone numbers for the groups requested. The entire population of 3,107 healthcare providers was asked to complete the questionnaire in an effort to establish statewide statistical data referring to healthcare provider beliefs, screening protocol, and testing practices.

Sampling done using an anonymous survey technique, as tracking of questionnaires was thought to inhibit or deter participation further. It was thought that coding or using identifiers to determine non-responders would in this case further lower the response rate, as the healthcare providers might somehow misinterpret the coding effort as an attempt to identify individual healthcare providers. Reasons given in similar studies used to assess healthcare provider attitudes and beliefs using a mailed questionnaire included: coding of questionnaire could be misunderstood by healthcare provider (Bar-On & Boyle, 1994) and tracking not done in order to maximize response (Goldman et al., 1998). Preservation of anonymity was thought to be an important factor to healthcare provider participation.

Instrumentation

After careful review of the literature, an instrument was not found that would adequately represent the intent of the research without significant adaptation and validation for this study population. The Tennessee Childhood Lead Screening Practices Instrument was created by combining specific questions from the three sources. These sources were: 1) The New Jersey Physician Survey (See Chapter II, Literature Related in Content and Methodology for discussion on the development, validity, reliability, and implementation of this instrument), 2) the South Carolina Physician Attitude Survey (developed for the South Carolina Childhood Lead Poisoning Prevention Program), and 3) new questions developed by the researcher. The questions developed by the researcher were developed based on the review of literature, information from the TDH concerning screening questions and health status requirements, interviews with healthcare providers, and questions relating to the HBM discussed in Chapter I. A panel of experts was created to assist in the development and review of new questions included as part of the questionnaire. As part of the questionnaire, questions were included to collect baseline information concerning the total risk posed by lead poisoning to children in the state of Tennessee by asking the healthcare providers what percent of children seen by the provider had lead blood testing done and the number of TennCare recipients included in the provider's pediatric practice.

Instrument Variables and Constructs

Instrument Construction

Introduction

The questionnaire created by the researcher entitled "The Tennessee Childhood Lead Screening Practices Instrument" consisted of 58 items. The eight-page self-administered questionnaire piloted and administered in this study was comprised of six sections: a) physician characteristics and practice demographics; b) knowledge items relating to significant lead levels and requirements for clinical management from the TDH ; c) blood testing practice item ;d) health beliefs items relating to the Health Belief Model [Glanz et al., 1998; Rosenstock, 1974] ; e) screening questionnaire items, which were listed as required and recommended questions to include in an initial screening protocol of patients; and f) items to assess healthcare provider's interest in parent education and obtaining information on resources available . Not all of these elements

Table 3.1

Items from questionnaire used for analysis

Topical Areas	Questionnaire Numbers
Demographics of Healthcare Provider	53,55,56
Practice Demographics	57
Blood Testing/ Percent of Children Tested	8
TennCare (Medicaid) information	12
"Required" Screening Protocol Variable	41,42,43
Health Belief Model Perceived Susceptibility	17,18,19,20,21,22,23
Health Belief Model Perceived Severity	24,25,26,27
Health Belief Model Perceived Benefits	28,29,30
Health Belief Model Perceived Barriers	31,32,33,34
Health Belief Model Cues to Action	35,36,37
Health Belief Model Self-Efficacy	38,39,40

were significant to this research; some of the questions were for information purposes relating to TDH's requests. Items pertaining to this research included physician characteristics and demographics, the HBM items (including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy), screening protocol items (number of required screening questions asked), percent of childhood population with lead blood testing done and provider information on TennCare (Medicaid) receipt. A question-by-question breakdown relating to the variables used in analysis is given in Table 3.1.

Demographic Information

Respondents were asked to respond to three demographic questions. These were: "Which of the following best describes your professional employment?" Selections included: "a) pediatrician, b) family practice physician, c) general practice physician, d) nurse practitioner, and e) other"; "Please indicate your gender." Selections included: "a) Male or b) Female"; and "Please indicate the length of time you have practiced." Selections included: "a) less than 5 years, b) 5-10 years, c) 11-15 years, d) 16-20 years, and e) greater than 20 years."

Practice Demographics

One item addressed practice demographics. This question was: "Check the blank that best describes the location setting of your primary practice." Choices were: "a) urban, b) suburban, and c) rural."

Screening Protocol Variables

Twelve questions were initially asked to determine the screening protocol practices of the healthcare providers. These questions were related to the recommended risk assessment questions from the TDH. The analysis was to be done only on the three questions "require" by TDH to be asked during the screening process.

Respondents were asked, "For the questions below indicate if your office uses these questions as a part of your childhood lead screening protocol." The required lead screening questions from the TDH were: a) "Does your child live in or regularly visit a house built before 1950?"; b) "Does your child live in or regularly visit a house built before 1978 with recent, ongoing, or planned renovations or remodeling?"; and c) "Does your child have a sibling, close relative or playmate that has or did have lead poisoning?" Participants were asked to respond to these by indicating "Yes", this question was included in the lead screening protocol followed ,or "No" it was not ,or "Do Not Know" if it was not known if the question was included in the lead screening protocol followed.

Optional screening questions from TDH to be used in the screening protocol followed to assess risk posed by lead in the child's environment (questions # 44-52) were not used in the data analysis effort. These items were most often left blank (average approximately 5%), answered "Don't know" (average approximately 20%), or answered "No" (average approximately 50%). This indicated that an average of 25% of the respondents were unsure about information collected in the office. Lack of provider information was suspected as the reason behind the inadequate amount of data collected for these items.

Percent of Children Tested

The percent of children tested for lead poisoning in each providers practice was assessed by asking the participants to "Estimate the percent of children less than six years old seen in your practice who have had a blood test for lead poisoning." Choices were: "a) less than 20%, b) 20-39%, c) 40-59%, d) 60-79%, and e) greater than 80%."

TennCare Provider Information

Information on whether the participant provided primary healthcare services to children receiving TennCare benefits was assessed by asking the respondents to "Estimate the total number children under the age of six years receiving TennCare or Medicaid seen in your practice in 2001." The respondents were asked to state "none" if the office did provide services to TennCare recipients. If the respondent indicated any children seen received these benefits, a "yes" was entered for the variable, if the respondent indicated there were "none seen," a "no" was entered for this variable. As discussed in Chapter II of this document, TennCare requires that all children receiving benefits be tested for lead poisoning at ages one and two years, or at least have lead blood testing done by age six if not previously tested for lead. Children not receiving TennCare benefits are tested for lead based upon lead hazards identified by questions posed in the screening protocol followed in the healthcare provider's office.

Health Belief Model Constructs

Perceived Susceptibility

Participants were asked to respond to seven items pertaining to perceived susceptibility. These included items to assess providers beliefs such as, "Epidemiological studies should be performed to determine which communities have significant lead levels" ; "Childhood lead poisoning is not a significant health threat to patients in my practice"; "Blood lead levels >10 μg/dl are common among children living in poverty in Tennessee" ; " Blood lead levels > 10 μg/dl are common among children living in urban inner cities in Tennessee" ; "Blood lead levels > 10 μg/dl are common among children in rural communities in Tennessee" ; "There are a significant number of children at risk for lead poisoning in my practice to indicate the need to have blood lead levels drawn at the 12 month checkup" ; and "There are enough children in Tennessee with high blood lead levels to warrant universal screening of all children in Tennessee." Each of these items was designed to allow responses on a five-point Likert-type scale from five "strongly agree;" to one "strongly disagree."

Perceived Severity

Four items on the survey instrument addressed perceived severity of lead poisoning. Participants were asked to respond to the statements: "Childhood lead poisoning can result in life long learning disabilities"; " Blood lead levels of > 20 μg/dl should be considered a serious health hazard to children"; "Learning disabilities associated with childhood lead poisoning are irreversible" ; and " It is the duty of the healthcare provider who receives a childhood blood lead level of ≥ 10 μg/dl to report this case to the Tennessee Department of Health." Each of these items was designed to be scored on a five point Likert-type scale ranging from five "strongly agree;" to one "strongly disagree."

Perceived Benefits

Three items on the survey instrument addressed the perceived benefits of testing. The participants were asked to respond to the statements: "Environmental interventions for children who have blood lead levels greater than 20 μg/dl are effective in reducing the severity of the lead poisoning related symptoms in the child"; "It is important to test all children for lead poisoning as early detection of lead poisoning is beneficial to the child" ; and "Removal of lead hazards in the environment can be beneficial in the prevention of childhood lead poisoning." These were scored on a five point Likert-type scale with results ranging from five "strongly agree;" to one "strongly disagree."

Perceived Barriers

Four items on the survey addressed the perceived barriers. Participants were asked to respond to the statements: "Drawing blood lead levels as an in office procedure gets a higher level of compliance than sending children to an out of office lab"; "Educating parents about lead poisoning prevention and detection takes a lot of time"; "Testing children for lead poisoning is expensive so it should only be done when absolutely necessary"; and "Lead blood testing in children is often reimbursed at a very low rate therefore not usually done by our office." Responses were measured on a five point Likert-type scale with results ranging from five "strongly agree;" to one "strongly disagree."

Cues to Action

Three items on the survey addressed the cues to action. Respondents were asked to respond to the statements: "Educating parents about sources of lead exposure is important in the prevention of childhood lead poisoning"; "TV ads about lead poisoning prevention and causes would reduce the rate of exposure to lead in children"; and "Lead screening should be required for all children like a TB screening test as part of the pre-school immunization process." Responses to these were measured on a five-point Likert-type scale with results ranging from five "strongly agree;" to one "strongly disagree."

These items were originally used and validated in "The New Jersey Physician Survey" to assess the cues to action (Goldman, et al., 1998). It was indicated that although these statements were aimed toward cueing parents to action, they were important cues for the healthcare providers as well since parents/childcare providers often initiate the testing process with the healthcare provider.

Self-Efficacy

Three items were incorporated into the survey instrument to address self-efficacy. Respondents were asked to respond to the statements: "My office can educate parents on how to remove lead hazards from the child's environment"; "My office could educate parents about dietary measures that reduce the risk of lead poisoning in children"; and "My office offers educational material concerning lead poisoning prevention to parents." Responses were measured on a five-point Likert-type scale with results ranging from five "strongly agree;" to one "strongly disagree."

Validation and Reliability

Validation

A preliminary copy of the survey instrument entitled "The Tennessee Childhood Lead Screening Practices Instrument" was reviewed by a panel of experts. The panel consisted of two pediatricians (each from a different town in Tennessee), one psychologist, and four nurse practitioners providing primary healthcare services to children. Each of these represented a different town in Tennessee. Two were rural practitioners, two urban practitioners, and two were suburban practitioners. The panel of experts was chosen based upon their experience with childhood disease detection and prevention, location of practices and willingness to participate. The panel members were asked to review the questionnaire to determine content validity, proper survey instrument design, and appropriateness of the instrument for the population under study. The instrument was sent to each of the individuals in the validation panel and comments were collected. Changes were then made to the instrument based on the evaluations received. The statement assessing number of children tested for lead was reworded to reflect the percent of children seen who have been tested for lead (question # 8). The blood lead level on statement on the HBM referencing environmental interventions was changed from 10 μg/dl to 20 μg/dl to make determination of significant level of hazard easier (question # 25). The word important was replaced with the word beneficial in the statement determining whether testing was needed for all children (question # 29).

Reliability

Reliability of the instrument was determined by test-retest of a group of family practice residents at The University of Tennessee Medical Center in Knoxville, Tennessee. A group of 20 physicians were asked to participate in this process and respond to the questionnaire. However, only 12 agreed to participate in the test/retest process. A retest was done 10 days later to determine reliability of the instrument. At this time the respondents were interviewed (via e-mail or comment on returned surveys) to determine if the instrument could be self-administered, if the questions were clear, and if the questions solicited appropriate information.

The initial design of this study was to conduct the test-retest phase of reliability testing on a 25 day schedule. It was believed this group of residents would be together in the family practice rotation of their training for this amount of time. However, as it turned out after initiation of the test phase, the rotation time together was reduced, allowing only 10 days between the test-retest periods.

Pilot Testing

Pilot Data Collection

Pilot testing was conducted with a group of twelve family practice residents at The University of Tennessee Medical Center in Knoxville, Tennessee. This group of physicians was selected to be representative of the population under study. The returned questionnaires along with ancillary information on administration problems encountered were analyzed.

Pilot Data Analysis

Using the Statistical Package for Social Sciences (SPSS) version 10.0, the data collected from pilot testing were analyzed for reliability and validity. Thirty-two variables were analyzed from these participants. The variables included in this analysis were: screening protocol variables (three-using only the required questions), HBM variables (24), personal demographics (gender), and percent of children seen with lead blood testing done. Other variables such as type of provider, location of practice, and TennCare (Medicaid) provision were not analyzed due to the singularity nature of the pilot group. Results of this analysis gave an overall reliability coefficient alpha of 0.8625 for pre testing and 0.8732 for post testing with the 31 variables analyzed. From these results, the instrument was determined to be reliable and dependable for data collection.

Reliability Testing of Health Belief constructs

Given the HBM is composed of constructs put together, a construct by construct analysis was done in order to determine the reliability of each construct in the model. The reliability for the perceived susceptibility construct had a Cronbach's alpha coefficient of 0.9333 for pre-testing and 0.8345 for post-testing. The reliability of the perceived severity construct had a Cronbach's alpha coefficient of 0.8755 for the pre-test and 0.8777 for the post-test. The perceived benefits construct had a Cronbach's alpha coefficient of 0.6220 for the pre-test and 0.7225 for the post-test. Analysis of the cues to action construct gave a Cronbach's alpha coefficient of 0.5796 for the pre-test and 0.6555 for the post-test. The perceived barriers construct gave a Cronbach's alpha coefficient of 0.8255 for the pre-test and 0.8934 for the post-test. Analysis of the self-efficacy construct gave a Cronbach's alpha coefficient of 0.6125 for the pre-test and 0.5250 for the post-test. Results for these constructs show variations in the pre- and post-test periods indicating there were some participants answering the questions differently in the pre- versus post-tests.

Pilot Administration

From the pilot group all physicians were also asked to fill out a short administration questionnaire along with comments. The administration questionnaire contained questions about problems such as readability of the instrument, perceived validity of the instrument, time required to fill out the questionnaire, and asked for suggestions on changes to be made in the instrument. After obtaining this information, suggested changes were made and adjustments were done to make the instrument easier to understand. A change was made in the ordering of the sections of the questionnaire. In order to insure that the HBM statements were completed, the screening protocol questions originally questions # 17-28 were moved to be # 41-52, as the participants in the pilot study indicated they did not understand the importance of these questions and were tempted to stop at this point. A copy of the specific instrument used in this study is included as Appendix B.

A detailed description of how this instrument entitled "The Tennessee Childhood Lead Screening Practices Instrument" was employed to analyze healthcare provider beliefs and characteristics associated with childhood lead practices including screening protocol and blood testing practices will be presented in the following sections. The mean scores for each of the HBM constructs was calculated and used for data analysis of the HBM constructs.

IRB Approval & Confidentiality

The Institutional Review Board (IRB) at the University of Tennessee Knoxville approved a Form A for use in this study because the nature of the study did not include sensitive materials or vulnerable study groups. Permission to proceed with the study was obtained from the IRB. Certificate for exemption from IRB Review involving human subjects is on file in the Department of Health, Safety, and Exercise Science at the University of Tennessee, Knoxville.

Respondents were assured in the cover letter accompanying the questionnaire that participation was strictly voluntary and anonymous. A completed returned questionnaire served as consent to participate in the study. Respondents were also encouraged to complete and return the questionnaire within one month. Also included in the mailing packet was a descriptive study information sheet to explain the study.

Data Collection

Collection Methodology

The questionnaires were sent via regular first class mail to 3,107 physicians and nurse practitioners and clinicians representing the entire population of healthcare providers mentioned. Given this was an adult population, assurance the survey results would in no way be directly linked to any individual, physician, nurse or practice location was provided in the cover letter accompanying the questionnaire. This same data collection method was used in similar surveys of this nature done by Goldman et al. (1998), Choate & Polivka (2000), Bar-On & Boyle (1994), and Ferguson & Lieu (1997). In order to encourage participation in the survey, a return postcard was included in the mailing packet for entry into a drawing for a pair of tickets to The University of Tennessee versus The University of Arkansas football game in Knoxville, Tennessee on October 5, 2002.

Collection Follow Up

Follow up was done by randomly telephoning healthcare providers represented. Each of the healthcare providers was sequentially assigned a number, and then a random numbers table was utilized in the selection of providers to contact via telephone. Three hundred seventeen (317) healthcare providers were contacted using this method, representing approximately 10% of the population included in the original survey mailing. In the telephone call, the healthcare providers were asked if the questionnaire had been returned or if another copy of the questionnaire was needed. Another copy of the instrument was either mailed or faxed of the providers who indicated misplacement of the original questionnaire in the telephone conversation. Less than 15 of the faxed surveys were later returned, indicating that telephoning was not an effective manner of contacting the healthcare providers for follow up.

Data Analysis

Introduction

For all statistical testing a significance level of alpha level of 0.05 was used. Data analysis and compilation were done using SPSS version 10.0. Responses for each of the question areas were summarized. Mean responses for each of the constructs of the HBM as well as self-efficacy were also calculated. Chi-square analyses were performed to determine significant differences, followed by the cross-tabulation residual analysis to determine where differences were most prominent. Multivariate analysis of variance (MANOVA) and Tukey's post hoc (as necessary) was done as follow up to detect where differences lay within grouping of the HBM as related to percentage of children tested for lead , location of practice (urban, suburban, or rural) and gender of healthcare provider. Observance power and sample powers were calculated in order to determine if the sample size was large enough for each analysis.

Variable Analyses

There were eight dependent variables to be used in this analysis. These were: 1) the percentage of children tested for lead, 2) the screening protocol followed, 3) perceived severity (HBM), 4) perceived susceptibility (HBM), 5) perceived benefits (HBM), 6) barriers (HBM), 7) cues to action (HBM), and 8) self-efficacy (HBM).

The statistics applied to the HBM constructs in comparison to the dependent variable of children tested for lead include a multivariate analysis of variance

(MANOVA), by gender and practice location. MANOVA was used because there were six dependent variables from the HBM (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy) and three effects to be tested (gender, location, and percent tested) in the hypothesis testing. A Tukey's post hoc was done to determine differences between percentages of children tested after the MANOVA was performed.

The dependent variable, the percent of children having had lead blood testing done, was compared to the demographic variables and TennCare provision variable via means of the chi-square test. The screening protocol variable was a composite variable determined by the answers to which questions the healthcare provider used as part of the screening protocol followed in the office where they practiced. The screening protocol variables from Table 3.1 were compressed into one variable indicating the number of TDH "required" questions asked by the provider as part of the screening protocol followed. If the healthcare provider used "all three," indicating all three of the required TDH questions were asked; "one or two," indicating one or two of the required screening questions were asked; or "none," indicating none of the required questions were asked as part of the screening protocol followed by the healthcare provider. Further discussion of this variable is found earlier in Chapter II of this document. This variable was compared to the percent of children tested, location of practice (urban, suburban, or rural), and number of years the provider had practiced by using a chi-square analysis followed by a cross-tabulation residual analysis test to indicate where significant differences were most prominent. See Table 3.2 for questionnaire section used and analysis performed in hypothesis testing.

Table 3.2

Questionnaire section and analyses performed

Questionnaire section	Analyses Performed
Demographics of healthcare providers	Chi-square analysis MANOVA
Practice demographics (Location of Practice)	Chi-square analysis MANOVA
Percentage of children with blood testing done	Chi-square analysis MANOVA Tukey's Post-Hoc
TennCare(Medicaid) information	Chi-square analysis
Screening Protocol	Chi-square analysis
Health Belief Model Constructs including Self-efficacy	MANOVA

Coding of Variables

Self-reported lead blood testing practices of the healthcare providers were coded as follows: Responses of "less than 20% tested" were coded as "1," responses of "20-39%" were coded as "2," responses of "40-59% " were coded as "3," responses of "60-79% " were coded as "4," and responses of "greater than 80%" were coded as "5."This self-reported lead testing variable was then recoded and compressed to represent a small ("less than 20%" coded as "1"), medium ("20-79%" coded as "2"),and large ("greater than 80%"coded as "3") percentage of children tested for lead. This was done to improve the power of the test itself and did not affect the outcome of the significance testing.

Practice location variables were : "urban" coded as "1," "suburban" coded as "2," and "rural" coded as "3." Length of time or number of years practicing were coded as follows: A response of " less than 5 years" was coded as "1," "5-10 years" was coded as

"2," "11-15 years" was coded as "3," "16-20 years" was coded as "4," and " more than 20 years" was coded as "5." The gender variable was coded as "0" for "males" and "1" for "females."

The HBM construct variables including perceived severity, perceived susceptibility, benefits, barriers, cues to action, and self-efficacy were all coded on a one to five point Likert scale, with "5" indicating respondents "Strongly Agree," "4" indicating "Agree," "3" indicating respondents were "Not Sure," "2" indicating respondents "Disagree," and "1" indicating respondents "Strongly Disagree" with the statements posed. A mean value was then calculated for each of the constructs of the model.

The number of required screening questions asked as part of the screening protocol followed, as mentioned earlier included compiling whether the provider used "none," "one or two," or "all three" of the TDH's required elements of the screening process. "All three" was coded as "3," indicating all three of the required questions were asked , "one or two" was coded as "2" indicating the provider used one or two of the required questions, and "none" was coded as "1" indicating none of the required questions were asked in the screening process.

TennCare (Medicaid) information was obtained from the question which asked the provider to estimate the total number children seen receiving TennCare (Medicaid) benefits. The TennCare variable was created with responses of "None" being coded as "1" and "TennCare providers" being coded as "2" if it was indicated healthcare was provided to any children receiving TennCare benefits.

Summary

This chapter presented the population characteristics and definition of the group to be studies. Following this the variables used in the study were defined and discussed as they related to the instrumentation (methodology) that was used. Instrumentation including validity, reliability, and usability were also discussed, with changes being made after the initial pilot test to improve utility of the survey instrument. IRB consideration and patient consent information was also presented and discussed. In separate sections the data collection process, data management process, and analysis of the data were discussed. In the next chapter (Chapter IV) will present data as collected, specific results, tables and plots of the analyses done on the data. Chapter V will present specific results and conclusions to address the research hypotheses presented in Chapter I. Chapter IV will also contain a section relating to non-responder data analysis, the method used to analyze the non-response, and the significance of non-response bias if found in this study. Chapter V will present the findings, conclusions, and recommendations based upon the hypotheses tested in Chapter IV. Chapter VI will then present a retrospective analysis of the study.

Chapter IV

ANALYSIS AND INTERPRETATION OF DATA

Introduction

The purpose of this study was to investigate the relationships between healthcare providers' beliefs toward childhood lead poisoning, questions asked in lead screening protocol, and blood lead testing practices in Tennessee. This was done by analyzing data collected from a questionnaire mailed to 3,107 healthcare providers listed with the TBHS as licensed to practice primary care in the state of Tennessee, who were thought to provide primary care services to children. The questionnaire focused on the constructs of the HBM and lead practices followed including testing and number of TDH's required questions asked during screening process. This chapter represents the findings associated with the data as they relate specifically to the research hypotheses introduced in Chapter I of this document.

Population and Sample Description

Population Demographics

This study was conducted to ascertain the health beliefs, testing, and screening protocol questions used by healthcare providers in Tennessee providing primary care to children. A total of 3,107 healthcare providers were mailed a questionnaire. Among these were: 176 pediatric nurse practitioners, 162 family nurse practitioners, 1,041 pediatricians, 1,462 family practice physicians, and 266 general practice physicians. The 58-item questionnaire was sent via first-class mail to the healthcare providers. Four hundred and twenty-six questionnaires were returned by responding healthcare providers. Of the 426 returns, 336 questionnaires were returned as completed questionnaires and usable for analysis. Of the 90 surveys returned that were not included in the analysis, eight were returned as non-deliverable, six were returned by retired providers, two were returned reporting the addressee was deceased, 68 respondents self-reported working only with adults (most of these were nurse practitioners and general practice physicians from the self-reported type of practitioner indicated on the questionnaire), and six respondents self-reported working in specialized areas of pediatric care, not providing primary healthcare services to children. The total of 90 non-usable questionnaires were subtracted from the initial population of 3,107, leaving an eligible population of 3,017 with a total response rate of 11.1% (n=336). Approximate individual response rates by groups can be seen in Table 4.1.

From a mailed-questionnaire study of homeopathic practitioners concerning an individual case analysis, Aghadiuno (2002) reported a disappointing response rate of only 15% but, concluded that the sample size was more significant to the study outcomes than the percentage of returns received, reporting that although the study was small further questions about case analysis and interpretation of law were raised. In a recent survey to study follow up protocol used by French general practice surgeons, 1000 questionnaires were mailed out but only 12.4% were returned. Conclusions to this study were recommended to be interpreted with caution, acknowledging some sample bias may be present in the study (Baufouta, Beauchet, Poisson-Salomon, & Saiag; 1999). Non-response bias analysis will be done later in this chapter.

Before any statistical analysis were performed, sample power and observation power were performed to assure the sample size was adequate for the individual statistical tests performed. No interpretations were made where sample or observation power were below 0.8, indicating power was less than 80%. A further discussion of sample size, sample power, and observation power is included in the data analysis section of this chapter.

Sample Demographics

Of the 336 responses included for analysis, 125 (approximately an 8.5% group return rate) self-reported being family practice physicians, 16 (approximately a 6.0% group return rate) self-reported being general practice physicians, 149 (approximately a 14.3% group return rate) self-reported being pediatricians, and 46 (approximately a 13.6% group return rate) self-reported being nurse practitioners or clinicians. (See Table 4.1) Beyond simple descriptive statistics, this sample of 336 healthcare providers was analyzed as one group without comparisons between the subgroups of healthcare providers in order to insure adequate sample size for data analysis.

Table 4.1

Respondents by healthcare provider type

Provider Group	Frequency	Percent	Approximate % Response by Group*
Family Practice Physician	125	37.2	125/1462 = 8.5%
General Practice Physician	16	4.8	16/266 = 6.0%
Pediatrician	149	44.3	149/1041 = 14.3%
Nurse Practitioners/Clinicians	46	13.7	46/338 = 13.6%
Total	336	100.0	

* note: These percentages do not reflect removal of the 90 respondents indicating they did not provide primary healthcare to children

Table 4.2

Healthcare provider demographics

Variable	N	Percent
Gender		
Males	192	57.1
Females	137	40.8
Missing	7	2.1
Number of Years Practicing		
less than 5 years	79	23.5
6-10 years	75	22.3
11-15 years	50	14.9
16-20 years	37	11.0
more than 20 years	90	26.8
Practice Location		
Urban	94	28.0
Suburban	109	32.4
Rural	127	37.8
Missing	6	1.8

Respondents self-reported being 92 (57.1%) male healthcare providers and 137 (40.8%) female healthcare providers. Seven (2%) of the respondents did not report gender.

Of the self-reported number of years in practice; 79 (23.5%) reported practicing "less than five years," 75 (22.3%) self-reported practicing between "six and ten years," 50 (14.9%) reported practicing "11-15 years," 37 (11.0%) self-reported practicing "16-20 years," and 90 (26.8%) reported practicing "more than 20 years." The self-reported practice locations included 94 (28.0%) practicing in an "urban" community, 109 (32.4%)

practicing in a "suburban" location, and 127(37.8%) practicing in a "rural" community. These demographic characteristics can be seen in Table 4.2

One hundred eighty-one (53.9%) of the respondents self-reported providing healthcare services to children less than six-years-old receiving TennCare(Medicaid) benefits with 93 (27.7%) of the respondent self-reporting only providing healthcare services to children less than six-years-old not receiving TennCare (Medicaid) benefits. There were 62 (18.5%) respondents leaving the question blank. (See Table 4.3)

One hundred fifty-eight (47.0%) of the responding healthcare providers self-reported "less than 20%" of the children seen in their practice were tested for lead, 117 (34.8%) of the responding healthcare providers indicated "20-79%" of the children seen in their practice were tested for lead, and 51 (15.2%) of the responding healthcare providers indicated "more than 80%" of the children seen in their practice were tested for lead. There were 10 (3%) of the respondents leaving this question blank. See Table 4.4 for these results.

Table 4.3

TennCare (Medicaid) provider status

	TennCare Acceptance	Frequency	Percent
	Not a TennCare (Medicaid) provider	93	27.7
	TennCare (Medicaid) provider	181	53.9
	Total	274	81.5
	Missing	62	18.5
Total		336	100.0

Table 4.4

Self-reported percentage of children tested for lead

	Percentage Tested	Frequency	Percent
	less than 20 %	158	47.0
	20-79%	117	34.8
	greater than 80%	51	15.2
	Total	326	97.0
	Missing	10	3.0
Total		336	100.0

Table 4.5

Number of required (from the Tennessee Department of Health) lead screening questions self-reportedly asked by the healthcare provider

Number of required lead screening protocol questions asked by the healthcare provider	Frequency	Percent
Asked None	115	34.2
One or Two	72	21.4
Asked Three	144	42.9
Missing	5	1.5
Total	336	100.0

Results of questions related to the number of "required" lead screening questions asked by the healthcare provider included 115 (34.2%) of the responding healthcare providers self-reporting asking "none" of the lead screening questions "required" by the TDH , 72 (21.4%) of the responding healthcare providers self-reporting asking either "one or two" of the questions in the lead screening process, and 144 (42.9%) of the responding healthcare providers self-reporting asking "all three" of the required questions as a part of the lead screening protocol followed by their practice. Five (1.5%) respondents left the three screening protocol questions blank. (See Table 4.5)

Health Belief Model Constructs

Health Belief Model Analysis

Introduction

Table 4.6 shows the responding healthcare providers' self reported responses to the statements on constructs of the HBM of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

Perceived Susceptibility

Seven statements were used to determine the healthcare provider self-reported perceived susceptibility for childhood lead poisoning. Responses to these statements may indicate the healthcare provider's perception of health risk involved of children because of lead poisoning . Overall responses to questions associated with perceived susceptibility ranged from a low of one indicating the perceived risk was very low to a high of five indicating the respondent perceive the risk to be high.

Table 4.6 Self-reported responses of healthcare providers to statements on Health Belief Model constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy)

Perceived Susceptibility	**N**	**Mean**	**S.D.**
17. Epidemiological studies should be performed to determine which communities have significant lead levels.	335	4.36	0.71
18. Childhood lead poisoning is not a significant health threat to patients in my practice.	335	3.42	1.12
19. Blood lead levels >10 µg/dl are common among children living in poverty in Tennessee.	334	3.13	0.89
20. Blood lead levels >10 µg/dl are common among children in urban inner cities in Tennessee.	334	3.31	0.85
21. Blood lead levels >10µg/dl are common among children in rural communities in Tennessee.	334	2.81	0.83
22. There are a significant number of children at risk for lead poisoning in my practice to indicate the need for having blood lead levels drawn at the 12 month checkup.	335	2.58	1.09
23. There are enough children in Tennessee with high blood lead levels to warrant universal screening of all children in Tennessee.	335	2.73	1.03
Overall Mean		**3.19**	**0.44**
Perceived Severity			
24. Childhood lead poisoning can result in lifelong learning disabilities.	335	4.59	0.53
25. Blood lead levels of >20 µg/dl should be considered a serious health hazard to children.	335	4.41	0.71
26. Learning disabilities associated with childhood lead poisoning are irreversible.	335	3.87	0.82
27. It is the duty of the healthcare provider who receives a childhood blood lead level of ≥ 10µg/dl to report this case to the Tennessee Department of Health.	335	3.90	0.88
Overall Mean		**4.19**	**0.52**

(Table 4.6 continued)

Perceived Benefits	N	**Mean**	**S.D.**
28. Environmental interventions for children who have blood lead levels of >20 μg/dl are effective in reducing the severity of the lead poisoning related symptoms in the child.	334	3.84	0.81
29. It is important to test all children for lead poisoning as early detection of lead poisoning is beneficial to the child.	334	3.37	1.14
30. Removal of lead hazards in the environment can be beneficial in the prevention of childhood lead poisoning.	334	4.56	0.57
Overall Mean		**3.92**	**0.56**
Perceived Barriers			
31. Drawing of blood lead levels as an in office procedure gets higher levels of compliance than sending children to an out of office lab.	334	4.08	0.85
32. Educating parents about lead poisoning prevention and detection takes a lot of time.	334	3.13	1.11
33. Testing children for lead poisoning is expensive, so it should only be done when absolutely necessary.	334	2.50	0.88
34. Lead Blood Testing in children is often reimbursed at a very low rate, therefore it is not usually done by our office.	333	2.59	0.99
Overall Mean		**3.07**	**0.52**
Cues to Action			
35. Educating parents about sources of lead exposure is important in the prevention of childhood lead poisoning.	334	4.34	0.64
36. TV ads about lead poisoning prevention and causes would reduce the rates of exposure to lead in children.	334	3.79	0.90
37. Lead screening should be required for all children like a TB screening test as a part of the pre-school immunization process.	334	3.07	1.10
Overall Mean		**3.73**	**0.65**

(Table 4.6 continued)

Self-efficacy	**N**	**Mean**	**S.D.**
38. My office can educate parents on how to remove lead hazards from the child's environment.	335	3.52	0.96
39. My office can educate parents about dietary measures that reduce the risk of lead poisoning in children.	335	3.57	0.91
40. My office offers educational materials concerning lead poisoning prevention to parents.	335	3.22	1.07
Overall Mean		**3.44**	**0.81**

Self-reported responses of the healthcare providers to the perceived susceptibility statements indicated disagreement most with the statement: "There are a significant number of children at risk for lead poisoning in my practice to indicate the need for having blood lead levels drawn at the 12 month checkup." Responses to this statement resulted in a mean of 2.58 $\pm$1.09, indicating the respondents on the average disagreed with the statement. Of the healthcare providers responding to this question, 14.9% (50) "strongly disagreed," and 40.5% (136) "disagreed," while 20.2% (68) were "not sure," 19.9% (67) "agreed," and 4.2% (14) "strongly agreed." Self-reported response indicated more than half of the participants did not see lead as a significant health threat to children at 12 months of age.

The responding healthcare providers agreed most with the statement: "Epidemiological studies should be performed to determine which communities have significant lead levels." The mean response to this statement was 4.36 $\pm$0.71, indicating that respondents on the average agreed with this statement. Forty-seven percent (158) of the respondents "strongly agreed," 43.2% (145) "agreed," 7.7% (26) were "not sure," 1.5% (5) "disagreed," and 0.3% (1) respondent "strongly disagreed" with the statement. An analysis of reported responses indicated healthcare providers thought environmental or epidemiological studies would be beneficial to them in deciding when to order blood tests for lead.

Perceived Severity

The strongest agreement to perceived severity construct was found when the healthcare providers responded to the statement: "Childhood lead poisoning can result in lifelong learning disabilities." The mean self-reported response to this statement was 4.59 ± 0.53, indicating that most healthcare providers responding either "strongly agreed" or "agreed" with the statement. The overall mean for the perceived severity construct was high at 4.19 ± 0.52, indicating overall the healthcare providers self-reported they did see lead poisoning as having severe effects on children.

Perceived Benefits

When healthcare providers responded the statements about perceived benefits of lead testing respondents were most unsure to the statement: "It is important to test all children for lead poisoning as early detection of lead poisoning is beneficial to the child." A mean score of 3.37 ± 1.14 was obtained with this statement. Of the healthcare provider self-reported responses to statement: 17.6% (59) of the respondents " strongly agreed," 33.6% (113) of the respondents "agreed," 19.3% (65) of the respondents were "not sure," 25.9% (87) of the respondents "disagreed," and 3% (10) of the respondents "strongly disagreed".

Most responding healthcare providers were in agreement with the statement: "Removal of lead hazards in the environment can be beneficial in the prevention of childhood lead poisoning." The mean response to this statement was 4.56 $\pm$0.57, indicating the average healthcare provider response was between "agree" and "strongly agree."

Perceived Barriers

Barriers are associated with whether healthcare providers follow through with lead testing of children when indicated. Healthcare providers reported not being concerned with the cost of the test and did not self-report this as a barrier to lead blood testing in children. The statement: "Testing children for lead poisoning is expensive, so it should be done only when absolutely necessary" had a mean response of 2.50 $\pm$ 0.88, indicating a mean level of disagreement with the statement. Eight percent (28) of the healthcare providers self-reported they "strongly disagreed," 50% (168) of the healthcare providers self-reported they "disagreed," 25.3% (85) of the healthcare providers self-reported they were "not sure," 14.9% (50) of the healthcare providers self-reported they "agreed," and 0.9% (3) of the healthcare providers self-reported they "strongly agreed" with this statement. This indicated expense of the test was not seen by the healthcare provider as a barrier to lead testing.

Most responding healthcare providers agreed with the statement: "Drawing of blood lead levels as an in office procedure gets higher levels of compliance than sending children to an out of office lab." The mean response here was 4.08 $\pm$0.58, indicating the average the respondent "agreed" with the statement and recognized sending children out of the office for lead testing was a barrier.

Cues to Action

Healthcare providers self-reported education of parents as being important in the prevention of childhood lead poisoning. Self-reported responses to the statement: "Educating parents about sources of lead exposure is important in the prevention of childhood lead poisoning" had a mean of 4.34 $\pm$0.64, indicating a general level of agreement with the statement. Responses to this statement indicate that 40.2% (135) of the responding healthcare providers "strongly agreed," 54.8% (184) of the responding healthcare providers "agreed," 2.7% (9) of the responding healthcare providers were "not sure," 1.5% (5) of the responding healthcare providers "disagreed," and 0.3% (1) of the responding healthcare providers "strongly disagreed" with the statement.

Of those healthcare providers responding, a majority were not sure if lead screening should be required for all children. The statement: " Lead screening should be required for all children like a TB screening test as a part of the pre-school immunization process" had a mean response of 3.07 $\pm$ 1.10, indicating the average healthcare provider was "not sure" if this was an important cue to action in screening for lead.

Self-Efficacy

Self-efficacy is important in the sustaining activities of any healthcare initiative. The ability or willingness of the healthcare provider to follow through with lead testing recommendations often hinges on this ability. Responding healthcare providers self-reported they were overall unsure about offering educational material to parents on lead poisoning. The statement: "My office offers educational materials concerning lead poisoning prevention to parents" had a mean self-reported response of 3.22 $\pm$ 1.07. Four percent (14) of the responding healthcare providers "strongly disagreed" with this statement, 28.6% (96) of the responding healthcare providers "disagreed," 15.5% (52) of the responding healthcare providers were "not sure," 44.0% (148) of the responding healthcare providers "agreed," and 7.4% (25) of the responding healthcare providers "strongly agreed" with the statement. .

Responding healthcare providers self-reported not being sure if their office could provide dietary education to parents. The statement: "My office can educate parents about dietary measures that reduce the risk of lead poisoning in children" had a mean response of 3.57 $\pm$ 0.91, indicating an average response of "not sure." Ten percent (34) of the responding healthcare providers "strongly agreed" with this statement, 54.5% (183) of the responding healthcare providers "agreed," 19.0% (64) of the responding healthcare providers were "not sure," 14.6% (49) of the responding healthcare providers "agreed," and 1.5% (5) of the responding healthcare providers "strongly agreed" with the statement.

Table 4.7

Participant responses to the Health Belief Model constructs by location

	Urban			Suburban			Rural		
Constructs of Health Belief Model	**#**	**Mean**	**S.D.**	**#**	**Mean**	**S.D.**	**#**	**Mean**	**S.D.**
Perceived Susceptibility	94	3.22	0.46	108	3.15	0.35	127	3.19	0.49
Perceived Severity	94	4.16	0.56	109	4.24	0.51	127	4.18	0.51
Perceived Benefits	93	4.02	0.59	109	3.82	0.53	127	3.93	0.54
Perceived Barriers	93	3.09	0.54	108	3.07	0.51	127	3.05	0.51
Cues to Action	93	3.74	0.58	109	3.65	0.68	127	3.77	0.68
Self-efficacy	94	3.37	0.84	109	3.53	0.83	127	3.43	0.76

Location and Health Belief Model

There were only slight differences when the overall mean responses to the HBM constructs were compared by practice location (urban, suburban or rural). The mean scores of healthcare providers to the perceived severity construct were 4.16, 4.24, and 4.18 for urban, suburban, and rural practices, respectably. The mean scores for the perceived susceptibility construct were 3.22, 3.15, and 3.19 for urban, suburban, and rural practices, respectably. The perceived benefits construct had mean scores of 4.02, 3.82, and 3.93 for urban, suburban, and rural practices. The perceived barriers construct had mean scores of 3.09, 3.07, and 3.05 for urban, suburban, and rural practices, respectably. Cues to action construct had mean scores of 3.74, 3.65, and 3.77 for urban, suburban, and rural practices, respectably. And self-efficacy constructs had mean scores of 3.37, 3.53, and 3.43 for urban, suburban, and rural practices. (See Table 4.7)

Provider Gender and Health Belief Model

When the healthcare providers self-reported responses to each of the HBM constructs were evaluated by gender, changes were noticed in the mean scores to each of the constructs. Mean scores for the constructs were higher for females than males, with the exception of the perceived barriers construct in which the males self- reported a higher mean score of 3.11 compared to female healthcare providers who self-reported a mean score of 3.01. The mean scores for the perceived susceptibility construct were found to be 3.14 and 3.26 for males and females, respectably. The mean scores for the perceived severity construct were found to be 4.12 and 4.30 for males and females, respectably. Mean scores for the perceived benefits construct were found to be 3.83 and 4.03 for males and females, respectably. When analyzing the cues to action construct,

Table 4.8 Participants' responses to the Health Belief Model constructs by gender

	Male			Female		
Constructs of the Health Belief Model	**#**	**Mean**	**S.D.**	**#**	**Mean**	**S.D.**
Perceived Susceptibility	191	3.14	0.46	137	3.26	0.41
Perceived Severity	192	4.12	0.52	137	4.30	0.51
Perceived Benefits	192	3.83	0.53	136	4.03	0.56
Perceived Barriers	192	3.11	0.51	135	3.01	0.53
Cues to Action	192	3.64	0.68	136	3.84	0.60
Self-efficacy	192	3.31	0.84	137	3.61	0.72

females were found to have a self-reported a mean score of 3.84 and males self-reported a mean score of 3.64. An analysis of the self-efficacy construct, however, showed the largest difference between male and female healthcare providers, with females reporting a mean score of 3.61 and males reporting a mean score of 3.31, indicating female healthcare providers reported believing they had greater self-efficacy (felt more empowered) when deciding to test children for lead than male healthcare providers. See Table 4.8 for the constructs by gender.

Statistical Analysis

The purpose of this study was to investigate the healthcare providers' beliefs and attitudes toward childhood lead practices including number of required lead screening questions asked as part of the screening protocol followed and percentage of children with blood testing for lead in Tennessee. Due to the nature of the data (the data were found to be categorical, multivariate, and binary) the following statistical analysis techniques were employed: Chi-square analyses, cross-tabulation residual analysis, MANOVA, Wilks' Lambda, and Tukey's post hoc analysis, when appropriate, to interpret differences found.

An analysis of sample power or observed power were also performed for each variable in the hypotheses being tested to determine if sample size was adequate for analysis performed. When analyzing the sample power and observed power a result of 0.8 or higher indicated there was a sufficient sample size to detect differences (or relationships).

Hypotheses Testing

Introduction

When testing the research hypothesis described in Chapter I, individual analyses were performed to determine significant differences and relationships between the variables. This section reflects the specific hypotheses presented and the results of the analysis performed toward testing these hypotheses.

Location of Practice (urban, suburban, or rural) and Percentage of Children Tested

Prior to analysis between the self-reported location of practice (urban, suburban, or rural) and the self-reported percentage of children less than six-years-old seen in the healthcare providers practice who were tested for lead a sample power analysis was performed. Sample power on the individual variables used to analyze this research hypothesis resulted in a sample power of 1.00 (100%), indicating the sample was large enough to detect any relationship found. None of the expected cells in the chi-square analysis had less than five expected observations.

To detect differences between healthcare providers' self-reported childhood lead testing practices and self-reported practice location (urban, rural, and suburban) exists, a chi-square analysis was performed. A significant difference was found by chi-square analysis (alpha= 0.05) between provider self-reported location of practice (urban, suburban, or rural) and self-reported percentages of children with blood testing for lead. The value of the Pearson's chi-square test statistic was 10.91 ($p = 0.028$), leading to the conclusion there was a difference between practice locations and percentage of children tested for lead. (See Table 4.9)

Results seen in Table 4.9 indicated suburban practitioners were most frequently found to be reporting "less than 20%" of the children seen were tested for lead poisoning. In investigation of the difference, a cross tabulation table was created to assess the adjusted residuals and determine which location was most different in the self-reported percent of children tested for lead. From cross tabulation the suburban practices reporting "less than 20%" of the children were tested for lead gave an adjusted residual of 3.0. An adjusted residual of + 2 indicates an observed value is significantly different from what was expected.

Number of years practicing and Percentage of Children Tested

Prior to analysis between the self-reported number of years the healthcare provider had been practicing and the self-reported percentage of children less than six-years-old seen in the healthcare providers practice tested for lead, a sample power

Table 4.9

Cross tabulation and residual analysis of self-reported location of practice and self-reported percentage of children tested

			Percent of children < 6 yrs old tested			
			less than 20 %	20-79% tested	more than 80%	Total
Location of practice	urban	Count	38	31	19	88
		% within Location of practice	43.2%	35.2%	21.6%	100.0%
		% within Percent of children < 6 yrs old tested	24.4%	27.0%	38.0%	27.4%
		Adjusted Residual	-1.2	-.1	1.8	
	suburban	Count	65	32	11	108
		% within Location of practice	60.2%	29.6%	10.2%	100.0%
		% within Percent of children < 6 yrs old tested	41.7%	27.8%	22.0%	33.6%
		Adjusted Residual	3.0	-1.6	-1.9	
	rural	Count	53	52	20	125
		% within Location of practice	42.4%	41.6%	16.0%	100.0%
		% within Percent of children < 6 yrs old tested	34.0%	45.2%	40.0%	38.9%
		Adjusted Residual	-1.8	1.7	.2	
	Total	Count	156	115	50	321
		% within Location of practice	48.6%	35.8%	15.6%	100.0%
		% within Percent of children < 6 yrs old tested	100.0%	100.0%	100.0%	100.0%

Chi-Square= 10.906 df= 4 p=0.028

analysis was performed. Sample power on the individual variables used to analyze this research hypothesis resulted in a sample power of 1.00 (100%), indicating the sample was large enough to detect any relationship found. None of the expected cells in the chi-square analysis had less than five expected observations.

A chi-square analysis (alpha= 0.05) between provider self-reported percentages of children with blood testing for lead and the self-reported number of years (length of time) the healthcare provider had been practicing found a significant difference exists between self-reported lead testing practice and number of years the provider had been practicing. The analysis gave a Pearson's chi-square test statistic of 22.21 ($p=0.005$). (See Table 4.10)

The most significant adjusted residual was seen with practitioners self-reporting practicing "more than 20 years" and self-reporting "less than 20 %" of the children seen were tested for lead. By follow up cross tabulation the adjusted residuals analysis determined the residual found with providers practicing "more than 20 years" self-reporting testing of "less than 20%" of the children was 4.0 quite a bit over 2, indicating the observed value was different from the expected value with these practitioners.

Percentage of Children Tested and Health Belief Model Constructs

To determine if a relationship existed between healthcare providers' self-reporting lead testing practices and the healthcare providers' beliefs concerning childhood lead poisoning (including the constructs of perceived severity, perceived susceptibility, perceived benefits, barriers to testing, cues to action, and self-efficacy from the HBM)

Table 4.10 Cross tabulation and residual analysis of number of years (length of time) practicing and self-reported percentage of children tested for lead

			Percent of children < 6 yrs old tested			
			less than 20 %	20-79% tested	more than 80%	Total
Length of time practiced	less than 5 years	Count	29	38	11	78
		% within Length of time practiced	37.2%	48.7%	14.1%	100.0%
		% within Percent of children < 6 yrs old tested	18.5%	33.0%	22.0%	24.2%
		Adjusted Residual	-2.4	2.8	-.4	
	5-10 years	Count	32	26	14	72
		% within Length of time practiced	44.4%	36.1%	19.4%	100.0%
		% within Percent of children < 6 yrs old tested	20.4%	22.6%	28.0%	22.4%
		Adjusted Residual	-.8	.1	1.0	
	11-15 years	Count	21	21	8	50
		% within Length of time practiced	42.0%	42.0%	16.0%	100.0%
		% within Percent of children < 6 yrs old tested	13.4%	18.3%	16.0%	15.5%
		Adjusted Residual	-1.0	1.0	.1	
	16-20 years	Count	16	14	4	34
		% within Length of time practiced	47.1%	41.2%	11.8%	100.0%
		% within Percent of children < 6 yrs old tested	10.2%	12.2%	8.0%	10.6%
		Adjusted Residual	-.2	.7	-.6	
	more than 20 years	Count	59	16	13	88
		% within Length of time practiced	67.0%	18.2%	14.8%	100.0%
		% within Percent of children < 6 yrs old tested	37.6%	13.9%	26.0%	27.3%
		Adjusted Residual	4.0	-4.0	-.2	
	Total	Count	157	115	50	322
		% within Length of time practiced	48.8%	35.7%	15.5%	100.0%
		% within Percent of children < 6 yrs old tested	100.0%	100.0%	100.0%	100.0%

Chi-Square= 22.214 df= 8 p= 0.005

by provider practice location (urban, suburban, or rural) or gender, two MANOVA analyses were performed. For the first analysis in this hypothesis, a MANOVA was done on the location and the self-reported percentage of children tested for lead by the HBM constructs. Using a significance level of alpha= 0.05, no significant relationship between practice location and HBM constructs was found, $F(12, 610) = 1.240$, $p= 0.251$ with a Multivariate MANOVA test used to determine the association between practice location and the HBM constructs of perceived severity, perceived susceptibility, perceived barriers, perceived benefits, cues to action, and self-efficacy. An interaction between the location of the practice and the percentage of children tested for lead was not found to be significantly related to the HBM constructs in this analysis $F(4,1065) =1.370$, $p= 0.110$. (See Table 4.11)

The self-reported percentage of children tested was found to be significantly related to the HBM constructs $F(12,610) = 4.708$, $p <0.001$. An examination of this

Table 4.11

MANOVA of location of practice and self-reported percentage of children tested as related to Health Belief Model constructs

Effect	Wilks' Lambda	F	Hypothesis df	Error df	Sig.	Observed Power[a]
Intercept	.007	7335.7[b]	6.000	305.00	.000	1.000
Location of Practice	.953	1.240[b]	12.000	610.00	.251	.711
Percentage of Children Tested	.838	4.708[b]	12.000	610.00	.000	1.000
Location * Percent Tested	.899	1.370	24.000	1065.2	.110	.903

a. Computed using alpha = .05

b. Exact statistic

Table 4.12

MANOVA of provider gender and self-reported percentage of children tested for lead as related to Health Belief Model constructs

Effect	Wilks' Lambda	F	Hypothesis df	Error df	Sig.	Observed Power[a]
Intercept	.007	7483 [b]	6.000	307.0	.000	1.000
Percentage of children tested	.862	3.947 [b]	12.000	614.0	.000	.999
Gender of Provider	.954	2.468 [b]	6.000	307.0	.024	.829
Percent Tested * Gender of Provider	.972	.733 [b]	12.000	614.0	.719	.436

a. Computed using alpha = .05

b. Exact statistic

Table 4.13

Tests of between subject effects with provider gender and self-reported percentage of children tested for lead

Source	Dependent Variable	F value	Sig.	Observed Power
Gender of Provider	SUSCEPTIBLITY	3.030	0.083	0.411
	SEVERITY	5.370	0.021	0.637
	BENEFITS	5.731	0.017	0.665
	BARRIERS	0.868	0.352	0.153
	CUES	5.251	0.023	0.627
	SELF-EFFICACY	6.531	0.011	0.722
Percentage of Children Tested for Lead	SUSCEPTIBLITY	1.062	0.347	0.235
	SEVERITY	6.619	0.002	0.910
	BENEFITS	10.739	0.000	0.990
	BARRIERS	4.848	0.008	0.799
	CUES	0.381	0.684	0.111
	SELF-EFFICACY	4.896	0.008	0.803

relationship will follow after examination of the second MANOVA analysis between gender, percentage of children tested and the HBM constructs. A second MANOVA was performed to examine the relationship between self-reported gender, self-reported percentage of children tested for lead and the HBM constructs. The resulting MANOVA found there was a relationship between the HBM constructs and gender, $F(6, 307) = 2.468$, $p = 0.024$. The overall observance power for the relationship between gender and HBM constructs was 0.829, indicating sufficient sample size exist. No significant interaction between self-reported gender and self-reported percentage of children tested for lead as related to the HBM constructs $F(12,614) = 0.733$, $p = 0.719$ was found. (See Table 4.12)

Follow up testing of between-subject effects of gender and the individual HBM constructs found overall there was a relationship between gender and the constructs of: perceived severity $F = 5.370$ ($p = 0.021$), perceived benefits $F = 5.731$ ($p = 0.017$), cues to action $F = 5.251$ ($p = 0.023$), and self-efficacy $F = 6.531$ ($p = 0.011$). (See Table 4.13)

The observed power for these individual constructs was less than 0.80, indicating the sample size was not large enough to analyze the individual construct relationships by gender therefore any interpretations of these relationships should be done with caution. (See Table 4.13)

Table 4.12 also shows relationship was found between the self-reported percentage of children tested for lead and the HBM constructs $F(12,614) = 3.947$, $p < 0.001$. This was also seen in the first MANOVA (Table 4.11).

From Table 4.13, the individual HBM constructs most significant to the self-reported percentage of children tested for lead were: perceived severity F= 6.6196 ($p=0.002$), perceived benefits F= 10.739 ($p<0.001$), perceived barriers F= 4.848 ($p=0.008$), and self-efficacy F= 4.896 ($p=0.008$). Further examination of the between subject effects of self-reported percentage of children tested with the individual HBM constructs shows the individual relationships all had high levels of observed power, all $\geq$ 0.8, indicating there was sufficient sample power (sample size) to detect relationships with individual constructs.

If the perceived severity were low, the percentage of children tested was low. If the perceived severity were high, the percentage of children tested was higher. In a Tukey's post-hoc examination to determine how the individual constructs were associated with the percentage of children tested for lead, differences in the "less than 20%" and "more than 80%" tested groups were found in relationship to perceived severity (mean difference = 0.2188, $p= 0.025$), indicating perceived severity was related to a higher percentage of children tested for lead. (See Table 4.14)

The mean score of the perceived benefit construct was higher for the groups of healthcare providers reporting "more than 80%" of the children seen were tested for lead. A Tukey's post-hoc of perceived benefits revealed there were differences between the "less than 20%" tested and "more than 80%" tested groups. The mean difference was 0.2875 ($p= 0.003$), indicating a direct relationship was seen between benefits and self-reported percentage of children tested for lead.

Table 4.14 Post-Hoc between the percentage of children tested and the Health Belief Model constructs

Tukey HSD

Dependent Variable	(I) Percent of children less than 6 yrs old tested	(J) Percent of children less than 6 yrs old tested	Mean Difference (I-J)	Std. Error	Sig.
SEVERITY	less than 20 % tested	less than 20 % tested			
		20-79% tested	-.2051	6.324E-0⁚	.003
		more than 80% tested	-.2188	8.408E-0⁚	.025
	20-79% tested	less than 20 % tested	.2051	6.324E-0⁚	.003
		20-79% tested			
		more than 80% tested	-1.3675E-0	8.748E-0⁚	.987
	more than 80% tested	less than 20 % tested	.2188	8.408E-0⁚	.025
		20-79% tested	1.368E-0⁚	8.748E-0⁚	.987
		more than 80% tested			
BENEFITS	less than 20 % tested	less than 20 % tested			
		20-79% tested	-.2550	6.601E-0⁚	.000
		more than 80% tested	-.2875	8.776E-0⁚	.003
	20-79% tested	less than 20 % tested	.2550	6.601E-0⁚	.000
		20-79% tested			
		more than 80% tested	-3.2479E-0	9.132E-0⁚	.933
	more than 80% tested	less than 20 % tested	.2875	8.776E-0⁚	.003
		20-79% tested	3.248E-0⁚	9.132E-0⁚	.933
		more than 80% tested			
BARRIERS	less than20 % tested	less than 20 % tested			
		20-79% tested	.1394	6.314E-0⁚	.070
		more than 80% tested	.2422	8.396E-0⁚	.011
	20-79% tested	less than 20 % tested	-.1394	6.314E-0⁚	.070
		20-79% tested			
		more than 80%tested	.1028	8.735E-0⁚	.467
	more than 80% tested	less than 20 % tested	-.2422	8.396E-0⁚	.011
		20-79% tested	-.1028	8.735E-0⁚	.467
		more than 80% tested			
SELFEFFI	less than 20 % tested	less than 20 % tested			
		20-79% tested	-.3529	9.485E-0⁚	.001
		more than 80% tested	-.3528	.1261	.014
	20-79% tested	less than 20 % tested	.3529	9.485E-0⁚	.001
		20-79% tested			
		more than 80% tested	1.140E-0⁴	.1312	1.000
	more than 80% tested	less than 20 % tested	.3528	.1261	.014
		20-79% tested	-1.1396E-0	.1312	1.000
		more than 80% tested			

The highest percentages of children tested were found when the perceived barriers were low. A Tukey's post-hoc analysis of the perceived barriers construct found there were significant differences between the "less than 20%" tested group and the "more than 80%" tested group. The mean difference here was -0.2422 ($p= 0.01$). This was an inverse relationship, indicating as the barriers were reduced the self-reported percentage of children tested was higher.

If the healthcare provider had a lower self-efficacy score then it was likely "less than 20%" of the children seen by the provider were tested for lead. A Tukey's post-hoc examination of the self-efficacy construct indicated that significant differences exist between the "less than 20%" tested groups and the other two groups, "20-79%" and "more than 80%" tested. The mean differences were 0.3529 ($p=0.001$) and 0.3528 ($p=0.014$), respectably. Indications were if the healthcare provider believed he could provide information on lead poisoning prevention and treatment to the parents, higher percentages of the children seen were tested for lead. (See Table 4.14)

Number of Screening Questions by Location of Practice or Number of Years Practicing

Prior to analysis between the self-reported location of practice (urban, suburban, or rural) or the self-reported number of years the healthcare provider had been practicing and the self-reported number of required screening questions asked by the healthcare provider, sample power analysis was performed. Sample power on the individual variables used to analyze this research hypothesis resulted in sample powers of 1.00 (100%), indicating the samples were large enough to detect any relationship found. None of the expected cells in the subsequent chi-square analysis had less than five expected

Table 4.15 Chi-square analysis of practice location and number of required screening questions asked

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.658 [a]	4	.798
Likelihood Ratio	1.642	4	.801
Linear-by-Linear Association	.055	1	.814
N of Valid Cases	327		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.48.

observations. A significant difference was not found between the provider's self-reported location of practice and the self-reported number of TDH's required questions asked as part of the lead screening protocol followed by chi-square analysis (at alpha=0.05) with a Pearson's chi-square test statistic of 1.658 (p= 0.798). (See Table 4.15) A significant difference was found between the self-reported number of required screening questions used as part of the lead screening protocol followed and the self-reported number of years the healthcare provider had been practicing. A chi-square analysis found a Pearson's chi-square test statistic of 35.526 (p<0.001). (See Table 4.16)

Cross-tabulation adjusted residual analysis examination found healthcare providers practicing "more than 20 years" were the most likely to report asking "none" of the required screening questions (53.3% of those practicing "more than 20 years") as part of the lead screening protocol followed. The adjusted residual for these healthcare providers was 4.5 (greater than 2), indicating the observed value was different from the expected value. (See Table 4.16)

Table 4.16 Cross-tabulation of length of time practicing and screening protocol

			Ask screening questions required by TDH			
			Ask none of the required questions	Ask one or two of the questions	Ask all three of the required questions	Total
Length of time practiced	less than 5 years	Count	12	27	40	79
		% within Length of time practiced	15.2%	34.2%	50.6%	100.0%
		% within Ask screening questions required by TDH	10.7%	37.5%	27.8%	24.1%
		Adjusted Residual	-4.1	3.0	1.4	
	5-10 years	Count	22	18	34	74
		% within Length of time practiced	29.7%	24.3%	45.9%	100.0%
		% within Ask screening questions required by TDH	19.6%	25.0%	23.6%	22.6%
		Adjusted Residual	-.9	.6	.4	
	11-15 years	Count	17	6	25	48
		% within Length of time practiced	35.4%	12.5%	52.1%	100.0%
		% within Ask screening questions required by TDH	15.2%	8.3%	17.4%	14.6%
		Adjusted Residual	.2	-1.7	1.2	
	16-20 years	Count	13	11	13	37
		% within Length of time practiced	35.1%	29.7%	35.1%	100.0%
		% within Ask screening questions required by TDH	11.6%	15.3%	9.0%	11.3%
		Adjusted Residual	.1	1.2	-1.1	
	more than 20 years	Count	48	10	32	90
		% within Length of time practiced	53.3%	11.1%	35.6%	100.0%
		% within Ask screening questions required by TDH	42.9%	13.9%	22.2%	27.4%
		Adjusted Residual	4.5	-2.9	-1.9	
Total		Count	112	72	144	328
		% within Length of time practiced	34.1%	22.0%	43.9%	100.0%
		% within Ask screening questions required by TDH	100.0%	100.0%	100.0%	100.0%
		Adjusted Residual				

Chi-Square= 35.526 df= 8 $p<0.001$

Number of Required Screening Questions and Percentage of Children Tested

Prior to analysis between the self-reported number of required lead screening questions asked as part of the lead screening protocol and the self-reported percentage of children less than six-years-old seen in the healthcare providers practice tested for lead, a sample power analysis was performed. Sample power on the individual variables used to analyze this research hypothesis resulted in a sample power of 1.00 (100%), indicating the sample was large enough to detect any relationship found. None of the expected cells in the subsequent chi-square analysis had less than five expected observations.

A significant difference by chi-square analysis was found between the self-reported percentage of children tested for lead and the self-reported number of TDH's required screening questions used as part of the screening protocol followed. The chi-square analysis yielded a Pearson's chi-square test statistic of 60.568 ($p < 0.001$). (See Table 4.17)

A follow up cross-tabulation analysis to determine where the difference was most significant found the healthcare providers reporting "less than 20%" of the children seen had been tested for lead, most often reported "none" of the required screening questions were asked as part of the screening protocol followed, with an adjusted residual of 6.7. These results indicate that healthcare providers not asking the required screening questions are most likely not testing for lead either. (See Table 4.17)

Table 4.17

Cross-tabulation of healthcare providers' self-reported percentage of children tested for lead and number of Tennessee Department of Health's required screening questions

		Ask screening questions required by TDH			
		Ask none of the required questions	Ask one or two of the questions	Ask all three required questions	Total
less than 20 % tested	Count	82	31	44	157
	% within Percent of children < 6 yrs old tested	52.2%	19.7%	28.0%	100.0%
	% within Ask screening questions required by TDH	74.5%	43.7%	31.2%	48.8%
	Adjusted Residual	6.7	-1.0	-5.6	
20-79% tested	Count	22	35	58	115
	% within Percent of children < 6 yrs old tested	19.1%	30.4%	50.4%	100.0%
	% within Ask screening questions required by TDH	20.0%	49.3%	41.1%	35.7%
	Adjusted Residual	-4.2	2.7	1.8	
more than 80% tested	Count	6	5	39	50
	% within Percent of children < 6 yrs old tested	12.0%	10.0%	78.0%	100.0%
	% within Ask screening questions required by TDH	5.5%	7.0%	27.7%	15.5%
	Adjusted Residual	-3.6	-2.2	5.3	
Total	Count	110	71	141	322
	% within Percent of children < 6 yrs old tested	34.2%	22.0%	43.8%	100.0%
	% within Ask screening questions required by TDH	100.0%	100.0%	100.0%	100.0%
	Adjusted Residual				

Chi-Square= 60.568 df= 4 p <0.001

TennCare (Medicaid) Reimbursement Acceptance and Percentage of Children Tested

Prior to analysis between the self-reported acceptance of TennCare (Medicaid) reimbursements and the self-reported percentage of children less than six-years-old seen in the healthcare providers' practice tested for lead, a sample power analysis was performed. Sample power on the individual variables used to analyze this research hypothesis resulted in a sample power of 1.00 (100%), indicating the sample was large enough to detect any relationship found. None of the expected cells in the subsequent chi-square analysis had less than five expected observations.

A significant difference was found by chi-square analysis (at alpha=0.05) between the self-reported percentages of children tested for lead and the self-reported acceptance of TennCare (Medicaid) reimbursement with a Pearson's chi-square test statistic of 41.838 ($p < 0.001$). (See Table 4.18)

Cross-tabulation residual analysis to determine where the difference was most significant found healthcare providers self-reporting not accepting TennCare (Medicaid) reimbursement were the most likely group to be testing "less than 20%" of the children seen, with an adjusted residual of 6.3. Healthcare providers accepting TennCare (Medicaid) reimbursements indicated testing "20-79%" to "more than 80%" of the children seen, with residuals of 3.4 and 4.2, respectably. Healthcare providers accepting TennCare reimbursements appear to be more likely to test a higher percentage of children for lead.

Table 4.18

Cross-tabulation of healthcare providers' self-reported percentage of children tested for lead and self-reported TennCare (Medicaid) reimbursement acceptance

			Are you a TennCare (Medicaid) provider for children <6 yrs old?		
			Not a TennCare (Medicaid) provider	TennCare (Medicaid) provider	Total
Percent of children < 6 yrs old tested	less than 20 % tested	Count	72	70	142
		% within Percent of children < 6 yrs old tested	50.7%	49.3%	100.0%
		% within Are you a TennCare (Medicaid) provider for children <6 yrs old?	79.1%	38.9%	52.4%
		Adjusted Residual	6.3	-6.3	
	20-79% tested	Count	17	71	88
		% within Percent of children < 6 yrs old tested	19.3%	80.7%	100.0%
		% within Are you a TennCare (Medicaid) provider for children <6 yrs old?	18.7%	39.4%	32.5%
		Adjusted Residual	-3.4	3.4	
	more than 80% tested	Count	2	39	41
		% within Percent of children < 6 yrs old tested	4.9%	95.1%	100.0%
		% within Are you a TennCare (Medicaid) provider for children <6 yrs old?	2.2%	21.7%	15.1%
		Adjusted Residual	-4.2	4.2	
Total		Count	91	180	271
		% within Percent of children < 6 yrs old tested	33.6%	66.4%	100.0%
		% within Are you a TennCare (Medicaid) provider for children <6 yrs old?	100.0%	100.0%	100.0%
		Adjusted Residual			

Chi-Square =41.838 df= 2 p <0.001

Analysis of Non-Response Bias

A response rate of 11% can significantly bias the study results. Cost and time consideration made repeat follow-ups of all participants in this survey difficult. Assessing non-response bias in this case was also hindered by the confidentiality constraints of the survey. It was believed that any breach of confidentiality by attempting to track or code the material might further inhibit the response rates. Armstrong and Overton (1977) estimated non-response bias on mailed surveys by comparing early responders to late responders, indicating that late responders most closely parallel non-responders, as they delayed returning responses. Armstrong and Overton used approximately 10% percent of the total returns for this analysis. In an attempt to do a similar analysis with the data collected for this survey, results of five early responders and five late responders from each of the four healthcare provider groups for a total of 20 early returns and 20 late returns (which included the 15 faxed returns which were received after telephone follow up was done). The total sample size for this analysis was 40 returned surveys. The early responders were compared to the late responders using Pearson's chi-square analysis to determine if there were differences between how early and late responders answered the statements and questions posed by the instrument. All variables used in this research were compared by time of return (early versus late). Time of return was a study defined variable, coded as returns were received. Early returns were those received at the beginning of the data collection period and late returns were received toward the end of the data collection period. Significance of the chi-square analysis of the variables used for data analysis were: Gender ($p = 0.749$), length of time

Table 4.19

Chi-square comparisons of early versus late returns in non-response bias analysis

Variable	chi-square value	df	Significance
Gender	0.102	1	0.749
Length of Time in Practice	5.467	4	0.243
Location of Practice	3.793	2	0.150
Percent of children tested	0.681	2	0.711
Screening questions asked	0.170	2	0.919
TennCare Acceptance	0.121	1	0.728
HBM- Susceptibility Variable	8.923	11	0.629
HBM- Severity Variable	3.667	8	0.886
HBM- Benefits Variable	4.868	6	0.561
HBM- Barriers Variable	7.894	10	0.639
HBM- Cues to Action Variable	9.280	9	0.412
HBM- Self-efficacy Variable	14.200	10	0.164

practicing (p= 0.243), location of practice (p= 0.150), percent of children tested (p=0.711), screening protocol (p= 0.919), TennCare acceptance (p= 0.728), Susceptibility (p= 0.629), Severity (p= 0.886), Benefits (p= 0.561), Barriers (p= 0.639), Cues to Action (p= 0.412), and Self-efficacy (p= 0.164).

Results of this analysis indicate that there was not a significant difference at alpha= 0.05 between early responders and late responders on any of the variables used in data analysis of this study. These results indicate that non-responders bias is probably not a significant factor to the outcomes of this study. The chi-square analysis comparison of study variables can be seen in Table 4.19.

Summary

This chapter presented the analysis and interpretation of data collected from the survey of healthcare providers in Tennessee. The analyses of the self-reported data found self-reported lead testing was significantly associated with the number of years which the provider had practiced, with healthcare providers in practice “more than 20 years” reporting most frequently “less than 20%” of children seen were tested for lead.

Increases in self-reported percentages of children tested for lead was also found to be associated with a higher number of the required TDH screening questions asked as part of the lead screening protocol followed, indicating a more thorough screening process. Acceptance of TennCare (Medicaid) reimbursements was also associated with higher percentages of children being tested for lead.

The self-reported number of required screening questions asked as part of the lead screening protocol followed did not significantly differ by the self-reported location of practice (urban, suburban, or rural).

The number of years the provider had been practicing was significantly associated with the number of required screening questions asked as part of the screening protocol followed by the healthcare provider. Healthcare providers self-reportedly practicing “more than 20 years” were found to be doing less thorough lead screening, most often asking “none” of the required questions as part of the lead screening protocol followed.

The HBM constructs of perceived severity, perceived benefits, and self-efficacy skills were found to be related to increases in the percentage of children tested for lead poisoning. Healthcare providers who believed lead presented a significant health threat to children, saw benefits in testing children for lead poisoning, and believed they could provide parents with the necessary information on follow up treatment, reported higher percentages of children were tested for lead. An opposite relationship was found between the perceived barriers construct and percentage of children tested for lead, with increases in lead testing seen as the perceived barriers were reduced.

Finally, non-responder bias analysis was performed (due to low response rate) by comparing study variable responses of early responders with late responders for each of the healthcare provider groups studied. Non-responder bias was not indicated by the analysis performed as being statistically significant to the study outcomes.

Chapter V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Study

The purpose of this study was to investigate the health beliefs of healthcare providers in Tennessee toward childhood lead practices including lead testing and number of TDH's required screening questions asked as part of the screening protocol. Healthcare providers in Tennessee most likely providing primary healthcare services to children were surveyed for this research.

A questionnaire based upon the HBM was developed, piloted and administered to collect the required data. A panel of experts, assumed to be providing primary health care to children validated the instrument. Recommended changes were made in the format and administration of the questionnaire. The instrument was then pilot tested for reliability using a group of family practice residents. The health belief portion of the instrument used was presented in a Likert-scale format, and was similar in nature and format to surveys administered and validated in New Jersey and North Carolina by the Childhood Lead Poisoning Prevention Programs in those states.

The data collected were coded and analyzed by using chi-square testing, residual analysis, MANOVAs and post-hoc Tukey's. Sample power and observed power were done to determine if the sample size was adequate to detect relationships in question. Comparisons were done between the HBM to the self-reported percentages of children tested for lead by self-reported practice location and self-reported gender of the provider. Comparisons were also made between the self-reported percentage of children tested for lead by self-reported practice location and number of years the healthcare provider had practiced. Comparisons were made by using the number of required screening questions used as part of the screening protocol followed and the self-reported percentage of children tested for lead, self-reported practice location, and self-reported number of years the provider had practiced. Finally, non-response bias was analyzed using chi-square statistics. It was determined that non-responder bias while it may exist, was not detected in this analysis and thus, was not thought to significantly affect study outcomes.

General Findings

i) An analysis of the self-reported location of practice reported there were 28.0% (94) urban healthcare providers, 32.4% (109) suburban healthcare providers, and 37.8% (127) rural healthcare providers responding to the questionnaire.

ii) Forty-eight percent (156) of the responding healthcare providers self-reported testing "less than 20%" of the children seen in the practice for lead poisoning.

iii) Only 15.6% (50) of the responding healthcare providers self-reported testing "greater than 80%" of the children seen in their practice for lead poisoning.

Findings as Related to Hypothesis Testing

Hypothesis #1: Healthcare providers' self-reported percentage of children tested for lead and the self-reported practice location (urban, suburban, or rural)

i) Healthcare providers' self-reported lead testing practices were found to be significantly different by the self-reported location of the practice, particularly for children in suburban areas, with a Pearson's chi-square of 10.906 ($p= 0.028$).

ii) Of the responding suburban healthcare providers 60.2% (65) self-reported "less than 20%" of the children seen in the practice were tested for lead.

iii) Of the rural healthcare providers 42.4% (52) self-reported between "20-79%" of the children seen in the practice were tested for lead.

iv) Of healthcare providers in suburban practices 10.2% (11) self-reported "more than 80 %" of the children seen in the practice were tested for lead.

v) Of the healthcare providers self-reporting "more than 80%" of the children seen in the practice were tested for lead: 38.0% (19) were urban and 40.0% (20) were rural healthcare providers.

Hypothesis #2: Healthcare providers' self-reported percentage of children tested for lead and self-reported number of years in practice

i) The self-reported lead testing of children was found to be significantly different by the self-reported number of years a healthcare provider had been practicing with a Pearson's chi-square value of 22.214 ($p= 0.005$).

ii) Healthcare providers self-reporting “less than 20%” of children seen were tested for lead had most often self-reported practicing “more than 20 years” with an adjusted residual value of 4.0 seen on the cross-tabulation analysis.

iii) Of the healthcare providers self-reporting practicing “more than 20 years,” 67.0% (59) self-reported testing “less than 20%” of the children seen in the practice.

iv) Healthcare providers self-reporting practicing “less than five years” more than 60% self-reported testing at least 20% of the children seen for lead, with 48.7% (38) self-reporting “ 20-79%” of children seen had been tested and 14.1% (11) reporting that “more than 80%” were tested for lead.

Hypothesis #3: Healthcare providers' self-reported percentage of children tested for lead and practice and the providers' beliefs (from the Health Belief Model) by provider gender or practice location (urban, suburban, or rural)

i) Overall females healthcare providers were found to rank (by means) the HBM constructs of perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy higher with an $F= 3.947$, $p= 0.024$, but the observed power of the individual HBM constructs (less than 0.8) indicated that interpretation of the individual constructs as related to gender was impossible.

ii) No significant relationship was found between healthcare provider's self-reported location of practice and the HBM constructs by MANOVA test with a Wilks' Lambda value of $F(12,610) = 1.240$, $p = 0.251$ at alpha 0.05 level of significance.

iii) No interaction was found between the healthcare provider's self-reported location of practice and the self-reported percentage of children tested for lead by MANOVA with a Wilks' Lambda $F(24, 1065.2) = 1.370$, $p = 0.110$.

iv) A significant relationship was found between the HBM constructs and the self-reported percentage of children tested for lead, with a Wilks' Lambda $F(12,610) = 4.708$, $p<0.001$.

v) The self-reported percentage of children tested for lead was found to be related by MANOVA to the HBM constructs with a Wilks' Lambda $F(12,614) = 3.947$, $p<0.001$.

vi) Responses to the means of the HBM constructs of perceived severity $F= 6.619$ ($p=0.002$), perceived benefits $F= 10.739$ ($p<0.001$), and self-efficacy $F= 4.896$ ($p=0.008$) were found to be related to self-reported higher percentages of children tested for lead being reported ("more than 80%").

vii) Responses to the means of the HBM construct of perceived barriers was found to be inversely related $F= 4.848$ ($p=0.008$) to the self-reported percentage of children being reported as tested, indicating as the perceived barriers were removed, percentages of children tested rose.

Hypothesis #4: Number of Tennessee Department of Health's required screening questions asked as part of the screening protocol followed by the self-reported location of practice (urban, suburban, or rural) or the self-reported number of years the provider had been practicing

i) The number of required screening questions asked as part of the screening protocol was not found to significantly differ by the self-reported location of the practice (urban, suburban, or rural) with a Pearson's chi-square of 1.658 ($p=0.798$).

ii) "None" of the Tennessee Department of Health's required screening questions were self-reportedly asked by 35.5% (33) of urban respondents, 33.9% (37) suburban respondents, and 33.6% (42) of the rural respondents as part of the screening protocol.

iii) "One or two" of the required questions were self-reportedly asked by 19.4% (18) of the urban respondents, 20.2% (22) of the suburban respondents, and 25.6% (32) of the rural respondents as part of the screening protocol.

iv) "All three" of the Tennessee Department of Health's required screening questions were self-reportedly asked as part of the screening protocol by 45.2% (42) of the urban respondents, 45.9% (50) of the suburban respondents, and 40.8% (51) of the rural respondents.

v) The self-reported number of required screening questions asked as part of the screening protocol was found to significantly differ by the self-reported number of years the provider had been practicing, with a Pearson's chi-square value of 35.526 ($p<0.001$).

vi) Of those providers self-reportedly practicing "more than 20 years," 53.3% (48) reported asking "none" of the required screening questions as part of the screening protocol followed.

vii) Of the providers self-reporting practicing "less than five years," 50.6% (40) reported asking "all three" of the required screening questions as part of the screening protocol.

Hypothesis #5: Healthcare providers' self-reported percentage of children tested for lead and the number of Tennessee Department of Health's required screening questions asked as part of the screening protocol followed

i) A significant difference was found between the self-reported percentage of children tested for lead and the number of required screening questions asked by the healthcare provider with a Pearson's chi-square of 60.568 ($p<0.001$).

ii) Of healthcare providers self-reporting "less than 20%" of the children were tested for lead, 74.5% (82) reported not asking any of the required questions as part of the screening protocol.

iii) Of healthcare providers self-reporting "more than 80%" the children seen were tested for lead, 78.0% (39) self-reported asking "all three" of required questions as a part of the screening protocol.

iv) Of those healthcare providers self-reporting "20-79%" of the children seen were tested for lead, 30.4% (35) self-reported asking "one or two" of the required questions as part of the screening protocol, and 50.4% (58) self-reported asking "all three" of the required questions.

Hypothesis #6: Healthcare providers' self-reported percentage of children tested for lead and acceptance of TennCare (Medicaid) reimbursements as payment for services

i) Healthcare providers' self-reported percentage of children tested for lead was found to significantly differ by the self-reported acceptance of TennCare (Medicaid) reimbursements as payment for services within the practice, with a Pearson's chi-square of 41.838 ($p<0.001$).

ii) Of the healthcare provider's self-reporting "more than 80%" of the children seen were tested for lead, 95.1% (39) self-reported accepting TennCare reimbursements as payment for services within their practice.

iii) Of healthcare providers self-reporting not accepting TennCare (Medicaid) reimbursement as payments for services within their practice 79.1% (72) self-reported "less than 20%" of the children seen were tested for lead.

iv) Of the healthcare providers self- reporting "20-79%" of the children seen were tested for lead 80.7% (71) reported accepting TennCare reimbursements as payment for services within their practice.

v) Of the healthcare providers who self-reported accepting TennCare reimbursements, 38.9% (70) reported "less than 20%" of the children seen were tested for lead.

Conclusions

Within the limitations of this study, analysis of the data, and the findings presented in the previous section, the following conclusions can be drawn.

Conclusion #1: Suburban practices were associated with lower percentages of children being tested for lead than urban or rural practices. Sixty percent of the responding suburban practitioners self-reported that "less than 20%" of the children they saw had been tested for lead.

Conclusion #2: The longer a healthcare provider had been practicing, the less likely the healthcare provider was to test children for lead. Healthcare providers reporting practicing "more than 20 years" were least likely to report testing children for lead whereas, healthcare providers reporting practicing for "less than five years" reported testing higher percentages of children for lead.

Conclusion #3: Gender and the HBM constructs (perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy) were found to be related. However, further interpretation of the relationship could not be determined as the sample size was not large enough for interpretation between gender and the individual HBM constructs. In addition, the healthcare provider's self-reported practice location (urban, suburban, or rural) was not significantly related to any of the HBM constructs.

The HBM constructs of perceived severity, perceived benefits, perceived barriers, and self-efficacy were found to be related to higher percentages of children tested for lead. As the perceived severity, perceived benefits of testing, and self-efficacy skills of the healthcare provider went up; the self-reported percentage of children tested for lead also rose. The perceived barrier construct was negatively related to the percentage of children tested for lead. As the perceived barriers went up, the reported percentage of children tested for lead fell.

Conclusion #4: The number of "required" screening questions used by the healthcare provider did differ by the number of years the healthcare provider reported practicing. Healthcare providers reporting practicing for "more than 20 years" were less likely to be asking all of the required screening questions as part of the lead screening protocol followed. The reported location (urban, suburban, or rural) of the healthcare provider, however, did not make a difference in the number of "required" screening questions ask as part of the lead screening protocol.

Conclusion #5: A difference in the number of "required" screening questions used as part of the lead screening protocol was related higher reported percentages of children with lead blood testing. Healthcare providers self-reporting asking "all three" of the required screening questions also self-reported testing higher percentages of children for lead.

Conclusion #6: Healthcare providers who reported accepting TennCare (Medicaid) reimbursements were more likely to report higher percentages of children with lead blood testing. At least 60% of the healthcare providers accepting TennCare report testing between 20% and 100% of the children seen for lead.

Recommendations

The following recommendations are based upon the findings and the conclusions of this study:

Recommendation #1: Finding from this study indicated that suburban practitioners report less of the children they see have lead blood testing done. Reasons for suburban practitioners to be testing fewer percentages of children for lead need to be investigated. Possible reasons may be that the lead screening indicated actual blood testing was not needed, based upon fewer risk factors present in a suburban environment. Or there may be fewer TennCare recipients in suburban locations and thus the number children required to have lead blood testing done may be lower in these areas.

Recommendation #2: Healthcare provider continuing education efforts should be specifically concentrated toward providers practicing for more than 20 years. Results of this study indicated providers practicing more than 20 years were less likely to have children tested for lead.

Recommendation #3: An investigation of gender differences in relationship to the practices involve in lead blood testing should be done. Gender differences were seen in beliefs concerning lead blood testing but, no further investigation of this could be done based on the data provided.

Finding of this study also indicate the percentage of children tested for lead rose when the perceived benefits to testing, perceived severity, and self-efficacy skills of the healthcare provider went up. Increasing efforts toward providing the healthcare provider with information needed to empower him/her in determining when lead blood testing is needed, increasing provider awareness of the benefits of lead blood testing, and increasing provider awareness of the severe consequences of not testing for lead in children could facilitate increases in percentages of children tested for lead.

Perceived barriers to lead blood testing were seen by the healthcare provider as an important factor in lowering percentages of children tested for lead. An investigation and reduction in the exact barriers (for example, insuring that healthcare providers are reimbursed for in office testing for lead) present for lead testing of children could contribute to increasing the percentage of children tested for lead.

Recommendation #4: Healthcare provider continuing education emphasizing the questions which are "required" by the TDH to be included in the lead screening protocol should focus specifically on healthcare providers practicing for more than 20 years. Results of this study indicated healthcare providers practicing more than 20 years were less likely to report asking "all required" questions as part of the lead screening protocol they followed.

Recommendation #5: Many healthcare providers were "unsure" as to what questions should be included as part of the lead screening protocol, as was evidenced by the number asking "one or two" and "none" of the required screening questions. Information should be provided through promotion, continuing education, and other methods to outline the "required" screening questions from the TDH to be asked as part of the screening protocol followed. Results of this study indicated that healthcare providers asking "all three" of the required screening questions as part of the screening protocol were likely to test a greater percentage of children for lead.

Recommendation #6: Provider's accepting TennCare should be educated that testing all children receiving TennCare for lead at ages one and two years is required by TDH (see

Chapter II). Almost 40% of the healthcare providers who reported accepting TennCare reimbursement also reported that "less than 20%" of the children seen had been tested for lead. Further investigation may need to be done to determine the individual percentage of children receiving TennCare seen by the healthcare providers as this may give clues why these providers are testing less frequently. For instance, healthcare providers may also be providing healthcare services to many non-TennCare recipients within the individual practices thus not feel the need to universally test for lead, particularly if the screening process determines blood testing for lead is not warranted.

Recommendations for Further Research

1. Additional research focusing on the amount and kinds of parental education ,written or oral, being done by healthcare provider's offices would be important to determining actual measures are being taken by the healthcare provider to reduce the risk of lead poisoning in children..
2. Follow up research should be conducted to further understand the parental perceptions of childhood lead poisoning risk (risk assessment). A study of this nature would be an important step in determining what should be done next in the prevention of lead poisoning.

Summary

Overall this study indicated the self-reported number of years a provider had been in practice, self-reported acceptance of TennCare (Medicaid) reimbursements, and the self-reported numbers of required screening questions asked as part of the screening protocol followed were all significant to the percentage of children tested for lead.

Healthcare providers' self-reported location of practice (urban, suburban, or rural) was of no significant value in determining the number of required screening questions used as part of the screening protocol followed but, there was a slight difference between suburban practices and other locations (rural and urban) practices in the self-reported percentages of children tested for lead.

The number of required screening questions used as part of the screening protocol followed was to shown to have a significant association with self-reported testing of children for lead. Results indicated more thorough screenings were associated with a higher percentage of the children seen in the practice being tested for lead.

Higher mean scores on the HBM constructs of perceived severity, perceived benefits, and self-efficacy were related to the higher percentage of children tested for lead. Higher mean scores on the HBM construct of perceived barriers was related a lower percentage of children being tested for lead poisoning.

Healthcare provider continuing education efforts should focus on providing clarity to healthcare providers on the required elements of the screening and testing protocols to follow, particularly for healthcare providers practicing for "more than 20 years." Recommended follow up research should be conducted to further understand the parental perceptions of childhood lead poisoning and the information (types and amount) concerning lead poisoning prevention provided to parents by the healthcare provider's office.

Chapter VI

THE STUDY IN RETROSPECT

Introduction

This chapter represents a retrospective review of the study covering the strengths, weaknesses, things the researcher would have done differently, problems encountered, specific comments associated with the returned questionnaires, and other factors that did not lend themselves to analysis but may have been reflected in the outcomes of the investigation. The purpose of this study was to investigate the factors relating to testing and screening practices of healthcare providers in Tennessee toward childhood lead poisoning, specifically using the HBM to assess the constructs that were important to the providers.

Importance of Study

Knowing healthcare provider's beliefs and attitudes toward testing and screening children for lead poisoning is important in the detection and subsequent treatment of the illness. The actual prevalence rates for childhood lead poisoning in Tennessee are still being tabulated. Reports from surrounding states indicate that up to five percent of the children may be affected (CDC, 1997). A second reason for the study was to lay the "ground work" for future childhood lead exposure and prevention research, i.e. what should or needs to be done next as far as the healthcare providers are concerned. Parental risk assessment research should probably be the next step in the investigation of childhood lead poisoning, as this would provide information on what parents actually know about lead poisoning exposure and prevention.

Observations and Problems Encountered

This study was funded in part by the Tennessee Childhood Lead Poisoning Prevention Program. Planning, preparation, and implementation of this questionnaire took much time and effort. Preparations for mailing were difficult; it took many hours of "stuffing" envelopes before mailing. All of this had to be done in a timely manner, as there were specific deadlines for returns to be mailed back.

Due to limitation of funds available, there was only sufficient funding for one mailing of the questionnaire to take place. This may have introduced some sample bias. Incentive for participation was to include a pair of tickets for The University of Tennessee versus The University of Arkansas football game on October 5, 2002. Three hundred and seventeen random follow up telephone calls were also done in an effort to increase the return rate. These were approved upon filing of a Form D modification to the IRB. Even after the telephone calls, the response rate did not increase significantly. From the comments received on the questionnaire, some of the healthcare providers in Tennessee commented on being "over-worked" and stressed much of the time, with little time for participating in research. The low response rate was a disappointment but, was felt to be a reflection of these factors.

Strengths and Weaknesses of the Study

Although the HBM constructs have proven useful in predicting behaviors of healthcare (caregivers) providers, if this study were to be repeated the theory of Reason Action might be better applied than the HBM. The Theory of Reason Action might be more appropriate due to the nature of the desired outcomes, essentially the researcher was trying to determine "why" the healthcare providers screened and tested for lead as they do. The Theory of Reason Action is based upon the premise that human beings are rational. Humans assimilate information received and apply it to the decision-making process and thus determine the course of action followed, with due concern to the implications of the action (Ajzen & Fishbein, 1985). A person's attitude is a function of his/her beliefs and the Theory of Reason Action is based on this (Ajzen & Fishbein, 1985).

A major weakness of this study was the low response rate and possible introduction of sample bias as a result. Non-responder bias, determined by comparing early responder's responses with late responder's responses was not determined to be a significant factor in relationship to outcomes of this study. While the responses obtained were analyzed and determined to have adequate power to consider reported results accurate, a higher return rate would allow the sample to be separately analyzed using subgroups of healthcare providers. If this survey were to be repeated, a different research design might improve the rate of return. Data collection done at a medical conference or meeting of the Tennessee Medical Association might improve the overall response rate. Stratified random sampling or cluster sampling might have allowed for the researcher to do increased follow up on low response rates.

Many of the responses which were "unusable" were from nurse practitioners and general practice physicians responding that "they did not work with children at all." For future research it would be recommended that only family practice physicians, pediatricians, and pediatric nurse clinicians be surveyed, as these groups most often indicated that they provided primary healthcare services to children.

Another weakness of this study was that it was limited to the Tennessee healthcare population providing primary healthcare services to children. Applications of study findings cannot be extended beyond this population. The study was also limited in that healthcare providers already concerned with lead poisoning prevention and detection might have returned the questionnaire in greater numbers than healthcare providers who were unclear or indifferent to the issue of childhood lead poisoning.

Strategies to Improve Response Rates

In an effort to improve the response rate of future surveys of this nature, the following recommendations would be made:

1. An introductory letter adding endorsement for the project from leader of the medical community such as the State of Tennessee's Commissioner of Health, President of the Tennessee Medical Association, or the President of The University of Tennessee's Medical School might improve overall reception and response of physicians to the survey.

2. Use of cash incentives in order to improve response rates. Low return rates are common among physician groups in mailed survey research. Leug, Ho, Chan, Johnston, and Wong (2002) conducted research to determine the most effective incentive for mailed survey returns. Using a total of n= 4,850 physician, surveys were mailed to three groupings of physicians: a) a group receiving no incentive, b) a group receiving cash payment, and c) a group receiving entry into a lottery drawing. It was determined from this research that response rates were the highest when the physician was given a cash incentive.

3. Pre-notification of survey recipients to improve response rates. Survey recipients were found to respond favorably when prior notification or publicity was given that the research was going to take place (Kellerman & Herold, 2001).

4. Sending the questionnaire by certified mail to improve response rates. Del Valle, Morgenstern, Albright, and Vickrey (1997) reported that certified mail was an effective incentive in improving physician survey response rates (41.8% with certified mail versus 24.8% with first class mailing), with only a small difference in price of certified versus first-class mailing.

Recommendations for Future Research with this Instrument

If this survey were to be repeated the researcher would recommend the following changes in the questionnaire format:

1. Omitting open-ended questions, as these were most often left blank. Questions asking for the "total number of blood tests drawn," "total number of high lead blood levels," "total number of children seen receiving TennCare benefits," and "total number of children less than six years old seen in the practice" (questions # 9-12) should be replaced. Replacement of these with questions which have categories of answers giving the healthcare provider a "choice" of answers would probably increases the response rate on these items, as they were most often left blank on this survey.

2. Omit the "optional" screening questions (items # 44-52) to be asked by the healthcare provider as part of the lead screening protocol. Twenty-five percent or more of these

were either left "blank" or answered as "Don't Know." These items gave no additional information and added to the "lengthiness" of the questionnaire.

3. The HBM statements (items # 17-34, 38-40) containing items relating to perceived severity, perceived susceptibility, perceived benefits, barriers, and self-efficacy are believed to be good indicators of these constructs. However, items # 35-37, representing the cues-to-action construct are questionable in nature, considering the cues are directed toward parental caregiver cueing rather than healthcare provider cueing. These items were used in another study (Goldman et al., 1998) but after reviewing these in relation to this study, they are probably not good indicators of the cues for providers and should be replaced with more appropriated healthcare provider oriented statements. The cues-to-action in this study were not found to be significant.

4. The "required" screening questions used as part of the screening protocol followed were also good. These were used in an effort to determine the thoroughness of the screening which was being performed by the healthcare provider. The researcher believes that these variables did establish some scale to indicate that the appropriate screening questions were in use.

5. Omission of gender as a demographic variable. Whereas, gender is a significant demographic in several studies, it was not found to present any significant information in relationship to this study.

6. Reduction of the number of choices for healthcare provider setting (item #54). This item was often left blank or had multiple answers checked. Overall confusion of the healthcare providers was seen with the question format. A limitation of "CHECK ONLY

ONE" should be added to the statement, as well as reduction of the choices to four or five. Model choices should include: "a) single provider practice, b) group practice setting, c) HMO (or HMO like practice), d) community clinic, or e) other___________." As the item was worded most providers who indicated working in the health department setting, also indicated working in at least one of the other settings. Walk-in and community clinics were most often checked at the same time. So a reduction in the number of choices would increase the total amount of useable data received for this statement.

State and National Strategies to Increase Lead Testing

The importance of properly screening and testing children for lead cannot be over emphasized. In order better to facilitate the screening and testing of children for lead the following suggestions would be made at the state or national level:

1. States should supply healthcare provider's offices with lead related educational materials for distribution to parents. Many healthcare providers expressed a need for literature to distribute to parents in the provider's office. By insuring that healthcare providers have the necessary information available to pass along to parents, the detection and prevention rates for childhood lead poisoning can be increased. Healthcare providers may act as gatekeepers for the necessary healthcare services involved in screening and testing children for lead but parents when informed may initiate the process of testing for lead.

2. Community involvement in the effort to reduce lead exposures. A parental community risk assessment (administered by states) in conjunction with a health education effort would be very helpful in the prevention of childhood lead poisoning, particularly in locations where community risk factors (i.e. older homes, minority populations, industrial lead pollution, etc…) are present. Public service announcements where emphasis is placed on testing children for lead poisoning, looking for and removing lead hazards from the child's environment would all be valuable health education and promotion activities.

3. National inclusion of questions to analyze risk of lead poisoning on the Behavioral Risk Survey (BRFS) or the Household Survey administered by the CDC or development of a risk assessment tool to be administered by the National Center for Health Statistics for family risk would be useful in the detection and prevention of childhood lead poisoning in the United States.

4. Development of nationwide definitions for "lead screening" and "lead testing" to dispel confusion within the medical community. Healthcare providers indicated some confusion between the words "screening" and "testing" being used interchangeably in the literature, recommendations and guidelines from the state and the CDC. For the purposes of this dissertation, the researcher tried to clearly differentiate "lead screening" as a process whereby a set of questions was asked to determine the risk factors present in the child's environment. In this research, the words "lead blood testing" were used to specifically refer to having blood lead levels drawn. Future studies and information distributed to healthcare providers should clearly differentiate between these terms, so that further confusion over wording is dispelled.

5. Make sure healthcare providers are updated on the latest "recommendations" and "requirements" at both the state and national level. The population of healthcare providers in Tennessee is constantly changing as new healthcare providers move into the state from other states and newly license providers begin careers caring for patients. Regulations, requirements, and recommendations from government agencies for lead poisoning detection and treatment also change from time to time. For these reasons, future healthcare provider education should be presented regularly at conferences, in pamphlets to update the healthcare providers, in journal articles, and in peer meetings with fellow healthcare providers to outline specifically what procedures are "currently" recommended by the CDC and the Tennessee Department of Health in the screening, testing, and prevention of childhood lead poisoning.

6. Increase partnerships between major universities and state health officials in construction of assessment instruments in order to design more effective instruments. Many of the instruments inspected prior to this research contained errors, confusing statements, and wording which was inconsistent with the research.

7. Increase provider education on the importance of the use "optional" screening questions to assess lead risk hazards in the child's environment. It was determined by this project that many of "optional" screening questions were either not asked, provider's didn't know if they were asked, or the provider was unsure if they should be asked. It is felt that healthcare provider education (by the state or CDC) about the importance or reasons behind using these additional questions in the screening protocol followed would improve the screening and testing process for lead poisoning in children.

Summary

This chapter discussed some of the important issues that arose in the course of this research project. Some were very important and may have affected the study outcomes somewhat (i.e. the length of the instrument) but had no place in the formal analysis of data. The strengths and weaknesses of this research were explored and presented. Two weaknesses were the low response rate received and the limited applications of the study findings. Non-responder bias was analyzed and not found to be a significant factor in relationship to outcomes of this study.

The health education implications of this are tremendous and in general, health education efforts should be targeted to reach healthcare providers new to the state, newly licensed, and to update healthcare providers on periodic changes in recommendations for screening and testing. It is anticipated that the comments and suggestions made here may provide direction for future research on this topic.

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APPENDICIES

APPENDIX A: SUMMARY TABLES

SUMMARY TABLE A
Demographics/Screening and Testing Practices

Test Variables	Chi-Square Value	df	Significance
Location of practice (urban, suburban, or rural) by Percentage of Children with blood testing	10.906	4	0.028*
Number of years practicing by Percentage of Children with blood testing	22.214	8	0.005*
Location of practice (urban, suburban, or rural) by Number of "required" Screening Questions asked	1.658	4	0.798
Number of years practicing by Number of "required" Screening Questions asked	35.526	8	<0.001*
Number of "required" Screening Questions asked by Percentage of Children with blood testing	60.568	4	<0.001*
Insurance of Service (TennCare/ not TennCare) by Percentage of Children with blood testing	41.838	2	<0.001*

* Denotes significant associations

Sample power on all of these variables indicated (1.000 or 100% power) which was sufficient sample to detect differences. None of the cells in the chi-Square analyses had expected values of less than five.

SUMMARY TABLE B
Testing of the Health Belief Model

Test Variables	F	Hypothesis df	Error df	Sig	Observed Power
Model 1					
Location of practice (urban, suburban, or rural)	1.240	12.00	610.00	0.251	0.711
Percentage of children with blood testing	4.708	12.00	610.00	<0.001*	1.000
Model 2					
Gender of provider	2.468	6.00	307.00	0.024*	0.829
Percentage of children with blood testing	3.947	12.00	614.00	<0.001*	0.999

* Denotes significant relationship

APPENDIX B: INSTRUMENT

Tennessee Childhood Lead Screening Practices Instrument

1. Of the following groups please check any that you may have contacted in the past year concerning childhood lead poisoning prevention, screening or treatment: (Check any that apply.)

____ (a) County Health Departments
____ (b) Tennessee Medical Association
____ (c) Poison Control Center
____ (d) County/ Local Hospital
____ (e) Regional Hospital Medical Center
____ (f) Tennessee Department of Health's Childhood Lead Poisoning Prevention Program
____ (g) U. S. Environmental Protection Agency
____ (h) Other (please specify)__________.

2. How does your office prefer to receive resource materials concerning lead poisoning prevention and treatment for use in patient education? (Check any that apply.)

___ (a) internet sites
___ (b) professional associations
___ (c) direct mail
___ (d) newsletters from the Tennessee Department of Health
___ (e) other (please specify)______________.

3. How would you prefer to receive information related to individual case management protocol options for children with confirmed high lead blood levels? (Check any that apply.)

___ (a) phone line to a consultant at the Tennessee Department of Health
___ (b) interactive internet site
___ (c) by accessing an identified contact with the local county health department
___ (d) other (please specify)__________________

4. Estimate the percent of parents or guardians of children under age 6 that your office educates concerning lead poisoning prevention as part of an **oral patient education** consultation. (Check one.)

___ (a) <10 %
___ (b) 10-24 %
___ (c) 25-49%
___ (d) 50-74%
___ (e) >74%

PLEASE TURN THIS PAGE OVER FOR NEXT QUESTIONS:

5. Estimate the percent of parents with children under the age of 6 that your office provide with **written educational material** concerning lead poisoning prevention. (Check one.)

___ (a) <10 %
___ (b) 10-24 %
___ (c) 25-49%
___ (d) 50-74%
___ (e) >74%

6. From the following list please choose the types of educational materials on lead poisoning which are currently available in your practice. (Check all that apply.)

___ (a) videos for children
___ (b) videos for adults
___ (c) pamphlets
___ (d) fact sheets
___ (e) children's coloring books
___ (f) other (please specify) ______________

7. Where are most of your pediatric lead blood samples collected? (Check one.)

___ (a) in house/office
___ (b) sent to an outside lab
___ (c) blood drawn offsite/at another office or clinic in practice
___ (d) other (please specify)____________________.

8. Estimate the **percent** of children less than 6 years old seen in your practice who have had a blood test for lead poisoning: (Check one)

___ (a) <20 %
___ (b) 20-39 %
___ (c) 40-59%
___ (d) 60-79%
___ (e) >80%

9. Estimate the <u>total number</u> of lead blood screening test drawn through your practice in the year 2001 from children **under age 6 years** who received **TennCare/ Medicaid** services that year. _____________.

10. Estimate the <u>total number</u> of high lead blood levels ($\geq$ 10 μg/dl) in children seen by your practice in the year 2001.________________.

11. Estimate the <u>total number</u> of patients **under 6 years old** seen in your practice in the year 2001. ______________.

12. Estimate the <u>total number</u> of patients **under 6 years** old seen in your practice who received TennCare/Medicaid benefits in the year 2001. ______________________.
If you do not take TennCare please state "none".

13. According to the Tennessee Department of Health protocol, at what **minimum** confirmed blood lead level does clinical management **require** that children receive family lead poisoning prevention education , follow-up testing **within 3 months**, and a referral for social services (if necessary)? (Check one.)

___ (a) 10-19 μg/dl
___ (b) 20-44 μg/dl
___ (c) 45-69 μg/dl
___ (d) >69 μg/dl
___ (e) not familiar with level

14. According to the Tennessee Department of Health protocol, at what confirmed blood lead level does clinical management **require** that children receive a referral for a complete medical evaluation **within 1 week** , establishment of a plan for intervention and referral for environmental investigation and lead hazard control?
(Check one.)
___ (a) 8-14 μg/dl
___ (b) 20-44 μg/dl
___ (c) 45-69 μg/dl
___ (d) > 69 μg/dl
___ (e) not familiar with level

15. Is lead screening a regular part of the EPSDT (well child) exam in your practice? (Check one.)

___ (a) Yes
___ (b) No
___ (c) do not know
___ (d) we do not perform EPSDT exams

16. Which of the following is a federal requirement for children receiving TennCare/Medicaid benefits? (Check one.)

___ (a) Children should be tested for lead at 36 months and again before entering school.
___ (b) Children should be tested for lead at 12 and 24 months; children ages 36 to 72 months without documentation of prior lead testing should be tested.
___ (c) All children 6 years old and under should be tested for lead every year at well-child visit.
___ (d) Not familiar with requirements.

PLEASE TURN THIS PAGE OVER FOR NEXT QUESTIONS:

Instructions: For the questions below put a check in the box that **indicates your level of agreement or disagreement** with the statement. Please **(X)** the column.

Example:

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
A. All children should receive a tetanus booster every seven years.	X				

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
17. Epidemiological studies should be performed to determine which communities have significant lead levels.					
18. Childhood lead poisoning is not a significant health threat to patients in my practice.					
19. Blood lead levels >10 µg/dl are common among children living in poverty in Tennessee.					
20. Blood lead levels >10 µg/dl are common among children in urban inner cities in Tennessee.					
21. Blood lead levels >10µg/dl are common among children in rural communities in Tennessee.					
22. There are a significant number of children at risk for lead poisoning in my practice to indicate the need for having blood lead levels drawn at the 12 month checkup.					
23. There are enough children in Tennessee with high blood lead levels to warrant universal screening of all children in Tennessee.					

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
24. Childhood lead poisoning can result in lifelong learning disabilities.					
25. Blood lead levels of >20 μg/dl should be considered a serious health hazard to children.					
26. Learning disabilities associated with childhood lead poisoning are irreversible.					
27. It is the duty of the healthcare provider who receives a childhood blood lead level of $\geq$ 10μg/dl to report this case to the Tennessee Department of Health.					

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
28. Environmental interventions for children who have blood lead levels of >20 μg/dl are effective in reducing the severity of the lead poisoning related symptoms in the child.					
29. It is important to test all children for lead poisoning as early detection of lead poisoning is beneficial to the child.					
30. Removal of lead hazards in the environment can be beneficial in the prevention of childhood lead poisoning.					

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
31. Drawing of blood lead levels as an in office procedure gets higher levels of compliance than sending children to an out of office lab.					
32. Educating parents about lead poisoning prevention and detection takes a lot of time.					
33. Testing children for lead poisoning is expensive, so it should only be done when absolutely necessary.					
34. Lead Blood Testing in children is often reimbursed at a very low rate, therefore it is not usually done by our office.					

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
35. Educating parents about sources of lead exposure is important in the prevention of childhood lead poisoning.					
36. TV ads about lead poisoning prevention and causes would reduce the rates of exposure to lead in children.					
37. Lead screening should be required for all children like a TB screening test as a part of the pre-school immunization process.					

Please indicate your level of agreement or disagreement with the following statements about childhood lead poisoning.	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
38. My office can educate parents on how to remove lead hazards from the child's environment.					
39. My office can educate parents about dietary measures that reduce the risk of lead poisoning in children.					
40. My office offers educational materials concerning lead poisoning prevention to parents.					

Instructions: For the questions below indicate **if your office** uses these questions as a part of your childhood lead screening protocol. Please (X) the appropriate column.

Example:

Does your office ask parents this question as part of the lead screening protocol?	Yes	No	Don't Know
B. Does your child drink from school water fountains?	X		

Does your office ask parents this question as part of the lead screening protocol?	Yes	No	Don't Know
41. Does your child live in or regularly visit a house built before 1950?			
42. Does your child live in or regularly visit a building built before 1978 with recent, ongoing, or planned renovations or remodeling?			
43. Does your child have a sibling, close relative or playmate that has or did have lead poisoning?			
44. Does your child frequently come in contact with an adult who works with lead?			
45. Does your home contain any plastic or vinyl mini blinds?			
46. Have you ever been told your child has low iron?			

Does your office ask parents this question as part of the lead screening protocol?	Yes	No	Don't Know
47. Have you seen your child eating paint chips, crayons, soil, or dirt?			
48. Does your child live near or visit with someone who lives near an active lead smelter, battery recycling plant or other industry that could release lead?			
49. Do you give your child any home or folk remedies that may contain lead?			
50. Does your child live within 80 feet (or one block) of a heavily traveled road or street?			
51. Does your home's plumbing have lead pipes or copper pipes with lead solder joints?			
52. Does your family use pottery ware or leaded crystal made outside of the U.S. for cooking, eating or drinking?			

PLEASE TURN THIS PAGE OVER FOR NEXT QUESTIONS:

53. Which of the following best describes your professional employment? (Check one.)

___ (a) pediatrician
___ (b) family practice physician
___ (c) general practice physician
___ (c) nurse practitioner
___ (d) other (please specify) _______________

54. Check the type of healthcare setting that **best** describes the one in which you practice.
___ (a) single proprietorship
___ (b) group partnership
___ (c) community clinic (non-profit)
___ (d) walk-in clinic
___ (e) health maintenance organization
___ (f) clinic attached to a hospital
___ (g) health department clinic
___ (h) other (please specify) __________________

55. Indicate your gender by checking the appropriate blank.

___ (a) male ___ (b) female

56. Check the blank that best describes the length of time you have practiced.
____(a) <5 years
____(b) 5-10 years
____(c) 11-15 years
____(d) 16-20 years
____(e) >20 years

57. Check the blank that best describes the location setting of your primary practice.
____(a) urban ____(b) suburban ____(c) rural

58. In what zip code is your primary practice located? __________________.

Please provide the researcher with any comments/concerns you may have regarding this research:____

Thank you for completing this survey. Your responses are important in determining the present status of lead testing and practice in the state of Tennessee.

If you have any questions regarding this research, please contact:
Dr. Susan M. Smith at (865) 974-1108 or Karen Lowry at (865) 974-4215.

APPENDIX C: COVERLETTER

Dear < Healthcare Provider by Name >

Childhood lead poisoning is a common, but preventable disease. According to the CDC (1997) as many as 890,000 children in the U.S. are still suffering from the adverse effects of lead poisoning. The age and condition of housing as well as socio-economic status largely predict its prevalence. Recent surveys, such as the National Health and Nutrition Survey II (NHANES), have shown marked decreases in the rates of lead poisoning among children over the last two decades. In this same period however, the rates of decline in prevalence are disproportional among the socio-economic groups, with lower socio-economic groups and recent immigrant groups showing slower rates of decline than other groups.

The University of Tennessee Department of Health and Safety Sciences in collaboration with the Tennessee Childhood Lead Poisoning Prevention Program is conducting research to assess the current status of childhood lead poisoning prevention in the state of Tennessee. As a part of this project, I am writing to request your professional assistance in completion of the enclosed survey. Your response to the enclosed questionnaire is valuable in assessing the current status of lead poisoning testing within our state. Your participation will be greatly appreciated and will improve the accuracy of this project. Completion of the survey will take approximately 15 minutes of your time.

Your participation is voluntary and completely confidential. When you return the questionnaire, its completion serves as your consent and acknowledgement. **Please mail your response in the enclosed business reply envelope by July 1, 2002.**

Included in your packet will also be a return post card for entry into a **drawing for a pair of tickets to the University of Tennessee vs. Arkansas football game in Knoxville on October 5, 2002.** This can be returned independently to assure your confidentiality on the questionnaire.

Your knowledge and experience are important to this project and in assessing the public health needs of the children in Tennessee. If you would like to receive a summary report of this survey at no charge, please e-mail a request to utsafety@utk.edu using the subject heading of Lead Testing Survey. If requested the summary report, which will contain no individual healthcare provider identifiers will be e-mailed to you as a Microsoft Word document attachment after August 30, 2002. If you need additional information to complete the questionnaire, please contact me by phone at (865) 974-4215 or (865) 974-1108.

Thank you for your time and effort.

Sincerely yours,

Susan M. Smith, MSPH, EdD
Associate Professor
Dept of Health and Safety Sciences
The University of Tennessee, Knoxville

Karen Lowry, MPH
Doctoral Research/Teaching Associate
Dept of Health and Safety Sciences
The University of Tennessee, Knoxville

VITA

Karen Adele Rasnake Lowry; daughter of Conlie and Arlene Rasnake; was born in Richlands, Virginia on December 2, 1962. She is the oldest of three children and grew up in Madisonville, Tennessee. She graduated from Hiwassee College with an Associate Degree in 1983. She then continued her education at Tennessee Wesleyan College and graduated from The University of Alabama in Birmingham, Alabama with a Bachelor's of Science degree in Biology and Chemistry in 1985. She then qualified to sit for and passed the licensure exam to practice Medical Technology by completing an internship at Holston Valley Hospital and Medical Center in Kingsport, Tennessee in 1987. After practicing Medical Technology for 10 years, she obtained a laboratory supervisor's license from the State of Tennessee by completing required coursework in laboratory management. She began work on a Master's of Public Health in Health Planning and Administration at The University of Tennessee, Knoxville in 1997. After completing her MPH in 1999, she entered the doctoral program at The University of Tennessee, Knoxville in January of 2000. Karen served as a Graduate Teaching Associate at UTK while working toward a doctoral degree. As a GTA, she taught Advanced Emergency Care, Personal Health and Wellness, and Seminar in Human Sexuality. Karen graduated with a Ph.D. in Community Health Education and a minor in Statistics in December 2002. Karen has been married to Robert B. Lowry for 18 years. They have two children, Robert Joseph and Christopher Thomas Lowry. They currently reside in Morristown, Tennessee.