ENVIRONMENTAL RISK REDUCTION THROUGH NURSING INTERVENTION AND EDUCATION: A LOOK AT PARENTS' PERCEPTIONS OF RISK OF CHILDREN'S EXPOSURE TO ENVIRONMENTAL TOXINS

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TABLE OF CONTENTS

TABLE OF CONTENTS - CONTINUED

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

ABSTRACT

The success of efforts to provide environmental health (EH) information to families relies on testing interventions delivered in home and clinic settings. Few rural children's EH studies targeting multiple exposure pathways have been conducted. It is recommended that EH programs be framed and delivered in a manner meaningful to families and high-risk subgroups.

This research addresses two questions: 1.) What are the risk avoidance behaviors regarding environmental tobacco smoke, radon, well water contamination, lead, and CO among a sample of rural households? 2.) Is there a difference in perception of risk between households that undertake risk avoidance actions and those that do not? Answers to these questions advised educational intervention construction.

Participants were referred by public health nurses (PHN) serving pediatric programs within the Gallatin City County Health Department. All participants met specific enrollment criteria. Baseline biomonitoring, household exposure and self-reported knowledge/attitude/behavior (KAB) data were completed for 31 rural families. Biomarker data was collected from each child under age 6, each home was tested for radon and CO, and well water was processed using a well screen. Questionnaire data was collected from each child and adult. Questionnaire components addressed demographics, KAB towards agents, resources, risk reduction and acceptability of risk reduction behaviors, child's health history and behaviors, potential exposures and parent's occupations.

Biological data results were analyzed for each agent in each home. Results show smoking households perceive significant risk of children's exposure to ETS, but do not perceive that exposure leads to severe health consequences. Only 17.5% of households engage in radon testing. Parents who don't test for radon are guided by misconceptions and fear that remediation is costly and effort-intensive. Two-thirds of households have CO detectors. Those that do not, perceive no risk to children. More households engaged in treating their water than in testing. Knowledge of well water contamination and testing issues were limited. Blood lead results indicate that public lead campaigns have been successful in disseminating lead information.

Results indicate a significant need for educational interventions to dismantle social and contextual barriers to protective behavior modification and that interventions can be successfully administered by a PHN.

CHAPTER 1

INTRODUCTION

Background/Problem Statement

Currently more than seven million families participate in pediatric public health programs. These programs struggle to integrate and deliver effective risk reduction educational programs in environmental health that are meaningful to families and high-risk sub groups. In addition multiple exposure and exposure pathway studies have been conducted with inner city, border and farm worker populations, but rural children have been largely under explored. (Butterfield, 2002) The National Report on Human Exposures to Environmental Chemicals recently addressed 27 chemicals through biomarker data collected on 3,813 individuals and this information is being used to form ranges of reference that will allow researchers and healthcare providers to compare possible risks among several agents for multiple exposure reduction efforts (2001). JJ Quackenboss and colleagues assessed multi-pathway exposures in children within microenvironments, while many single-agent exposure assessments have been conducted along with a few multiple-agent exposure assessments performed in the states of Minnesota, North Carolina, New York and Texas (2000). Quackenboss concluded his study by pointing out that there is a salient need to merge in-home reports of children's

behavior with exposure data in order to gain more accurate estimates of risk than either method alone can provide (2000).

Significance of the Study

Environment is one of the single most significant determinants of health in human beings. However, scientists do not yet have a complete idea of the potential health effects created by environmental agents (Bent, 2003). In addition, the literature on published data and findings that support the clinical practice of nursing in relation to environmental health are "fragmented and isolated" (Bent, 2003). This study offers a potential for significant yield in public health by testing interventions delivered by public health nurses in home and clinic settings, thereby using a common sense strategy to integrate environmental health into existing health programs.

Studies on single-agent exposures in low-income children have been widely explored through programs and research carried out by pediatric projects such as WIC because environmental agents such as lead, ETS, carbon monoxide, pesticides and contaminated water are causes of unnecessary morbidity and mortality, physical limitations, and general ill health, impacting overall quality of life. Furthermore environmental agents are also potential precursors to cancer as well as neurological, reproductive and developmental effects. (Butterfield, 2002) It is important that studies such as these are recorded because a core set of childhood exposure data is essential to understanding an area of investigation that has been developed largely through the collection of data on exposed adults (Olin & Sonawane, 2003). The processes by which health in early life is influenced by environmental agents are not clearly understood at

this time, making the assessment of children a unique population study (Olin & Sonawane, 2003; Champagne & Meaney 2001).

Finally, international recognition of the need for risk reduction programs focusing on exposure to environmental toxins in children has been growing and it is generally agreed that intervention programs can have a positive impact on vulnerable families. Often, however, appropriate evaluation necessary for planning successful prevention programs has not been undertaken (Armstrong, Fraser, Dadds, & Morris; 1999).

In specific relation to ETS, intervention approaches that set non-smoking as the social norm within the home need to be developed and these approaches depend on identifying target groups and strategies that can be incorporated to reduce domestic levels of ETS. Before practical and practicable strategies for reduction can be developed, however, barriers to the adoption of these behaviors must be evaluated and addressed because issues such as restriction of domestic smoking and its effect on ETS in children has not been well quantified by the few studies of this sort undertaken in recent years (Green, Courage, & Rushton; 2001).

In an area of high radon, such as Gallatin County, studying the effects of radon alone would have significant impact within the community. It is important to understand, however, that radon and ETS have a synergistic and multiplicative effect on rates of lung cancer. Much research has been devoted to studying ETS and radon as separate agents and the independence of these two veins of research has resulted in large numbers of homes at significant risk for lung cancer being completely ignored (Lee, Lichtenstein, Andrews, Glasgow, & Hampson; 1999). Again, it is vital that environmental toxins be

studied in combination and in reference to children whose rates of exposure are distinctly unique from those of the adult population.

Well water contamination is specifically targeted in this study because of the rural nature of Gallatin County and a significant proportion of its residents' reliance upon well rather than municipal water. In the EPA's surveillance for waterborne-disease outbreaks, 66.7% of waterborne disease outbreaks could be traced back to a well water source (1996).

The CDC notes that more than 500 people die of carbon monoxide poisoning per year in the United States. It further states that certain groups, including children and infants, are more susceptible to the effects of carbon monoxide (CDC, 2005). Because this study also captures data on ETS and radon, two other major contributors to indoor air pollution, carbon monoxide becomes an important component contributing to the degradation of a vulnerable child's environment.

The EPA has invested huge amounts of time and money in lead abatement campaigns since the 1970's. While they state that U.S. citizens are exposed to lead much less frequently due to these measures, the lead challenge is still present. The Agency's Lead Awareness Program continues to work "to protect human health and the environment against the dangers of lead by developing regulations, conducting research, and designing educational outreach efforts and materials (EPA, 2005)." This study is consistent with the future aims of the EPA and studies lead as a primary agent of ongoing concern in combination with other environmental toxins.

This study is unique in that it simultaneously evaluates rural household exposure and biomarker data across five environmental toxicants in children receiving public

services through Gallatin County, taking into account additional survey and qualitative data and thereby offering a multidimensional approach to designing an environmental health education and intervention program to be administered by the public health nurses. In addition, a multifactorial study such as this one is valuable in that it may be able to provide information on the combined, and in some cases exponential, effects of simultaneous, multiple exposures to household toxins during childhood. Finally, this study seeks to maximize the effect of health services already in use by providing risk reduction education through a public health nurse-delivered intervention based on collected knowledge, attitude and behavior data.

Purpose

The overall goals of the ERRNIE project are 1.) To produce data addressing multiple exposures to children from low-income families residing in Gallatin County, Montana, 2.) To collect data addressing parent's knowledge and attitudes toward environmental risk reduction, and 3.) To test the effectiveness of a household risk reduction intervention delivered within the context of existing public health programs. This thesis focuses on the Exploratory Phase of ERRNIE research and will address two primary questions: 1.) What are the risk avoidance behaviors regarding environmental tobacco smoke (ETS), radon, carbon monoxide, well water contamination, and lead among a sample of rural households? 2.) Is there a difference in perception of risk between households that engage in protective activities and those that don't? Findings related to these questions,

will allow researchers to create an appropriate and effective educational intervention for use by public health nurses.

Hypothesis

At least two outcomes are expected for this study. The first hypothesis suggests that there is a direct relationship between parents' knowledge, attitudes and behaviors with respect to environmental health issues. We expect that a positive relationship will reflect that the more environmental awareness parents' knowledge, attitudes and behaviors show, the healthier the home environment will be. Conversely, if parents' knowledge, attitudes and beliefs about environmental health issues within the home have an inverse relationship to the health of the home environment, this will suggest that while they may possess a strong understanding of environmental health issues, their actions within the health protection domain do not reflect this information.

On the whole radon and well water contamination are only just beginning to show up in media campaigns and other awareness activities. For this reason is it expected that preventative action will correlate with knowledge and behaviors about these environmental issues.

Because ETS education is such a widely publicized campaign in the social sector, this area of the study is expected to reflect an inverse relationship; that of sufficient knowledge accompanied by insufficient parental action.

Most users of gas appliances are familiar with the dangers associated with combustion of gases, namely carbon monoxide poisoning. Owners of wood stoves, and space heaters, however, may be less aware of the dangers of carbon monoxide poisoning

because they do not think of these as “gas” appliances. Therefore it is difficult to project a relationship between knowledge of the dangers of carbon monoxide and preventative action executed.

Finally, this research examines knowledge, attitudes, and behaviors related to lead exposure. Until recently, lead was the focus of a major childhood campaign. Due to funding cuts within the government, however, lead information and testing is no longer supported in Montana. The former campaigns did much to eradicate lead from paints and gasoline and to inform parents of the risks of living in older housing. For this reason it is expected that there will be a positive relationship between knowledge and action in relation to lead risk reduction. This relationship may be limited, however, because other sources of lead such as foundries, batteries, bullets, etc. may not be taken into consideration by the general public.

Delimitations

The study drew participants from a rural county (Gallatin County) offering public health services to families with children ages 0-6. Since one environmental agent common to rural areas is well water, participants were restricted to having a private or community well as their primary source of drinking water (rather than municipal water systems which are federally regulated). The sample of participants was similar to the general population of Gallatin County demographically, but dissimilar according to household income due to the fact that the Gallatin City County Health Department (the source of the sampling pool) serves a disproportionate number of low-income families.

Limitations

While this study is formatted to suggest random assignment of participants, the validity of this assumption may be somewhat weakened by the fact that participating persons must consent to being contracted by MSU staff, thus essentially introducing self-selection into the random sample. In addition public health nurses who suspect that families may be experiencing health problems related to environmental agents may encourage some clients more urgently to consent to participation in the research study. In order to comply with HIPPA requirements, the ERRNIE project must allow participants to decline any part or all of the study if they are so inclined. Therefore missing data may have a significant impact on computational analysis of some parts of the study.

Generalizability of Results

Since the baseline data acquired from this research is intended to advise the creation of a public health nurse-delivered intervention, the results are generalizable to the population that will be reached by the intervention because the target population randomly supplied a sample population of significant size to reflect the general population of people receiving public health services in a rural county.

CHAPTER 2

REVIEW OF RELATED LITERATURE

According to the Institute of Medicine's Committee on Enhancing Environmental Health Content, the term "environmental health" is used in the context of "promotion of safe, healthful living conditions and protection from environmental factors that may adversely affect human health or the ecological balances essential to long-term human health and environmental quality, whether in the natural or man-made environment. These factors include but are not limited to air, food, soil and water contaminants; radiation; toxic chemical exposure; disease vectors; worksite hazards; and habitat alterations (Grady, Hardin, Moritz, & Amende; 1997)." In September of 1995, the Institute felt that it was necessary to convene a consortium of federal agencies to compile a report called "Nursing Health, and the Environment", which responded to a growing need for enhanced content addressing occupational and environmental health for the practice of nursing education, research and training (Grady et al, 1997). During this time the Environmental Health Sciences Working Group identified a number of promising areas for nursing research which included "identifying differences in perceptions about behavioral responses to environmental hazards among populations of interest, such as ethnic minorities and those in low-income, rural and high-density urban communities," and exploring "ways to maximize accuracy of exposure data obtained through self report techniques (Grady et al, 1997)."

Health related bulletins such as these motivated the proposal for the Environmental Risk Reduction Through Nursing Intervention and Education (ERRNIE) program which began its first phase of research using questionnaires to gather data about household environmental issues in rural health history and environmental data. A study by Armstrong and colleagues used a 30-item questionnaire to examine to what degree parental knowledge influenced implementation of preventive healthcare for infants. This study showed that mothers are willing to provide researchers with sensitive details about family issues when a questionnaire is used (Armstrong et al, 1999). In a similar study, women were given questionnaires which assessed their awareness of health risks within the home. These survey findings showed that 95% of participants identified several agents including lead, ETS, pesticides and drugs as harmful to children's health indicating that overall awareness of environmental agents was high. However, although more than 95% of the participants noted taking at least one protective action to reduce risk, these actions were highly variable (Evans, Fullilove, Green, & Levison; 2002). Researchers involved with this study suggest that intervention programs that teach women new and consistent ways to protect the health of their families are needed (Evans et al, 2002).

The questionnaire portion of research is vital because it is widely recognized that several studies have shown that lay people and scientific professionals have differing perceptions about health risks, values, and priorities and while experts in the health field may know more about health consequences and their scientific basis, people of the community probably have better understanding of local quality of life issues (Evans et al, 2002). In deciding the scope of environmental health questionnaire probes, Chalupka

outlines five exposure pathway parameters and several personal characteristics that should be included in environmental agent assessments. Questionnaires should include information on 1.) possible sources of contamination, 2.) environmental media and mechanisms for transport, 3.) exposure points, 4.) exposure routes, and 5.) the receptor populations. In addition age, physical characteristics, gender, health history, mental and physical status, preexisting conditions, lifestyle patterns, and previous exposures should be reported (Chalupka, 2001).

Recording complete sets of household questionnaire information from all members of the household, adults and children alike, is essential to having a complete understanding of the impacts of environmental agents on children. A few studies have recognized the potentially significant timing of exposures to agents during periods of developmental susceptibility, such as one finds in children (Olin & Sonawane; 2003). During early childhood both toxicokinetic and toxicodynamic issues make children much more vulnerable to health risks from exposure (Olin & Sonawane; 2003). Therefore, in order to accurately characterize environmental health risks to children, specific consideration of developmental stages in relation to children's susceptibility due to activities, behaviors, and consumption is required (Olin & Sonawane; 2003). According to Olin, "The complexity and unique insights of a risk assessment focusing on early life stages will depend critically on the data available and scope of the assessment (2003)." This statement supports broad research, like the ERRNIE project, which attempts to consider the holistic environment a child is born into, along with all of its inherent risks.

A study of vulnerable families with newborns noted that there exists a significant subgroup of children who, because of the environment into which they are born, are exposed to multiple risks encompassing the large range of negative health and developmental effects (Armstrong et al, 1999). While it is generally accepted that interventions are a successful way to reach vulnerable families, and in the above study mothers who received interventions did score higher on issues related to the environment and child protection, an appropriate evaluation is required for the planning of these programs and in many cases this type of evaluation has not been done (Armstrong et al, 1999). A second study involving vulnerable families supported home-based care provision as a way of gaining access to at-risk children and noted that those delivering child health services face two significant dilemmas. 1.) Children born into adverse circumstances bear an inequitable percentage of poor health outcomes, and 2.) these adverse circumstances become barriers to accessing well-child health care (Armstrong et al, 1999). Situations and circumstances like these have lead behavioral and community-based researchers to believe that, "if we wish to empower communities to make the tough decisions necessary to truly protect the well-being of their most vulnerable members, each domain must be attended to, and links between scientific knowledge and social process must be understood (Dixon, 2002)."

Nowhere is this need more apparent than in the studies of environmental tobacco smoke (ETS) exposure in children. A disparity exists between what scientists and lay people perceive as the most important protective actions for guardians of young children to take. According to one study, scientists ranked not smoking in the house as second from the top of a list of important protective actions. Young mothers of children, on the

other hand, ranked not smoking in the house second from the bottom of the same list of eight protective actions (Evans et al, 2002). This finding is significant and explains why the Environmental Protection Agency recently drafted supplemental guidelines for assessing early-life exposure to carcinogens (such as ETS, the leading cause of lung cancer and radon, the second leading cause of lung cancer) and their associated risks of cancer, acknowledging the enhanced risk to children (Alliance for Healthy Homes, 2003). Furthermore, studies from both the United States and Europe have shown that persons living in industrialized nations spend more than 90% of their lives indoors, where air pollution from radon, ETS, and carbon monoxide can be highest (American Nurses Association, 2001). For infants, this percentage is probably even higher and added to other factors such as increased respiratory rate, underdeveloped organs, and risk-increasing actions specific to children (i.e. hand-to mouth patterns, being carried or held by smoking parents, crawling on the floor, etc.), results in several combinations of exposures that significantly increase the risk of cancer for children. Besides the risk of cancer, ETS has also been causally linked to adverse health effects within the developmental, respiratory, and cardiovascular systems of children. Increased incidences of ear infections, lower respiratory infections, decreased lung function, and increased frequency and severity of asthma attacks result from exposure to ETS (America Nurses Association).

In spite of this, many parents seem to be unresponsive to the health problems posed by indoor air pollution. One study shows that only 5% of women report taking any action to control air pollution within their homes (Evans et al, 2002). This finding could

be the result of either knowledge gaps or psychosocial decisions on the part of the parents and is the reason that one researcher suggests that management guidelines for indoor air pollution should be based on psychosocial principles and risk perception elements (Boxer, 1990). It has been noted that low levels of support for ETS control measures can be contributed to social pressures and that psychosocial decisions may be the reason that 43% of children in the United States grow up exposed to ETS within their own households (Green, Courage, & Rushton, 2003).

Of all the possible sources of ETS, it has been found that ETS resulting from a smoking mother has the most significant impact on a child's exposure (Jordaan, Ehrlich, & Potter; 1999). The intensity of this exposure can be further modified by additional smokers in the home, exposure to other additional air pollutants, and by demographic and socioeconomic factors common to low-income families such as crowding of the home, limited economic agency, and restricted educational level (Jordaan et al, 1999). Furthermore, Greenberg and colleagues have reported that absorption of tobacco smoke increases from 53% to 77% during the first year of a child's life (Jordaan et al, 1999). This finding makes in-home pediatric nursing intervention programs delivered by public health nurses a vital means of providing education and protective action strategies to parents of vulnerable children.

Two other factors common to low-income and rural exposures involve well water and lead. Because of financial limitations, many rural families are forced to rent or buy older homes, which increases their risk of exposure to both lead and contaminated well water. Deteriorating lead paint in older homes and homes being remodeled is still an area of concern to the EPA and is still targeted by their campaigns to eradicate lead exposure

in private residences (EPA, 2005). Because rural residences and even some residences within community boundaries also rely upon well water, further opportunity for exposure to lead among a great many other contaminants, including diseases followed by the CDC, compounds the health effects experienced by families exposed to environmental agents (CDC, 2005).

In light of the significant risks facing low-income, rural families, public health departments become the ideal means of distributing knowledge and aid to vulnerable families because their mission places this agency as the first and most consistent contact for vulnerable populations with young children.

Summary of Literature

In summary the literature shows that substantial concern and emphasis are being placed on children as a significant and unique subgroup of exposure studies. Several of the above studies also show that interventions produce significant results and that intervention programs can be successfully delivered to vulnerable families by public health services staff. Finally, the above studies show that there is an imminent need for successful interventions designed to increase the protective actions being taken by parents with regard to their children's environmentally related health issues.

CHAPTER 3

METHODOLOGY

Participants

The participants were selected on the basis of referral by a public health nurse from the Gallatin City County Health Department. Thirty-one families meeting the following criteria were selected for the study: 1.) use of a private or community well as the primary source of drinking water, 2.) habitation in Gallatin County, and 3.) the consistent presence of children ages 0-6 in the home. The population from which the sample was selected represents the demographic makeup of the lower half of the county's socioeconomic spectrum. In 2001, 1,791 children were seen by public health nurses in pediatric health programs (Gallatin City Count Human Services, 2002). This number is expected to be slightly larger in 2004 and the fifty-nine children in the thirty-one sampled families were drawn from this pool.

Research Design

Causal comparative design was undertaken to determine if families who had a good understanding of environmental risks took more preventative actions than those families who indicated a low understanding of environmental risks.

The conceptual design for this research was chosen with the expectation that the design would be applied consistently throughout the four phases of this five-year study. However, only Phases I through IV of the research will be discussed at this time.

The goals of ERRNIE research are focused on two conceptual approaches proposed by Patricia Butterfield in her article, *Upstream reflections on environmental health* (2002) . In her article Butterfield argued that it is essential for public health nurses to move the involvement of their practices in environmental health topics from reactions to patients' responses to their health conditions towards increased participation in etiological and community-based action. In addition, Butterfield urged researchers in the nursing field to concentrate their efforts on creating common sense options for families that allow for translation of scientific results into usable information that families can successfully implement to reduce environmental risks present within the household. Finally, Butterfield noted the need for studies in environmental health that approach environmental health problems from the multiple-exposure perspective in which families find themselves, rather than the single-agent perspective which restricts opportunity for patient-response options.

The etiological and community-based conceptual approaches proposed by Butterfield were then integrated into a four-domain model of environmental health introduced by Dixon and Dixon in their article, *An integrated model for environmental health research* (2002). In this article Dixon and Dixon emphasize that while many studies have focused on environmental health issues within one of four domains (physiological, vulnerability, epistemological, or health protection), a comprehensive study of environmental health issues should include an integration of the effects of all four domains, thus providing a more effective means of translating environmental health research into meaningful action and policy. See Figure 1 for a description of the

measures, concepts, and domains addressed by the incorporated design used in the ERRNIE research.

Figure 1. Measures, Concepts, and Domains Addressed by ERRNIE Research

Research focus	**Etiologic research**	Physiological	Biomarkers Environmental monitoring	Blood lead (C)* Cotinine (C) Air (H) ▪Radon ▪Carbon monoxide Water (private well-H) ▪Total coliforms, *E-coli* ▪Nitrate/nitrite ▪Metals-lead, arsenic, copper ▪Petroleum screen ▪Insecticide/herbicide screen
	Community-based research	Vulnerability	Individual characteristics-child Family and community characteristics	Child age and weight (P) Child hand-to-mouth habits (P) Child dietary patterns (P) Child Race / ethnicity (P) Family structure (P) Socioeconomic status (P) Parents' occupations (P) Hobbies, cottage industry work (P) Wood stove use Indoor cigarette smoking Use and storage of household products (e.g., pesticides, organic solvents) (P) Property location - cultivated land and livestock (P) Property location - septic systems (P)
		Epistemological	Knowledge of EH (environmental health) risks Attitudes	Parent's knowledge of child's potential exposures (P) Parent's perceptions addressing EH issues with child (P) Risk perception to child (P)
		Health protection	EH concerns Sense of efficacy Potential actions	Perceived EH concerns for child (P) Perceived ability to act to promote health (P) Current actions (P) Acceptability of potential actions (P)
*=source of data: C=child, H=home, P=parent				

Methods

Baseline biomonitoring, household exposure, and self-reported knowledge/attitude/behavior data were collected from thirty-one rural families with children ages 0-6. The sample families were recruited from Gallatin City County Health Department pediatric health programs. Infant/child follow-up, WIC, and partnership to strengthen families were among the programs solicited for participants. Infant/child follow-up served 581 children in 2001. WIC served a total of 641 children and 222

adults in 2000. And partnership to strengthen families served 58 children and 45 adults in 2001 (Gallatin City County Human Services, 2002). Participants were recruited according to the criteria listed above.

Perspective participants were asked by Gallatin City County Health Department personnel if they would be willing to release their names and phone numbers to members of the ERRNIE research team. Consenting families/households were contacted by MSU personnel and their eligibility was determined. (The terms “families” and “households” are used interchangeably and are defined as all adults and children continuously residing at the enrolled residence. A primary household respondent is not limited to the mother, however, in this research all primary household respondents were the female heads of the home.) Eligible families received survey data through a mailing, and the survey data was collected by MSU personnel during a home visit. Survey data about the household was solicited from one parent (the parent subject) through a single interviewer using a uniform format (questionnaires). Additional survey data was collected from each adult and each child in the home. Survey questions addressed demographics; knowledge/attitude/behaviors toward agents, resource information, risk reduction, and acceptability of risk reduction behaviors; child’s health history and behaviors, potential exposures; and parent’s occupations. Using a covariance matrix, instrument reliabilities for all Likert scale items were calculated to have alpha of at least 0.80.

The home visit was conducted by MSU personnel at a time convenient for the family. Biomarker samples were collected and informational packets were distributed to help participants understand risks and testing procedures. (See appendix 3 for protocols

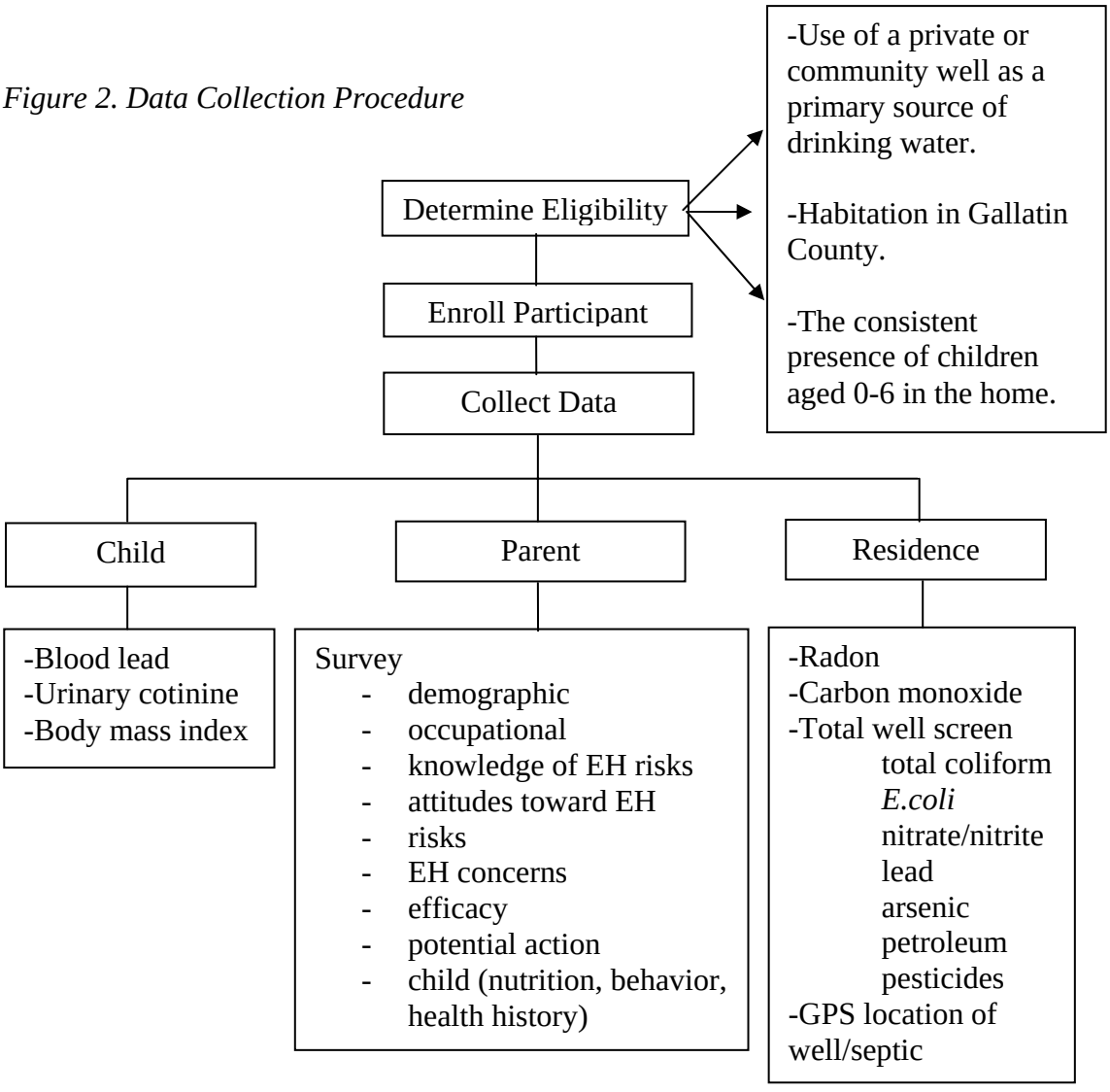
used in collecting biomarker data.) Water samples were taken from each kitchen faucet according to standard collection protocol and were processed by the state laboratory. Radon samplers were placed in optimal places within the homes for 48 hours after which they were sealed and sent to a radon-specific laboratory for evaluation. A carbon monoxide tester was used to evaluate all fuel-burning appliances, four inches above the point of combustion. GPS tracking devices were used to record the precise location of the home, well, and/or septic system. Information on blood-lead levels was collected for each child in the home using a filter paper collection method processed by a medical laboratory. Specimen bags were used to collect urinary cotinine samples processed by Montana's Billings Deaconess Hospital. Billings Deaconess also took complimentary creatinine readings on each cotinine sample. Household and biomarker data were then entered into SPSS spreadsheet formats where they were analyzed to evaluate descriptive statistics, frequencies, and percentages of cases in excess of the defined biological indicator or exposure level standard or limit. Estimated reliabilities were computed for all scales relating to parental knowledge, attitudes, and behaviors. Upon completion of Phase I, each household was given a copy of their household environmental data. (Any time that household data exceeded the prescribed limit or standard they were given the corresponding data as soon as was possible and a second confirmatory test was performed.) *See Figure 2.*

Data Analysis

For the risk perception results discussed here, Mann-Whitney U tests were used to evaluate perceptions of risk of children's exposure to ETS, carbon monoxide,

contaminated well water, lead, and radon. Secondly, descriptive evidence, calculating means and standard deviations, was used to evaluate differences in risk reducing behaviors as well as for providing basic demographic descriptors.

Figure 2. Data Collection Procedure



CHAPTER 4

RESULTS

Data Analysis Procedures

Questionnaire and biomarker data were collected and analyzed for the thirty-one families that were surveyed and their households evaluated. Urinary cotinine/creatinine ratios were established for all children within the household according to research, which shows that "the noninvasive nature of urinary cotinine is particularly suited to epidemiological investigations." It has been reported by several investigators that it is possible to discriminate between reported ratios reflecting passive exposure to tobacco smoke in children using this technique (Jordaan, Ehrlich, & Potter; 1999). However, this data was not a part of the analysis performed here. Questionnaire information involving demographics, perception, or protective action (n = 31) was processed by SPSS using the Mann-Whitney U test to rank responses and to evaluate perceptions of risk of children's ETS, radon, carbon monoxide, contaminated well water, and lead exposure. Descriptive means and standard deviations were calculated on all demographic information. Cross-tabulation and frequencies were used to gain percentages of active/non-active participants' opinions and experiences. Missing data was appropriately coded within the SPSS data tables and was systematically excluded from all computations accounting for reported n values of less than the maximum number of n=31. Human Subjects requirements for this study make it mandatory that any participant be allowed to decline to answer any or all survey items. In cases where no response was given for an item, the

item was coded -9 = missing data and was not factored into the total tabulation for various descriptions of output.

Results

The research questions addressed by this study were two-fold. First, what are the risk avoidance behaviors regarding environmental tobacco smoke, radon, well water contamination, carbon monoxide, and lead among our sample of rural households receiving Gallatin City County Health Department services? And second, is there a difference in perceptions of risk between households that take preventative action and those that don't? These questions were answered first, by collecting questionnaire data from each of the households involved, second, by dividing the data into responses related to action and non-action, and third, by analyzing patterns of risk avoidance behavior and risk perception.

Questionnaires were administered by mail to all participants randomly referred to the study by Gallatin City County Health Department staff. The questionnaires were then collected during the scheduled home visit, during which biomarker data was collected. Thirty-one families completed questionnaires and contributed sets of biomarker data.

Analysis of Demographic Information

Demographic information was compiled to evaluate the representativeness of the sample population and to look for contributing socioeconomic predictors of exposure to

environmental agents. Table 1 illustrates overall demographic findings for all households surveyed.

Table 1 – Population Descriptors

Descriptive	Values		
	Range	**Mean**	**St. Deviation**
Average number of rooms in home	2-13	3	7
Average age of primary client	17-39	29	6.145
Average period of residence at location	1-62 mo.	22 mo.	17.650
Average level of education	8-17 years	13 years	2.401
Average income bracket	<10,000->60,000	25,000 – 29,999	20,000
	Percent	***n***	
Percentage of households that own home	51.6	16	
Percentage of households that rent home	45.2	14	
Percentage of primary clients female	100	31	

These results indicate that the average mother attending to young children is about 29 years old and that she has approximately one year of education after high school through either college or trade school. The average household income is considered low, but does not necessarily lock families into renting a home as the split between renting and owning homes is nearly half of each. On average these homes are approximately three bedroom homes that participants have been living in for an extended period of time (22 months).

Demographics Specific to Smoking and Non-Smoking Households

Drawing from questionnaire data, descriptive percentages were calculated for both smokers and non-smokers. This data acts primarily as an overview of the opinions and experiences of each group and has not been analyzed for its relationship to or its influence on perceptions or actions. See Figure 3 for percentage components.

Figure 3 – Smoking and Non-Smoking Household Opinions and Experiences

- 63% of the sample was non-smokers. 37% of the sample was smokers
- Of the female participants, 66% did not smoke, 34% did.
- Of the male participants, 60% did not smoke, 40% did.
- 26.1% of the female heads of the household smoke.
- 26.1% of the male heads of the household smoke.
- 13% of the households felt that their children were exposed to smoke regularly.
- 45% of non-smokers know someone who has ETS-related health problems.
- 33% of smokers know someone who has ETS-related health problems.
- 55% of non-smokers felt they could recognize health effects from ETS.
- 100% of smokers felt they could recognize health effects from ETS.
- 64% of non-smokers felt they knew quite a bit or a lot about ETS.
- 55% of smokers felt they knew quite a bit or a lot about ETS.

These results show that our sample contains more non-smokers than smokers. It also shows that more males smoke than females. Of the heads of households, however, an equal number of males and females smoked. Approximately half of the female heads of households who smoked believed that their children are exposed to ETS regularly. More non-smokers than smokers knew someone who had experienced health effects as a result of ETS and more non-smokers than smokers felt they knew quite a bit or a lot

about ETS. Interestingly, however, 100% of smokers believed they could recognize the health effects of ETS, while only 55% of non-smokers felt they could recognize ETS health effects.

Analysis of Risk Protection Actions – ETS

The primary purpose of computing crosstabs for each of the risk protection actions surveyed by the questionnaire was to determine which protective actions were being taken by smokers and non-smokers and to what degree each action was being taken. Table 2 shows percentages of protective actions taken by smokers and non-smokers.

Table 2 - Risk Protection Actions Taken by Smoking and Non-Smoking Households

Risk Protection Actions Taken During the Last Six Months	Smoking Household	Non-Smoking Household
Avoided taking your children to a restaurant or business that you considered too smoky?	44%	63%
Asked someone to roll down the window before smoking in the car with children present?	55%	09%
Asked someone to go outside your home to smoke?	45%	55%
Asked someone not to smoke in your car?	22%	36%
Avoided leaving your children with a caretaker or friend that smokes?	33%	18%
Opened doors or windows in your house to lessen the amount of cigarette smoke?	22%	0%

These results show that non-smoking households take more protective actions in the public sector than smoking households do and that some smoking households take personal action to protect their children from the passive effects of their own smoking while a larger percentage of smokers do not.

Analysis of Risk Perception for ETS Exposure

The purpose of performing the Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if smokers and non-smokers have similar perceptions of risk of ETS exposure to children or if the perceptions in these two groups are different. Table 3 below provides a *p* value for the comparison of each group for each element of risk perception.

Table 3 – Perceptions of Risk by Smokers and Non-Smokers

Perception of Risk (1 - 7 point scale) Smoking (n) = 10 Non-Smoking (n) = 15	**Mean Rank** NS = Non-smoking S = Smoking	**Mann-Whitney U**	***p****
Children in Gallatin County are at risk for being exposed to indoor tobacco smoke.	NS = 12.27 S = 14.10	64.000	.526
My children are at risk for being exposed to indoor tobacco smoke.	NS = 10.90 S = 16.15	43.500	.072
Indoor tobacco smoke is a serious problem for my children.	NS = 10.90 S = 16.15	43.500	.072
My children are at risk for having health effects due to tobacco smoke.	NS = 9.50 S = 18.25	22.500	.003

Health effects due to tobacco smoke are likely to be serious.	NS = 13.14 S = 11.40	61.000	.576
Being around less tobacco smoke would improve the long-term health of my children.	NS = 13.29 S = 11.40	59.000	.501
Being around less tobacco smoke would mean lower medical expenses for our family.	NS = 12.30 S = 14.05	64.500	.550
It takes a lot of effort to decrease the amount of indoor tobacco smoke.	NS = 13.60 S = 12.10	66.000	.610
I feel worried about the amount of indoor tobacco smoke around our children.	NS = 10.83 S = 16.25	42.500	.064
I feel frightened about the amount of tobacco smoke around our children.	NS = 10.20 S = 17.20	33.000	.014
I feel angry about the amount of tobacco smoke around our children.	NS = 13.57 S = 12.15	66.500	.616

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 10 smoking versus the n = 15 non-smoking households. The results indicate a difference in risk perception between smoking and non-smoking households. These results show that smoking households perceive that their children are at risk for ETS exposure and that their children are at risk of experiencing health effects from this exposure. They are also more worried and frightened about the effects of ETS. Smoking families are not, however, convinced that the health effects related to ETS will be serious or long-term. Non-smoking households do not perceive that their children are at risk for ETS exposure, but they do believe that the health effects related to ETS are serious and

long-term for children who are exposed to passive smoking. They are not as worried or frightened about the amount of ETS their children are around.

Analysis of Risk Perception for Radon Exposure

The purpose of performing the Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if households that have (17.5%) and have not (82.5%) tested for radon have similar perceptions of risk of radon exposure to children or if the perceptions in these two groups are different. The table below provides a *p* value for the comparison of each group for each element of risk perception.

Table 4 – Perceptions of Risk by Households that Have and Have Not Tested for Radon

Perception of Risk (1-7 point scale) Tested for radon (n) = 5 No radon testing (n) = 23	**Mean Rank** NT = not tested T = tested	**Mann-Whitney U**	***p****
Children in Gallatin County are at risk for radon.	NT =14.54 T =14.30	56.500	.948
My children are at risk for being exposed to radon.	NT =14.85 T =12.90	49.500	.612
I can sense (taste, smell, see) radon.	NT =14.26 T =10.30	36.500	.252
Radon is a serious problem for my children.	NT =13.98 T=14.10	54.500	.973
My children are at risk for having health effects due to radon.	NT =14.16 T =13.30	51.500	.813
Health effects due to radon are likely to be serious.	NT =14.07 T =16.50	47.500	.536
Being around less radon would improve the long-term health of my children.	NT =14.07 T=16.50	47.500	.536
Being around less radon would reduce my children's risk of lung cancer.	NT =13.34 T =16.90	40.500	.339

Being around less radon would mean lower medical expenses for our family.	NT =13.45 T =16.40	43.000	.397
It costs a lot of money to decrease the amount of radon.	NT =14.25 T =12.90	49.500	.670
It takes a lot of effort to decrease the amount of radon.	NT =14.73 T =10.80	39.000	.233
It is hard to decide which is the best way to reduce radon.	NT =14.98 T =09.70	33.500	.096
I feel worried about the amount of radon that my children are around.	NT =15.09 T =11.80	44.000	.367
I feel frightened about the amount of radon my children are around.	NT =14.93 T =12.50	47.500	.514
I feel angry about the amount of radon my children are around.	NT =13.77 T =15.00	50.000	.708

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 5 radon-tested versus the n = 23 non-radon tested households. The results indicate only a slight difference in risk perception between tested and non-tested households. Households that tested for radon did not perceive reducing radon to be a difficult process, while households that did not test for radon felt that it was difficult to decide what was the best way to reduce radon. Related to this idea, households that tested for radon felt that it did not take a lot of effort to reduce the amount of radon in the home, while those that did not test tended to fear that reducing radon might require significant effort. Finally, those households that had not tested for radon tended to have a higher incidence of misconception about radon's properties, believing that it is possible to sense (see, hear, smell, or taste) radon in the home environment.

Analysis of Risk Perception for Carbon Monoxide Exposure

The purpose of performing the Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if households that have a carbon monoxide detector (66%) and those that do not (33%) have similar perceptions of risk of carbon monoxide exposure to children or if the perceptions in these two groups are different. The table below provides a *p* value for the comparison of each group for each element of risk perception.

Table 5 – Perceptions of Risk by Households Have a CO Detector and Those That Do Not

Perception of Risk (1-7 point scale) Have a CO detector (n) = 15 No CO detector (n) = 7	**Mean Rank** ND = no detector D = detector	**Mann-Whitney U**	***p****
Children in Gallatin County are at risk for exposure to CO.	ND =09.40 D =16.00	21. 000	.021
My children are at risk for being exposed to CO.	ND =10.83 D =12.93	42.500	.466
I can sense (taste, smell, see) carbon monoxide.	ND =11.83 D =10.79	47.500	.714
Carbon monoxide is a serious problem for my children. -	ND =10.90 D =12.79	43.500	.496
My children are at risk for having health effects due to CO.	ND =09.63 D =15.50	24.500	.039
Health effects due to CO are likely to be serious.	ND =10.37 D =13.93	35.500	.211
Being around less CO would improve the long-term health of my children.	ND =11.07 D =12.43	46.000	.634
Being around less CO would reduce my children's risk of heart disease.	ND =10.40 D =13.86	36.000	.226
Being around less CO would mean lower medical expenses for our family.	ND =12.10 D =10.21	43.500	.494
It costs a lot of money to decrease	ND =12.23	41.500	.395

the amount of CO.	D =09.93		
It takes a lot of effort to decrease the amount of CO.	ND =12.10 D =10.21	43.500	.458
It is hard to decide which is the best way to reduce CO.	ND =12.57 D =09.21	36.500	.216
I feel worried about the amount of CO that my children are around.	ND =11.80 D =10.86	48.000	.746
I feel frightened about the amount of CO my children are around.	ND =11.50 D =11.50	52.500	1. 000
I feel angry about the amount of CO my children are around.	ND =11.33 D =11.86	50.000	.844

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 15 homes with CO detectors versus the n = 7 homes without detectors. The results indicate some difference in risk perception between households with CO detectors and those without. Households lacking carbon monoxide detectors did not feel that children in Gallatin County are at risk for CO exposure, while those that did have detectors believed that the risk of CO exposure was present. In addition in those households lacking CO detectors parents did not believe that their children were at risk for health effects due to carbon monoxide. Conversely, parents who did install CO detectors believed that CO posed a significant risk for health effects in their children.

Analysis of Risk Perception for Well Water Contamination Exposure

A two part analysis of well water was performed in order to independently evaluate perceptions involved with treatment of well water by methods such as filtration, softening, or use of other water sources such as pitcher filters, bottled water, or water from another residence and actual chemical and biological testing of well water.

The purpose of performing the first Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if households that treat their well water (57%) and those that do not (43%) have similar perceptions of risk of well water contamination exposure to children or if the perceptions in these two groups are different. The table below provides a *p* value for the comparison of each group for each element of risk perception.

Table 6 – Perceptions of Risk by Households That Treat Well Water and Those That Do Not

Perception of Risk (1-7 **point scale)** Treated drinking water (n) = 16 No water treatment (n) = 12	**Mean Rank** NT = not treated T = treated	**Mann-Whitney U**	***p****
Children in Gallatin County are at risk for impure drinking water.	NT = 14.00 T = 14.88	90.000	.771
My children are at risk for being exposed to impure drinking water.	NT =13.50 T = 15.25	84.000	.567
I can sense (taste, smell, see) impure drinking water.	NT = 11.92 T =16.44	65.000	.138
Impure well water is a serious problem for my children.	NT =11.63 T =16.66	61.500	.099
My children are at risk for having health effects due to impure water.	NT =13.33 T =15.38	82.000	.500
Health effects due to impure water are likely to be serious.	NT =14.88 T =14.22	91.500	.824
Being around less impure water would improve the long-term health of my children.	NT =12.50 T =16.00	72.000	.251
Being around less impure water would mean fewer stomach problems and diarrhea.	NT =11.79 T =16.53	63.500	.121
Being around less impure well water would mean lower medical expenses for our family.	NT =11.46 T =16.78	59.500	.076
It costs a lot of money to decrease the amount of impure well water.	NT =16.33 T=13.13	74.000	.274
It takes a lot of effort to decrease	NT =17.38	61.500	.092

the amount of impure well water.	T =12.34		
It is hard to decide which is the best way to improve the purity of well water.	NT =13.63 T =15.16	85.500	.612
I feel worried about the amount of impure well water that my children drink.	NT =11.71 T =15.83	62.500	.165
I feel frightened about the amount of impure well water my children drink.	NT =14.21 T =14.72	92.500	.865
I feel angry about the amount of impure well water my children drink.	NT =13.83 T =15.00	88.000	.679

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 16 homes that treated their well water versus the n = 12 homes that did not. The results indicate only a slight difference in risk perception between households that treat their water and those that do not. Those who treated their water tended to believe that impure well water was not a serious problem for their children. In addition they also believed that drinking less impure well water would mean lower medical expenses for the household. Those who did not treat their well water felt that it required a lot of effort to reduce the amount of impure well water to which their children were exposed.

The purpose of performing the second Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if households that tested (as opposed to treated) their well water for chemical and microbial contamination (16%) and those that did not (84%) have similar perceptions of risk of well water contamination exposure to children or if the perceptions in these two groups are different. The table

below provides a *p* value for the comparison of each group for each element of risk perception.

Table 7 – Perceptions of Risk by Households That Tested Well Water and Those That Did Not

Perception of Risk (1-7 point scale) Tested drinking water (n) = 4 No water testing (n) = 21	**Mean Rank** NT = not tested T = tested	**Mann-Whitney** U	***p****
Children in Gallatin County are at risk for impure drinking water.	NT =12.88 T =13.63	39.500	.847
My children are at risk for being exposed to impure drinking water.	NT =12.79 T=14.13	37.500	.730
I can sense (taste, smell, see) impure drinking water.	NT =11.86 T =19.00	18.000	.066
Impure well water is a serious problem for my children.	NT =12.86 T =13.75	39.000	.819
My children are at risk for having health effects due to impure water.	NT =12.45 T =15.88	30.500	.375
Health effects due to impure water are likely to be serious.	NT =12.07 T =17.88	22.500	.123
Being around less impure water would improve the long-term health of my children.	NT =12.71 T =14.50	36.000	.646
Being around less impure water would mean fewer stomach problems and diarrhea.	NT =12.00 T =18.25	21. 000	.109
Being around less impure well water would mean lower medical expenses for our family.	NT =11.79 T =19.38	16.500	.046
It costs a lot of money to decrease the amount of impure well water.	NT =12.17 T =17.38	24.500	.153
It takes a lot of effort to decrease the amount of impure well water.	NT =11.95 T =18.50	20.000	.082
It is hard to decide which is the best way to improve the purity of well water.	NT =13.60 T =09.88	29.500	.335
I feel worried about the amount of impure well water that my children drink.	NT =11.85 T =15.75	27.000	.293
I feel frightened about the amount	NT =12.57	33.000	.484

of impure well water my children drink.	T =15.25		
I feel angry about the amount of impure well water my children drink.	NT =12.33 T =16.50	28.000	.251

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 4 homes that tested their well water versus the n = 21 homes that did not. The results indicate only a slight difference in risk perception between households that test their water and those that do not. Those who did not test their water tended to believe incorrectly that they could sense (see, smell, taste, etc.) impurities in well water. In addition, those who had not tested their well water believed that if their children were around less impure well water it would lower their household medical expenses. Finally, those who did not test their well water believed that it would require significant effort to reduce the impurities that may be found in well water.

Analysis of Risk Perception for Lead Exposure

The purpose of performing the Mann-Whitney U test on a Likert scale of items designed to measure perceptions of risk was to determine if households that have tested for blood lead (16%) and those that have not (84%) have similar perceptions of risk of lead exposure to children or if the perceptions in these two groups are different. The table below provides a *p* value for the comparison of each group for each element of risk perception.

The original questionnaire responses, measured from 1-7 (1= disagree strongly, 7 = agree strongly), were rank-ordered and a Mann-Whitney U-test was used to compare the ranks for the n = 5 homes that had tested for blood lead versus the n = 21 homes that had not. The results indicate no significant difference in risk perception between households that have tested for blood lead and those that have not.

Table 8 – Perceptions of Risk by Households That Have Tested for Blood Lead and Those That Have Not

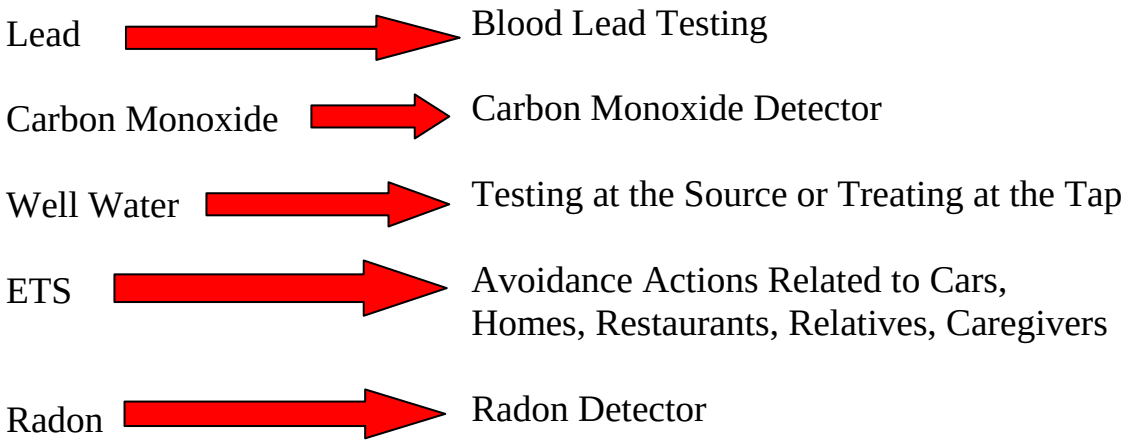
Perception of Risk (1-7 point scale) Tested for blood lead (n) = 5 No blood lead testing (n) = 21	**Mean Rank** NT = not tested T = tested	Man-**Whitney** U	*p**
Children in Gallatin County are at risk for being exposed to lead.	NT = 13.98 T = 11.50	42.500	.497
My children are at risk for being exposed to lead.	NT = 13.00 T = 13.00	50.000	1. 000
I can sense (taste, smell, see) lead.	NT = 13.38 T = 14.00	50.000	.866
Lead is a serious problem for my children.	NT = 12.95 T = 15.80	41. 000	.427
My children are at risk for having health effects due to lead.	NT = 13.12 T=15.10	44.500	.570
Health effects due to lead are likely to be serious.	NT = 12.90 T = 16.00	40.000	.398
Being around less lead would improve the long-term health of my children.	NT = 13.17 T = 14.90	45.500	.634
Being around less lead would mean fewer problems with anemia.	NT = 12.95 T = 15.80	41. 000	.427
Being around less lead would mean lower medical expenses for our family.	NT = 12.95 T = 15.80	41. 000	.403
It costs a lot of money to decrease the amount of lead.	NT = 13.86 T = 12.00	45.000	.478
It takes a lot of effort to decrease the amount of lead in homes.	NT = 13.62 T = 13.00	50.000	.847
It is hard to decide which is the best way to reduce lead in homes.	NT = 13.12 T = 15.10	44.500	.539

I feel worried about the amount of lead in my home.	NT = 12.60 T=17.30	33.500	.196
I feel frightened about the amount of lead in my home.	NT = 13.33 T = 14.20	49.000	.810
I feel angry about the amount of lead in my home.	NT = 13.43 T = 13.80	51. 000	.911

Summary of Risk Protection Actions and Their Implementation

By nature of the survey instrument used in this study, specific risk protection actions were surveyed and analyzed. Figure 4 illustrates each agent and the actions covered by survey questioning.

Figure 4 – Risk Protection Actions by Agent



In answering our research questions these results tell us that non-smoking families take more public protective action than smoking families. Some smoking families take actions to protect children from their own smoke.

Only 18% (5/28) of households took protective action by testing for radon in the home, using a radon kit.

Two-thirds of parents protected their children from CO by installing a CO monitor. One-third (7/22) of homes had no carbon monoxide detector installed.

A distinction was made between homes that engaged in protective action by treating their drinking water and by testing their well water. Fifty-seven percent of households treated their water in some manner (filtration, softener, bottled water, water from another source, etc.), 43% did not. Sixteen percent of households (4/25) engaged in the actual testing of their well water.

Finally, only 16% of households had been tested for blood lead.

Summary of Perception of Risk

With respect to environmental tobacco smoke, non-smoking families do not perceive that their children are at risk for exposure to ETS, but they do perceive the health effects of ETS to be serious and long-term. Smokers, on the other hand, perceive that their children are at risk for ETS exposure but do not believe this exposure will produce serious or long-term health problems. These perceptions may be influenced by what parents know and have experienced in relation to ETS.

Households that did not test for radon perceived that deciding how to fix a radon problem would be a difficult decision, while families that did test perceived radon remediation to be an easier decision and that the actual remediation would not require a lot of effort. Those families that did not test for radon exhibited some misconceptions about radon believing that radon can be sensed when it is present in the home.

Parents who did not install a CO detector perceived that children were not at risk of CO exposure and that there is no risk of health effects due to CO exposure. Parents who took protective action by installing CO detectors perceived that their children were at risk for health effects due to CO exposure.

Households that engaged in water treatment perceived that having purer water meant that impure well water was not a serious risk for their children and that they would have lower medical expenses as a result of purer drinking water. Parents who did not treat their water perceived that the cost of doing so would outweigh any possible risks involved with drinking impure well water. Those who did not test perceived that they would be able to sense (see, smell, taste, etc.) any risk water might pose to their children and believed that fixing any detected problems would require significant effort. In addition, parents who did not test also perceived that less impure well water would mean lower medical expenses for the household.

Data showed no appreciable difference in perceptions of risk between parents who had engaged in protective action by testing for lead and those who had not.

CHAPTER 5

DISCUSSION

Summary

The overall goals of the ERRNIE project are 1.) To produce data addressing multiple exposures to children from low-income families residing in Gallatin County, Montana, 2.) To collect data addressing parents' knowledge and attitudes toward environmental risk reduction, and 3.) To test the effectiveness of a household risk reduction intervention delivered within the context of existing public health programs. This thesis focused on the Exploratory Phase of ERRNIE research and addresses two primary questions: 1.) What are the risk avoidance behaviors regarding environmental tobacco smoke (ETS), radon, carbon monoxide, contaminated well water, and lead among a sample of rural households? 2.) Is there a difference in perception of risk between households that engage in protective actions and those that don't?

A review of literature pertaining to the effectiveness of questionnaires to gather self-reported data showed that questionnaires produce reliable representations of household exposure to environmental agents. Experimentation resulted in recommendations that children be considered a unique group of individuals with unique responses to exposure to environmental agents and that many of these children come from vulnerable families that can best be reached through in-home visitation and intervention programs. In specific reference to ETS as an environmental agent research has shown that psychosocial effects influence the practice of protective behaviors and

that children's exposure to ETS is related to demographic factors as well as environmental factors.

The problem emphasized by this study was to examine the risk avoidance behaviors in which parents are engaging and also to examine the perceptions parents have about exposure to ETS, CO, lead, contaminated well water, and radon in children. A household questionnaire was used to measure perceptions and risk avoidance actions.

Results of questionnaire data analysis showed that the sample population is representative of the population of Gallatin County receiving public health services. The data also showed trends for smoking and non-smoking households. These trends suggest that knowing someone who has experienced health effects as a result of ETS can increase ones knowledge of ETS and also decrease the likelihood of being a smoker. It can also be noted that smokers are well aware that smoking causes health problems that they feel they can recognize although it was not specifically asked if participants could recognize the health effects of ETS exposure in children. This question is linked to whether or not smoking parents believe that ETS health effects can be serious and long-term.

Analysis of the risk protection actions in which parents engaged showed that non-smoking households took more actions in the public sector and fewer in the private. However, the reason non-smoking households took fewer private precautions was due to the fact that ETS was not present in the homes of non-smoking families, therefore eliminating the need for these types of actions to occur. About half of all smoking families took some public precautionary actions and other research into ETS suggests that this is because smokers generally have strong beliefs about the sanctity of an individual's personal choice. This research did not, however, measure either the presence or absence

of this belief. Risk protection actions were taken on the part of smokers to protect their children from their own smoke but only on a minimal level (22-33%).

Only 17.5% of parents engaged in protective action by testing the home for the presence of radon. While Gallatin County is known by researchers to be a zone high in radon, this information has only recently received media attention in the form of public service announcements and it is believed that radon information in the average household is limited. Limited knowledge about radon is evidenced by the significant number of surveyed parents who believed that it is possible to sense the presence of radon by sight, smell, or taste.

Two-thirds of the households surveyed took protective action against carbon monoxide exposure by having carbon monoxide detectors installed in the home. It should be noted that the questionnaire employed here did not inventory gas appliances in the home and some homes in the study may have relied completely upon electric appliances. Parents might argue against the need for a CO detector if there were no gas appliances in the home. However, even in the absence of fuel-burning appliances, other less-publicized sources of CO may have existed within homes (i.e. wood or pellet stoves, space heaters, very low ventilation, etc.)

In the case of well water, it was possible for parents to engage in a wider range of protective actions. These actions were divided up into two general categories: 1. treating drinking water by the use of filtration systems or softeners or by getting drinking water from a safe source such as bottled water or transported city water, and 2.) by testing water from the well providing water to the home. Fifty-seven percent of households

treated their water in some way before drinking it. While this may have been due to parents' desires to provide pure drinking water for their families, these actions may also have been due, at least in part, to the desire for improved aesthetic water qualities such as softness, taste, and smell (or the lack thereof). It should be noted that treating drinking water will not improve the overall quality of a household's well water. Testing the actual well water, however, can lead parents to valuable knowledge about the contents of their well water and subsequently, to information about how to improve this water quality if need be. Only 16% of households reported that their well water had been tested. While this is a protective action parents can take to prevent exposure to contaminants, it should be noted that almost half of the homes surveyed were rented. In light of this, well testing should have been reported for at least 50% of the surveyed households as landlords are required to show yearly evidence of well testing. One factor that may allow for some of this discrepancy is that some of the surveyed families had not lived in their current place of residence for more than one year. Depending on the timing of the cycle of well testing, households might not have received such a well report as of the date they were surveyed.

With respect to protective actions taken to reduce blood lead, only 16% of parents had chosen to take the precautionary measures of testing. One significant contributor to these low numbers may be that blood lead testing used to be a practice largely encouraged and performed by the Public Health Department. As of late there are no longer lead testing services promoted through the Health Department because government funding for lead screening programs has been rescinded. In addition it is

largely believed that the lead-focused media campaign of the past 20 plus years has been effective in eradicating most major sources of lead exposure to the general public.

Evaluation of perceptions of risk showed that non-smoking households did not perceive that their children were at risk of exposure to ETS because no smoking was occurring within the household. They did not feel that ETS exposure was a serious problem for their children because exposure wasn't happening, but they did believe that health effects of ETS are serious and long-term. This belief may have contributed to the decision to avoid smoking and smoky environments. Smokers on the other hand perceived that they were very sure that their children were at risk for health effects due to ETS, but they did not believe that health problems associated with ETS were serious or long-term. One reason for these perceptions may be because of the delayed onset of serious ETS health effects, such as lung cancer, that usually show up later in life. Smokers also felt more worried and frightened about the amount of tobacco smoke around their children suggesting that they may feel they are unable to control the amount of ETS to which their children are exposed.

Evaluation of perceptions of risk of radon exposure suggest that households that did not test for radon may not have done so because of two underlying beliefs. First, it was believed that if a radon problem were detected through testing, significant effort would be required for a difficult remediation of the problem. Second, it was believed that if radon were present, one would be able to sense it by seeing, smelling, or tasting the gas. Since radon cannot be perceived by the senses, parents may not have felt a need to test for radon because they did not believe that it was present in their homes. Households

that did test for radon perceived remediation to be much easier and less effort-intensive and they also understood that radon cannot be sensed.

Evaluation of perceptions of risk of carbon monoxide exposure suggest that there is a direct correlation between use of a CO detector and perception of risk of CO exposure. Parents who chose not to install CO detectors did not perceive that children in general were at risk of CO exposure and more specifically they did not perceive that their own children would experience any health effects due to exposure to CO. Conversely, households that did have CO detectors perceived that their children were at risk for health effects due to CO exposure. This suggests that parents who do not perceive a risk of CO may be lacking information about the health effects of being exposed to carbon monoxide. As a note the researcher noticed during home visits that occasionally parents equated CO with carbon dioxide, which is exhaled from the respiratory system. This misconception may have contributed to the perception that CO does not pose a health risk.

Evaluation of perceptions of well water treatment suggest that parents who treated their drinking water believed that they were effecting the health of their children by do so and had helped to protect them from problems related to impure drinking water. It should be noted, however, that filtration systems and softeners cannot guarantee the safety of well water. The use of bottled water and/or city water, on the other hand, can be assumed to be safe. Parents who did not engage in any forms of water treatment perceived water quality assurance to be a difficult and effort-intensive process which may attribute to their reasons for not engaging in any type of treatment. In addition, whether parents treated their water or not, they did not perceive that their children were at risk for being

exposed to contaminated well water or its related health effects. This suggests two possible forms of reasoning among parents. First, parents who chose not to treat may not have engaged in water treatment because they did not perceive any risk. Second, parents who chose to treat may have engaged in water treatment either because they perceived no risk, but did perceive other benefits of treatment or because they originally perceived a risk which they believe is no longer present because of treatment.

Evaluation of perceptions of well water testing indicated, in the same manner as treatment, that parents who did not test their well water perceived water quality assurance to be a difficult and effort-intensive process. Those who did not test their water also believed that impurities could be sensed. Since impurities cannot always be perceived by the senses, parents may not have felt a need to test for well water contamination because they did not believe that it was present. Neither the tested nor the non-tested group perceived that their children were at risk for exposure to contaminated well water and its subsequent health effects. This suggests two possible forms of reasoning among parents. First, parents who chose not to test may not have engaged in water treatment because they did not perceive any risk. Second, parents who chose to test may have engaged in water testing either because they perceived no risk, but did perceive other benefits of testing or because they originally perceived a risk which they believe is no longer present because of testing. Finally, parents who elected not to test and are renting may not be aware of the landlord's yearly testing obligation or they may not be engaging in ensuring that testing is being done because they do not see it as their responsibility.

Evaluation of perceptions of lead exposure show that parents, whether they have tested blood lead or not, do not perceive their children to be at risk for lead exposure. Results do suggest that parents who have tested for blood lead may have marginally different perceptions about lead because they have a slightly higher margin of knowledge about lead and its health effects than those who have not tested, as they agree more strongly that health affects due to lead are serious and that lead exposure can result in anemia and elevated medical expenses.

Conclusions:

Based on the preceding data, the following conclusions are offered for ETS:

1. Smoking parents are not engaging in enough protective actions in the home environment.
2. Non-smoking parents are taking appropriate precautions to avoid ETS exposure in their children.
3. Knowledge and experience with ETS issues needs to be increased, especially in smoking households because the data shows that these decrease the incidence of smoking within the home.
4. More information on the seriousness of effects of ETS and how to recognize the symptoms of ETS health effects needs to be presented to families with young children because a consistently high level of ETS health effects awareness does not exist either in smoking or non-smoking families.
5. Smoking parents feel worried and frightened about the amount of ETS their children are around and therefore some impetus for change is present.

Based on the preceding data, the following conclusions are offered for radon:

1. Due to the fact that Gallatin County is high in radon, not enough parents are engaging in radon testing in spite of the fact that it is simple and inexpensive.
2. More public information about the properties and effects of radon is needed because a consistently high level of radon awareness does not exist as evidenced by the misconceptions about the ability to sense radon.

Based on the preceding data, the following conclusions are offered for CO:

1. Many parents are aware of the dangers of carbon monoxide and have taken appropriate action, but for those parents who have not, compelling information needs to be presented that will lead to the purchase and installment of a CO detector. This information should include facts about the health effects of CO and the specific vulnerabilities of children.
2. The difference between CO and CO_2 should be clearly stated in any information presented to the public.

Based on the preceding data, the following conclusions are offered for well water:

1. Treatment of water should be presented to the public as a low-cost way to manage exposure to well water contaminants when the status of a well is uncertain, since a limited number of households had had their well water tested.
2. The public should be informed about the limitations of filtration and water softening systems so that they understand that these cannot necessarily ensure the safety of drinking water.

3. The public should be informed of the landlord's responsibility to test on a yearly basis and to present test results to all tenants regularly so that tenants can hold landlords accountable, thereby taking responsibility for the quality of their own household's drinking water.
4. Household's relying upon well water should be informed of the possible contaminant issues involved with the use of unregulated water as parents did not perceive that well water contamination posed a risk to their children.
5. Household's relying on well water should be informed of low-cost and simple methods of improving water quality (when possible) and maintaining good water quality as parents perceived remediation of well water to be difficult and effort-intensive.

Based on the preceding data, the following conclusions are offered for lead:

1. Programs like the ERRNIE project should continue to screen for lead to locate possible remaining sources of contamination, as health departments are no longer able to do screening and the problem of lead exposure has not yet been entirely eradicated.
2. The lead exposure education that has occurred in the past should continue in order to ensure that new generations of parents continue to monitor their children's environments for sources of exposure.

Recommendations

Based on the preceding conclusions, the following recommendations are suggested:

1. Barriers to taking protective actions should be evaluated and addressed.

2. There is enough evidence to suggest that a public health nurse-delivered educational intervention could provide lacking information and decrease the incidence of exposure to toxic agents in children within the home as well as in the surrounding community.

Further Study

Further studies on the risk perceptions regarding other environmental agents should be undertaken in order to provide solid backing and competent design for educational interventions that can allow parents to control the environmental health of their homes. More multi-agent biomarker collection studies should be performed in rural areas as well as in other populations to better define the effects of concurrent exposure to many environmental agents via multiple pathways. In addition more should be learned about the effects of environmental agents on the growth and development of children during different stages of development. Focus group input for this study (not reported here) also suggested that mold is considered a priority agent by parents participating in the study and that it should be added as a sixth agent in the intervention phase of the ERRNIE project.

The importance of Phase I of this research is that it led to a decision by community and scientific focus groups about the agents of primary concern within Gallatin County. All agents designated as primary became the focus of a public health nurse-delivered educational intervention. This preliminary analysis of toxin exposures and perceptions indicates that there is a significant need for educational interventions to

circumvent or break down social and contextual barriers to protective behavior modification as well as to bolster basic environmental health knowledge and that these interventions can be administered within an intervention delivered by existing public health services programs.

Implications for Education

Results of this study have provided the basis for design of the ERRNIE educational intervention curriculum. The researcher has taken into account misconceptions about agents, behavioral barriers indicated by the lack of correlation between knowledge and action, and effective messages that have lead to knowledge and subsequent action as they have been described through analysis. Study results have allowed the researcher to apply sound educational principles to a comprehensive survey of knowledge, attitudes, and behaviors as they relate to the reduction of environmental risk for children.

A detailed explanation of the intent of the ERRNIE program to frame an intervention addressing the needs presented by this initial research in an interactive, effective, and progressive format is included as an appendix to this thesis. See appendix D.

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APPENDICES

APPENDIX A

AGENT ACTION LEVEL REPORTING

DATE: _____

TO: _____

Thank you for your participation in MSU's ERRNIE children's environmental health study. Your personal test results are in and are listed below. We have provided a copy of these results to the Montana state physician and your child's doctor or nurse. If you have any questions about these results, please:

- Call the MSU ERRNIE project office at 994-5098
- Call your doctor or nurse
- Call your nurse at the Gallatin City County Health Department
- Look for answers in the information folder that we gave to you

Here are your results:

Your WELL WATER
Coliforms – bacteria count

Your coliform value is:	Coliform safety range: None should be detected.	Is your value in the safety range?

Metals – determines the hardness of your water

Your lead value is:	Lead safety range: <0.015mg/L	Is your value in the safety range?
Your copper value is:	Copper safety range: <1.3mg/L	Is your value in the safety range?
Your arsenic value is:	Arsenic safety range: <0.010mg/L	Is your value in the safety range?
Your hardness value is:	Hardness preferred range: <500mg/L as $CaCO_3$	Is your value in the preferred range?

Herbicides/Pesticides - chemicals used to repel weeds or pests

Your pesticide value is:	Pesticide safety range: None should be detected.	Is your value in the safety range?
Your herbicide value is:	Herbicide safety range: None should be detected.	Is your value in the safety range?

Petroleum – byproducts from fuels like gasoline, diesel, lighter fluid, etc.

Your petroleum value is:	Petroleum safety range: None should be detected.	Is your value in the safety range?

Volatile Organic Compounds – contaminants from degreasers like dry cleaning solvents.

Your VOC value is:	VOC safety range: None should be detected.	Is your value in the safety range?

Nitrates – elevated levels of nitrates in drinking water may cause “blue baby syndrome” or methemoglobinemia.

Your nitrate value is:	Nitrate safety range: <10mg/L as N	Is your value in the safety range?

Your children's COTININE levels -- a byproduct made by the body when nicotine from cigarette smoke is present. Cigarette smoke in the lungs of children can lead to pneumonia, more severe asthma symptoms, and future risks for lung cancer.		
Child #1 (youngest) cotinine value is:	Cotinine safety range: <5ng/mL	Is your value in the safety range?
Child #2 cotinine value is:	Cotinine safety range: <5ng/mL	Is your value in the safety range?
Child #3 cotinine value is:	Cotinine safety range: <5ng/mL	Is your value in the safety range?
Child #4 cotinine value is:	Cotinine safety range: <5ng/mL	Is your value in the safety range?
Child #5 cotinine value is:	Cotinine safety range: <5ng/mL	Is your value in the safety range?

Your children's blood LEAD levels -- a naturally occurring element that may be found in paint, water pipes, and car batteries. Lead-exposed children may develop anemia, hearing problems, and changes in behavior.		
Child #1(youngest) lead value is:	Lead safety range: <10ug/dL	Is your value in the safety range?
Child #2 lead value is:	Lead safety range: <10ug/dL	Is your value in the safety range?
Child #3 lead value is:	Lead safety range: <10ug/dL	Is your value in the safety range?
Child #4 lead value is:	Lead safety range: <10ug/dL	Is your value in the safety range?
Child #5 lead value is:	Lead safety range: <10ug/dL	Is your value in the safety range?

CARBON MONOXIDE (CO) levels in your home **-- a colorless, odorless gas released when appliances do not completely burn their fuel. Symptoms of carbon monoxide poisoning include headache and dizziness. Deaths are rare, but can occur.**		
Your CO value is:	CO safety range: 9ppm over 8hr. period	Is your value in the safety range?

RADON levels in your home **-- a radioactive gas that comes from the natural decay of uranium in the soil. Radon gas releases small bursts of energy that can damage your lungs and lead to cancer.**		
Your radon value is:	Radon safety range: <4pCi/L	Is your value in the safety range?

Even though these values are our most accurate assessments to date, new research can bring changes to what we know about the ranges of safety we have reported to you. It is always a good idea to frequently update your own knowledge about environmental factors by reading new information provided by the Environmental Protection Agency or your health care providers. If you asked for a copy of the completed study, please be aware that this is a long study and you probably will not see these results for four years. If you have a change of address please notify the ERRNIE office so that we can get a copy to you when the time arrives.

If you'd like to discuss any of these results with the ERRNIE staff please call (406) 994-5098 and we would be happy to set up a personal appointment with you. Thank you for your time and support for this research. Your participation is greatly appreciated.

Sincerely,

Dr. Wade Hill, PhD, R.N.
Assistant Professor, MSU College of Nursing
(406) 994-4011

Ms. Megkian Penniman, B.S.
Graduate Research Assistant, MSU College of Nursing
(406) 994-5098

Dr. Pat Butterfield, R.N., PhD.
Professor, MSU College of Nursing
(406) 994-3783

APPENDIX B

QUESTIONNAIRE COMPONENTS

Item-Variable-Construct Crosswalk: ERRNIE Adult Questionnaire

Construct	**Variable(s)**	Response	Coding and Scale
Physiologic Domain	Has a doctor ever told you that you have any of these medical conditions? B1. Asthma B2. Anemia B3. Cancer B4. Diabetes B5. Other B6. Other	Check yes, no, or don't know. If cancer write in what type. If other write in.	1= yes, 0 = no, -6 – don't know other = string **all missing values = -9**
	B7. Do you smoke cigarettes?	Yes or No	1 = yes, 0 = no
	B8. On the average, how many cigarettes do you smoke a day?	Fill in number of cigarettes	numeric
	Do you use any of the following types of nicotine? B9. Snuff or chew B10. Smoking tobacco (pipe) B11. A patch to help you quit smoking. B12. Gum to help you quit smoking. B13. Other?	Yes or No. If yes, fill in how often. If other write in.	1 = yes, 0 = no how often = numeric other = string
Vulnerability			

Domain (Family)			
Vulnerability Domain (Community)			
Epistemological Domain (Personal Thought)	B14. In the past 12 months have you had an illness that you think was caused by something in the air or water where you have ever lived or worked, not something you caught from others? B15. Do you think it was something in the air, the water, or both.	Check Yes, No, or Don't know. Check Air, Water, Both, or Don't Know.	1 = yes, 0 = no, -6 don't know 1 = air, 2 = water, 3 = both, -6 = don't know
Epistemological Domain (Social Knowledge)			
Health Protection Domain (Concerns)			
Health Protection Domain (Efficacy)			
Health Protection Domain (Actions)			
Demographic and Contextual Data	A1. What is your current job status? A2. List your current jobs?	Working full time, Working part-time, Student and working, Student and not working, Employed at home, Full time homemaker, Disabled, Unemployed, Other Job title, What do you do? What does this company do or make?	1 = full time, 2 = part-time, 3 = working student, 4 = student not working, 5 = home employment, 6 = homemaker, 7 = disabled, 8 = other, 9 = unemployed, other = string job title = string, what you do = string, what

		How long have you worked there? (years and months) Do you ever do this work in your home or yard? (Yes or No) Do you usually wear your work clothes or boots inside the home after work? (Yes or No)	company does = string, how long = numeric; do this work at home—1 = yes, 0 = no; wear work clothes in home—1 = yes, 0 = no.
	A3. List other jobs you have had over the past three years.	Job title, What did you do? What did this company do or make? How long did you work there? (years and months) Do you ever do this work in your home or yard? (Yes or No) Do you usually wear your work clothes or boots inside the home after work? (Yes or No)	job title = string, what you did = string, what company did = string, how long = numeric; do this work at home—1 = yes, 0 = no; wear work clothes in home—1 = yes, 0 = no.
	A4. Have you done any of the following hobbies or home projects in the past year?	Check all hobbies and projects performed and write in how many times per year.	1 = yes, 0 = no, times per year = numeric
	C1. What is your year of birth?	List year	year = numeric last two digits
	C2. What racial background best describes you?	Check option that best describes racial background.	white = 1, black = 2, native amer. = 3, asian = 4, other = 5, describe other = string
	C3. Are you of Hispanic ethnicity?	Yes or No.	1 = yes, 0 = no
	C4. What is the highest grade you completed in school?	Check one box. Grades 6-18.	Unresolved
	C5. What type	I have no health insurance. I have	No insurance = 1,

	of health insurance do you have for yourself?	Medicaid health insurance. I have another type of health insurance (write in). I have private health insurance.	Medicaid = 2, another type = 3, private = 4, list other = string
	C6. What is your current marital status?	Married, Widowed, Divorced/separated, Living with partner, Never married, Other (write in).	Married = 1, widowed = 2, divorced/separated = 3, partner = 4, never married = 5, other = 6, list other = string
	C7. Are you male or female?	Check male or female	Male = M, female = F
Qualitative Probes			

RED = Predictors
BLUE = Mediators
GREEN = Outcomes

Item-Variable-Construct Crosswalk: ERRNIE Child Questionnaire

Construct	**Variable(s)**	Response	Coding and Scale
Physiologic Domain	Has a doctor ever told you that your child has any of these medical conditions? A1. Asthma A2. Anemia A3. Attention Deficit Hyperactivity Disorder (ADHD) A4. Arthritis A5. Cancer A6. Diabetes A7. Ear Infections A8. Eczema A9. Heart problems A10. Lead poisoning A11. Sleep problems or severe insomnia A12. Urinary infections A13. Other A14. Other A15. Please list any prescription medication your child is currently taking. A16. Please list any over-the-counter medication your child is currently taking. A17. Please list any allergies your child has to food,	Check yes, no or don't know. If cancer write in what type. If other write in. Write in name of medication, dose and frequency, and reason for taking medication. Write in name of medication, dose and frequency, and reason for taking medication. Write in allergies.	1 = yes, 0 = no, -6 = don't know, **all missing values = -9** what type of cancer = string list other = string Name of medication = string Dose and frequency = string Reason for medication = string Name of medication = string Dose and frequency = string Reason for medication = string Allergies = string

	medications, and/or environmental factors such as ragweed, pollen, dust, pet hair, etc.	Write in the number of times.	Times = numeric
	A18. During the past year, how may times has your child been seen (by a doctor or nurse) for a well child care?	Write in number of times.	Times = numeric
	A19. During the past year, how many times has your child been at the clinic or doctor's office for a health problem?	Yes or No. If yes write in reason(s).	1 = yes, 0 = no, list reasons = string
	A20. During the past year, has your child been seen in the emergency room?	Write in number of times. Write in reason(s).	Times = numeric List reasons = string
	A21. During the past year, how many times has your child been admitted to the hospital?	Yes or No. If yes write in reason(s).	1 = yes, 0 = no, list reasons = sting
	A22. During the past year, have you needed to call poison control for this child?	Check all that apply. If other write in. Yes or No. If yes write in.	formula = 1, baby food = 1, breast milk = 1, adult food = 1, other = 1, list other = string 1 = yes, 0 = no, explain = string
	B15. What is the best description of your child's diet?		
	B16. Does your child have any		

	unusual eating habits?		
Vulnerability Domain (Family)	Does your child have any of the following habits? B1. Use a blanket. B2. Suck a thumb or fingers. B3. Use a pacifier daily. B4. Put everything in his or her mouth. B5. Teeth on a particular item consistently. B6. Other B7. Other B8. Does your child spend over 4 hours a day in a basement room? B9. In which room does your child sleep? B10. Where does your child prefer to sleep most nights? B11. Do any pets sleep in your child's room? B17. Is your child around cigarette smoke? (depending on the answer to B18 this could be either family or community.)	Yes or No. If other write in. Yes or No. If yes write in description of room setting. Check best option. If other write in. Check best option. If other write in. Yes or No. If yes write in type of pet. Yes or No. Check all that apply. If other write in.	1 = yes, 0 = no, list other = string 1 = yes, 0 = no, describe room = string living room = 1, own bedroom = 2, parents room = 3, other = 4, describe other = string in a bed = 1, on the couch = 2, on the floor = 3, other = 4, describe other = string 1 = yes, 0 = no, type of pet = string 1 = yes, 0 = no, our home = 1, relatives = 1, childcare = 1, car = 1, other place = 1, list other = string

	B18. In what types of places is your child around cigarette smoke?		
Vulnerability Domain (Community)	B12. Does your child usually go to childcare (at a home, school, or daycare) during the day? B13. What type of childcare program does your child usually attend? B14. About how many hours per week does your child spend in daycare?	Yes or No. Check best option. Write in number of hours.	1 = yes, 0 = no relative's home = 1, daycare = 2, daycare + school = 3, in-home daycare = 4, public school = 5, private school = 6 numeric
Epistemological Domain (Personal Thought)	A24. During the past 12 months, has your child had an illness that you think was caused by something in the air or water where you have ever lived or worked, not something he/she caught from others? A25. Do you think it was something in the air, water, or both?	Check Yes, No, or Don't Know. Check Air, Water, Both, or Don't Know.	1 = yes, 0 = no, -6 = I don't know Air = 1, water = 2, both = 3, don't know = -6
Epistemological Domain (Social Knowledge)			
Health Protection Domain (Concerns)	A23. Do you have any other health concerns related to this child?	Yes or No. If yes write in concern(s).	1 = yes, 0 = no, list concerns = string
Health Protection			

Domain (Efficacy)			
Health Protection Domain (Actions)			
Demographic and Contextual Data	C1. How tall is your child? C2. How much does your child weigh? C3. What is this child's date of birth? C4. Is your child male or female? C5. What racial background best describes your child? C6. Is your child of Hispanic ethnicity? C7. What type of health insurance does your child have?	Write in number of inches. (convert from feet and inches) Write in number of pounds. Write in month, day, and year. Check Male or Female. Check best option. If other write in. Yes or No. Check best option or I don't know.	Number of inches = numeric Number of pounds = numeric Date: mm/dd/yyyy M= male, f= female White = 1, black = 2, native amer = 3, asian = 4, other = 5, list other = string 1 = yes, 0 = no no health ins. = 1, CHIP = 2, Caring program = 3, private = 4, don't know = -6
Qualitative Probes			

RED = Predictors
BLUE = Mediators
GREEN = Outcomes

Item-Variable-Construct Crosswalk: ERRNIE Household Questionnaire

Construct	**Variable(s)**	Response	Coding and Scale
Physiologic Domain	A6. Has your home had a major addition or renovation since it was built?	Yes, no, or don't know. If yes write in years.	0=no, 1=yes, -6=don't know. Years of renovation=string.
	A7.What type of foundation does your home have?	Check best option. If other write in.	1= concrete slab, 2= crawl space, 3=combo, 4=full basement, 5=other, -6= don't know.
	A8. Do you have a basement?	Yes or No. Yes or No. If yes write in when.	0=no, 1=yes 0=no, 1=yes. When=string
	A9. Have you ever had trouble with flooding?	Check all that apply. If other write in.	0=no, 1=yes for each heat source.
	B1. What types of furnaces and heaters are in your home?	Check all that apply. If other write in. 0, 1-5, 6-20, 21-60, 61-90, >90.	0=no, 1=yes for each fuel 1=none, 2=1-5, 3=6-20, 4=21-60, 5=61-90, 6=>90
	B2. What types of fuel heat your home?	0, 1-5, 6-20, 21-60, 60-90, >90.	1=none, 2=1-5, 3=6-20, 4=21-60, 5=61-90, 6=>90
	B3. In the past 12 months, how many days have you used a wood stove, pellet stove, or wood fireplace?	Yes or No. If yes write in how many times per year.	0=no, 1=yes for each appliance
	B4. In the past 12 months, how many days have you used a kerosene, natural		

	gas, or propane space heater?	Yes or No.	
	B5. Please check all of the appliances that you use in your home. Air conditioner Humidifier Air purifier	Yes or No. Yes or No. Write in number of smokers.	0=no, 1=yes 0=no, 1=yes 0=no, 1=yes number of smokers=numeric
	B6. Do you have a washing machine?	Check yes or no.	0=no, 1=yes
	B7. Do you have a dryer?	Check yes or no.	0=no, 1=yes
	B8. Is the dryer vented to the outside?	Check yes or no.	0=no, 1=yes
	D1. How many cigarette smokers, including yourself, live in your home?	Check yes or no. Check yes or no.	0=no, 1=yes 0=no, 1=yes
	D3. Within your home, does the female head of the household currently smoke?	Check "community sewer system" or "septic tank" or "don't know."	0=no, 1=yes 1=septic tank, 2=community sewer, -6=don't know
	D4. Does she smoke in the home?	Write in number of years or check "I don't know".	-6=don't' know. Number of years=numeric
	D5. Within your home, does the male head of the household currently smoke?	Yes, no, or don't know.	

	D6. Does he smoke in the home?	Yes, no, or don't know.	0=no, 1=yes, -6=don't know
	D7. Are your children exposed to cigarette smoke on a regular basis (at least one time a week) from anyone else (such as daycare providers, grandparents, or friends)?	Yes, no, or don't know. If yes write in years system was pumped. Check "private well", "community system", or "don't know".	0=no, 1=yes, -6=don't know 0=no, 1=yes, -6=don't know, years pumped=numeric 1=private well, 2=community system, -6=don't know
	G1. Is your home on septic tank or community sewer system?	Write in years or check "I don't know". Write in feet or check "I don't know."	-6=don't know, age of well=numeric
	G2. How old is your septic tank?	Yes or No.	-6=don't know, depth of well=numeric
	G3. Has your septic system ever backed up so that your toilets don't flush?	Check all that apply or "don't know." Write in results.	0=no, 1=yes 0=no, 1=yes for each type of pipe, -6=don't know
	G4. Has your septic system ever backed up so that sewage comes up in the yard?		results=string
	G5. Have your ever had your septic system		

	pumped out? G6. Do you know if your tap water comes from a private well or a community water system? G7. How old is your well? G8. About how deep is your well? G9. Do you know what types of water pipes are in your home? G10. What types of water pipes do you have? G13. What were the results of your water test?		
Vulnerability Domain (Family)	What types of hobbies, jobs, crafts, or work are done inside your home? A10. Furniture refinishing A11. Photo developing (darkroom) A12. Stained glass A13. Ammunition	Yes or No. If yes write in number of times per month or year and circle month or year. If other, write in.	0=no, 1=yes for each item. Number of times=numeric 0=no, 1=yes for each

	reloading A14. Wood working A15. Other A16. Other Tell us about your pets. Do you have a… A25. Dog? A26. Cat? A27. Rabbit? A28. Horse? A29. Bird? A30. Other? Does anyone you know have health problems from these issues? C29. Radon gas C30. Carbon monoxide C31. Impure well water C32. Lead C33. Indoor cigarette smoke C34. Other environmental health issues? I10. Do you recycle glass, newspaper, cardboard, and/or cans? I11. If you do not recycle, what are your reasons?	Yes or No. If yes check "inside," "outside," or "both." If other, write in. Check Yes, No, or Don't Know. If other things, write in. Check Yes or No. Check all that apply. If other, write in.	pet. If yes, 1=inside, 2=outside, 3=both. 0=no, 1=yes, -6=don't know. Write in other=string 0=no, 1=yes 0=no, 1=yes for each reason.
Vulnerability Domain			

(Community)			
Epistemological Domain (Personal Thought)	How much do you know about these issues… C31. Radon gas?	Check nothing, a little bit, some, quite a bit, a lot.	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C32. Carbon monoxide?	Nothing – a lot.	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C33. Impure well water?	Nothing – a lot	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C34. Lead?	Nothing – a lot	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C35. Indoor cigarette smoke?	Nothing – a lot, list other	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C36. other environmental health issues?		1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	Would you recognize health problems from these issues in members of your family? C37. Radon gas?	Nothing – a lot Nothing – a lot	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C38. Carbon monoxide?	Nothing – a lot	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C39. Impure well water?	Nothing – a lot	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C40. Lead?	Nothing – a lot, list other	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot

	C41. Indoor cigarette smoke?	Strongly disagree – Strongly agree.	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C42. Other environmental health issues.	Strongly disagree – Strongly agree.	1=nothing, 2=a little bit, 3=some, 4=quite a bit, 5=a lot
	C50. I think that most environmental health issues are not very serious.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C52. I am too busy getting through the day to worry about vague things like environmental health issues.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C53. When I find a place to live, I need to get money down on it, regardless of its condition.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C54. Environmental health issues are a bigger problem in other states than in Montana.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D16. Our children are at risk for being exposed to indoor tobacco smoke.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.

	D17. We can sense (taste, smell, see) indoor tobacco smoke.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D18. Indoor tobacco smoke is a serious problem for our children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D19. Our children are at risk for having health effects due to tobacco smoke.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D20. Health effects due to tobacco smoke are likely to be serious.	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D21. Being around less tobacco smoke would improve the long-term health of my children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D22. Being around less tobacco smoke would mean fewer colds and infections for my children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D23. Being		1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly

	around less tobacco smoke would mean lower medical expenses for our family.	Strongly disagree – Strongly agree.	sure, 6=sure, 7=very sure.
	D29. I feel angry about the amount of tobacco smoke around our children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D30. How sure or unsure do you feel about whether tobacco smoke in your home could cause health problems?	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree
	E3. Our children are at risk for being exposed to radon.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E4. We can sense (taste, smell, see) radon.	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E5. Radon is a serious problem for our children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E6. Our children are at risk for have health	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.

	effects due to radon.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E7. Health effects due to radon are likely to be serious.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E8. Being around less radon would improve the long-term health of my children.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	E9. Being around less radon would reduce the risk of my children getting cancer.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E10. Being around less radon would mean lower medical expenses for our family.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E16. I feel angry about the amount of radon around our children.	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E17. How sure or unsure do you feel about whether radon in	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5=

	your home could cause health problems?		slightly agree, 6=agree, 7=strongly agree.
	F3. Our children are at risk for being exposed to indoor carbon monoxide.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F4. We can sense (taste, smell, see) carbon monoxide.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F5. Carbon monoxide is a serious problem for our children.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F6. Our children are at risk for having health effects due to carbon monoxide.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	F7. Health effects due to carbon monoxide are likely to be serious.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F8. Being around less carbon monoxide would improve the long-term	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree

	health of my children. F9. Being around less carbon monoxide would reduce the risk of heart disease for my children. F10. Being around less carbon monoxide F16. I feel angry about the amount of carbon monoxide around our children. F17. How sure or unsure do you feel about whether carbon monoxide in your home could cause health problems? G16. Our children are at risk for being exposed to impure water. G17. We can sense (taste, smell, see) impure well water.	Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=very sure, 2=unsure, 3=slightly unsure,

	G18. Impure well water is a serious problem for our children. G19. Our children are at risk for having health effects due to impure well water. G20. Health effects due to impure well water are likely to be serious. G21. Being around less impure well water would improve the long-term health of my children. G22. Being around less impure well water would mean less diarrhea and stomach problems for my children. G23. Being around less impure well	Very unsure – Very sure.	4=neutral, 5=slightly sure, 6=sure, 7=very sure. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree,

	water would mean lower medical expenses for our family. G29. I feel angry about the amount of impure well water that our children drink. G30. How sure or unsure do you feel about whether impure well water in your home could cause health problems? H4. Our children are at risk for being exposed to lead. H5. We can sense (taste, smell, see) lead. H6. Lead is a serious problem for our children. H7. Our children are at risk for having health effects due to lead.		7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.

	H8. Health effects due to lead are likely to be serious. H9. Being around less lead would improve the long-term health of my children. H10. Being around less lead would mean fewer problems with anemia. H11. Being around less lead would mean lower medical expenses for our family. H17. I feel angry about the amount of lead in homes. H18. How sure or unsure do you feel about whether lead in your home could cause health		

	problems?		
Epistemological Domain (Social Knowledge)	D15. Children in Gallatin County are at risk for being exposed to indoor tobacco smoke. E2. Children in Gallatin County are at risk for being exposed to radon. F2. Children in Gallatin County are at risk for being exposed to carbon monoxide. G15. Children in Gallatin County are at risk for being exposed to impure water. H3. Children in Gallatin County are at risk for being exposed to lead.	Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
Health Protection Domain (Concerns)	C1. I am concerned about carbon monoxide from our furnace or stove.	Strongly disagree – Strongly agree. Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree,

	C2. I am concerned about radon levels in our home.	Strongly disagree – Strongly agree.	2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C3. I am concerned about wood stoves polluting the air outside our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C4. I am concerned about pesticide spraying inside our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C5. I am concerned about burning garbage polluting the air outside.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C6. I am concerned about local factories polluting the air.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C7. I am concerned about cigarette smoking inside our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C8. I am concerned about	Strongly disagree –	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5=

	our septic system polluting our well.	Strongly agree.	slightly agree, 6=agree, 7=strongly agree.
	C9. I am concerned about our well being contaminated by out neighbor's septic system.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C10. I am concerned about our septic system contaminating the Gallatin Valley.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C11. I am concerned about arsenic in my drinking water.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C12. I am concerned about bacteria and germs in my drinking water.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C13. I am concerned about lead in my drinking water.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C14. Pesticide spraying on farms or gardens	Strongly disagree –	

	near our home.	Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C15. I am concerned about floridation of drinking water in the U.S.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C16. I am concerned Asbestos inside our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C17. I am concerned about chronic wasting disease in the game we hunt.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C18. I am concerned about mold growth in our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C19. I am concerned about mercury in the fish we catch.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C20. I am concerned about animal waste around our yard or land.	Strongly disagree –	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5=

		Strongly agree.	slightly agree, 6=agree, 7=strongly agree.
	C21. I am concerned about hantavirus from mice droppings.	Strongly disagree – Strongly agree. Write in.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C22. I am concerned about West Nile virus from mosquitoes.	Check yes or no.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C23. I am concerned about lead paint in our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C24. I am concerned about pesticide dust in our food.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C25. I am concerned about wood stoves polluting the air inside our home.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C26. I am concerned about pesticides on our lawn or garden.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. Other=string
	C27. I am concerned about… nitrates in my drinking water.	Strongly disagree – Strongly agree.	0=no, 1=yes

	C28. I am concerned about asbestos from Libby in our insulation.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C29. Chlorination of drinking water in the U.S.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	C30. I am concerned about… Other?	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D14. In the last six months have you worried that your child may start smoking later in life from seeing others they care about smoking?		1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D27. I feel worried about the amount of indoor tobacco smoke around our children.		1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	D28. I feel frightened about the amount of		1=strongly disagree, 2=disagree, 3=slightly

	tobacco smoke around out children. E14. I feel worried about the amount of radon around our children. E15. I feel frightened about the amount of radon around our children. F14. I feel worried about the amount of indoor carbon monoxide around our children. F15. I feel frightened about the amount of carbon monoxide around our children. G27. I feel worried about the amount of impure well water that our children drink. G28. I feel frightened about the amount of		disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.

	impure well water that our children drink. H15. I feel worried about the amount of lead in homes. H16. I feel frightened about the amount of lead in homes.		
Health Protection Domain (Efficacy)	C49. I worry about having enough money to buy or rent a home that is free of contaminants. C51. I am concerned that my children may be exposed to things that I don't understand. D24. It costs a lot of money to decrease the amount of indoor tobacco smoke. D25. It takes a lot of effort to decrease the amount of indoor tobacco smoke.	Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Strongly disagree – Strongly agree. Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree. 1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree,

			7=strongly agree.
	D26. It is hard to decide which is the best way to reduce indoor tobacco smoke.	Very unsure – Very sure.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	D31. How sure or unsure do you feel about how to find out if your home is safe or unsafe?	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	D32. How sure or unsure do you feel about whether you should take steps to reduce tobacco smoke in your home?	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E11. It costs a lot of money to decrease the amount of indoor radon gas.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E12. It takes a lot of effort to decrease the amount of radon in our home.	Very unsure – Very sure.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	E13. It is hard to decide which is the best way to reduce radon.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
			1=strongly disagree,

	E18. How sure or unsure do you feel about how to find out if your home is safe or unsafe?	Strongly disagree – Strongly agree.	2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
		Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	E19. How sure or unsure do you feel about whether you should take steps to reduce radon in your home?	Very unsure – very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F11. It costs a lot of money to decrease the amount of carbon monoxide in our home.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	F12. It takes a lot of effort to decrease the amount of carbon monoxide in our home.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	F13. It is hard to decide which is the best way to reduce carbon monoxide.	Strongly disagree – Strongly agree.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F18. How sure or unsure do you feel about how to find out if your	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.

	home is safe or unsafe?		disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	F19. How sure or unsure do you feel about whether you should take steps to reduce carbon monoxide in your home?	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	G24. It costs a lot of money to decrease the amount of impure well water.	Strongly disagree – Strongly agree.	1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	G25. It takes a lot of effort to decrease the amount of impure well water.	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	G26. It is hard to decide which is the best way to improve the purity of well water.	Very unsure – Very sure.	1=strongly disagree, 2=disagree, 3=slightly disagree, 4= neutral, 5= slightly agree, 6=agree, 7=strongly agree.
	G31. How sure or unsure do you feel about how to find out if your home is safe or unsafe?		1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very sure.
	G32. How sure or unsure do you		1=very sure, 2=unsure, 3=slightly unsure, 4=neutral, 5=slightly sure, 6=sure, 7=very

	feel about whether you should take steps to reduce impure well water in your home? H12. It costs a lot of money to decrease the amount of lead in our home. H13. It takes a lot of effort to decrease the amount of lead in our home. H14. It is hard to decide which is the best way to reduce lead in homes. H19. How sure or unsure do you feel about how to find out if your home is safe or unsafe? H20. How sure or unsure do you feel about whether you should take steps to reduce lead in your home?		sure.
Health Protection	D2. How is	Check the appropriate	1=no one smokes,

Domain (Actions)	cigarette smoking handled in your home?	box: no one smokes, special guests smoke, smoke in areas, smoke anywhere.	2=special guests smoke, 3=smoke in certain areas, 4=smoke anywhere.
	In the last six months have you…	Check yes or no.	0=no, 1=yes
	D8. Avoided taking your children to a restaurant or business because you thought it was too smoky?	Check yes or no.	0=no, 1=yes
	D9. Asked someone to roll down the window before smoking in a car with children present?	Check yes or no.	0=no, 1=yes
		Check yes or no.	0=no, 1=yes
	D10. Asked someone to go outside your home to smoke?	Check yes or no.	0=no, 1=yes
	D11. Asked someone not to smoke in your car?	Yes, no, or don't know. If yes, write in results.	0=no, 1=yes, -6=don't know. If yes, results=string.
	D12. Avoided leaving you children with a caretaker or friend that smokes?	Yes, no, or don't know.	0=no, 1=yes, -6=don't know
		Yes, no, or don't know.	0=no, 1=yes, -6=don't know
	D13. Opened doors or windows n your house to lessen the amount	Check all that apply or Don't Know.	0=no, 1=yes for all contaminants, -

	of cigarette smoke? E1. Have you ever had your home tested for radon? F1. Do you have a CO detector in your home? G11. Have you ever had the water in your home tested? G12. What did you test your water for? G14. Do you do any of the following things to improve your drinking water? H1. Have you ever had your home tested for lead? H2. Have you or any member of your household ever had their blood lead level checked?	Check all that apply. If other write in. Check Yes, No, or Don't Know. If yes, write in why. Check Yes, No, or Don't Know. If yes, write in when and why.	6=don't know 0=no, 1=yes. Other=string 0=no, 1=yes, -6=don't know. If yes, why=string 0=no, 1=yes, -6=don't know. If yes, when and why=string
Demographic and Contextual Data	A1. How many rooms does your home have? A2. How long	Write in number of rooms. Write in number of	Number of rooms=numeric Number of

	have your lived in your current home? A3. Do you rent or own you home? A4. Is there a sidewalk on the street in front of your home? A5. About what year was your home built? What types of hobbies, jobs, crafts, or work are done inside your home? A10. Furniture refinishing A11. Photo developing (darkroom) A12. Stained glass A13. Ammunition reloading A14. Wood working A15. Other A16. Other What types of hobbies, jobs, crafts, or work are done outside the home in the yard? A17. Automotive	years and months. Check "own it" or "rent it". Check Yes or No. Write in year or check "don't know". Yes or No. If yes write in number of times per year. If other, write in. Yes or No. If yes write in number of times per year. If other, write in. Write in year. Check Male or Female Check Yes or No.	months=numeric Rent=1, own=2 0=no, 1=yes year=numeric, -6=don't know 0=no, 1=yes for each hobby. If yes, number of times=numeric 0=no, 1=yes for each hobby. If yes, number of times=numeric Year=numeric M=male, f=female 0=no, 1=yes

	repair A18. Clean and age game animals A19. Wood working A20. Ammunition reloading A21. Metal working A22. Gardening A23. Other A24. Other I1. What is your year of birth? I2. Are you male or female? I3. Are you of Hispanic ethnicity? I4. What racial background best describes you? I5. What is the highest grade you completed in school? I6. What was your total gross income last year? I7. Which of the following statements best	Check the one best answer. If other, write in. Check grade level 6-18. Check best answer. <$10,000 - >$60, 000. Check the one best answer. Check type of health insurance. If other, write in. Check Married, Widowed, Divorced/separated, Living with partner, Never married, or Other. If other, write in.	1=white, 2= black, 3=native amer, 4=asian, 5=other. Other=string. 1=<10000, 2=10-14.999, 3=15-19999, 4=20-24999, 5=25-29999, 6=30-34999, 7=35-39999, 8=40-44999, 9=45-49999, 10=50-54999, 11=55-59999, 12=60 or > 1=can't ever make ends meet, 2=some months can't make ends meet, 3=just enough money, 4=some months money left over, 5=always have money left over. 1=no health ins., 2=Medicaid, 3=another type on ins, 4=private health ins. Another=string. 1=married, 2=widowed, 3=divorced/separated, 4=living with partner, 5=never married, 6=other. Other=string

	describes you ability to get along on your income? I8. What type of health insurance do you have for yourself? I9. What is your current marital status?		
Qualitative Probes	What I would really like to know is… I think our town should… I think the doctors and nurses for my children should… I think the Gallatin County Public Health Department should… What concerns me the least about environmental health issues is… What concerns		For all qualitative questions 0=no answer, and 1=answer. Answers will be kept in qualitative analysis file.

	me the most about environmental health issues is…		

RED = Predictors
BLUE = Mediators
GREEN = Outcomes

Health & Home: Adult Health Questionnaire

Dear Participant:

We invite you to participate in this research study by answering the following questions about ***your health and your medical history****.*

The purpose of this research is to find ways that nurses can provide families with helpful and accurate information about their health, home, and the neighborhood where they live.

If you have questions about this project, please call us. We can be reached at (406) 994-5098; please let us know that you are a participant in the ERRNIE project. Our offices are in Sherrick Hall (by the duck pond) at MSU. We also work closely with the Gallatin City-County Health Department and the public health nurses there.

Thank you for your time. Your experiences and ideas are the most important part of this research.

Sincerely,

Dr. Patricia Butterfield
Montana State University-Bozeman

Education and Risk Reduction Through Nursing Intervention and Epidemiology
College of Nursing, 206 Sherrick Hall
Montana State University – Bozeman
Bozeman, MT 59717

Please complete one health history form for each adult (age 18 and older) living in your home. These questions ask about your job history, your health history, and your opinions.

Part A. About Your Jobs, Hobbies, and Home Projects

*The following questions refer to **your current and past jobs**.*

A.1. What is your current job status? *(check the one best answer)*

Working full time ❒	Working part-time ❒	Student and working ❒
Student and not working ❒	Employed at home ❒	Full time homemaker ❒
Disabled ❒	Other ❒	Unemployed ❒

If other please describe:

A.2. List **your current job(s).**

Job title:
What do you do?

What does this company do or make?

How long have you worked there? _____ years and _____months
Do you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Do you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What do you do?

What does this company do or make?

How long have you worked there? _____ years and _____months
Do you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Do you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What do you do?

What does this company do or make?

How long have you worked there? _____ years and _____months

Do you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Do you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

A.3. List **other jobs you have had over the past three years**.

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? (*check one answer)* Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one*

answer) Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

Job title:
What did you do?

What did this company do or make?

How long did you work there? _____ years and _____months
Did you ever do this work in your home or yard? *(check one answer)* Yes ❒ No ❒
Did you usually wear your work clothes or boots inside the home after work? *(check one answer)* Yes ❒ No ❒

A.4. Have you done any of the following **hobbies or home projects** in the past year?

			If "yes," about how many times per year?
Work with lead materials such as solder or automobile radiators?	No ❒	Yes ❒	_____ times per year
Work with art, craft, or workshop activities?	No ❒	Yes ❒	_____ times per year
Reload own ammunition?	No ❒	Yes ❒	_____ times per year

Use imported earthenware pottery?	No ❒	Yes ❒	_____ times per year
Use photographic material? (for processing your own photos instead of having it done at a store)	No ❒	Yes ❒	_____ times per year

Refinish furniture?	No ❒	Yes ❒	_____ times per year
Other? Please list_____	No ❒	Yes ❒	_____ times per year

Part B. About Your Health

Has a doctor ever told you that you have any of these **medical conditions**? *(please check yes, no, or don't know for each condition)*

B.1 Asthma	Yes❒	No❒	Don't know❒
B.2. Anemia	Yes❒	No❒	Don't know❒
B.3. Cancer? If so, what type_____	Yes❒	No❒	Don't know❒
B.4. Diabetes	Yes❒	No❒	Don't know❒
B.5. Other? If so, please list_____	Yes❒	No❒	Don't know❒
B.6. Other? If so, please list_____	Yes❒	No❒	Don't know❒

B.7. Do you **smoke** cigarettes?

Yes ❒ No ❒

☞ If yes, go to question B8.

☞ If no, skip to question B9.

B.8. On the average, **how many** cigarettes do you smoke a day? *(fill in the blank)*

_____cigarettes

Do you use any of the following **types of nicotine**?

	Yes	No	If yes, how often?
B.9. Snuff or Chew	❒	❒	

B.10. Smoking tobacco (pipe)	❒	❒
B.11. A patch to help you quit smoking	❒	❒
B.12. Gum to help you quit smoking	❒	❒
B.13. Other? If so, please list_____	❒	❒

B.14. In the past 12 months have you **had an illness** that you think was caused by something in the air or water where you have ever lived or worked, not something you

caught from others?

Yes ❒ No ❒ Don't know ❒

B.15. Do you think it was something in **the air, the water, or both**?

Air ❒ Water ❒ Both ❒

Don't Know ❒

Part C. About You

White ❒ Black / African American ❒

Native American, Eskimo, or Aleut ❒ Asian or Pacific Islander ❒

Other ❒ If other please describe _____

C.1. What is your **year of birth**? *(fill in the blank)* List year-----19_____

C.2. What **racial background** best describes you? *(please check the one best answer)*

C.3. Are you of **Hispanic** ethnicity? *(check the one best answer)*

Yes ❒ No ❒

***C.4. What is the** highest grade **you completed in school?* (check the one best choice)**

Grade school and junior high			High School				College or trade school				Graduate school		
< 6	7	8	9	10	11	12	13	14	15	16	17	18	>18
❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒

C.5. What type of health insurance do you have for yourself? *(check the one best choice)*

I have no health insurance ❒ I have health Medicaid health insurance ❒

I have another type of health insurance ❒
If so, please list_____

I have private health insurance
(for example, Blue Cross) ❒

C.6. What is your current marital status? *(check the one best answer)*

Married ❒ Widowed ❒ Divorced/separated ❒

Living with partner ❒ Never married ❒ Other ❒
_____ If other, please list_____

C.7. Are you male or female? Male ❒ Female ❒

Thanks so much for your time and ideas. 

Please supply the following information.

Any information provided on this page will be detached from the answers you have provided in this questionnaire in order to protect your privacy.

Name: _____

Name of Person in Household Completing Household Questionnaire (Parent): _____

Home Phone Number: _____

Some items have been adapted from the questionnaire “Opinions About Arsenic in Well Water: A Survey of Households in Winnebago and Outagamie Counties,” by Dolores J. Severtson, RN, MS

Health & Home:
Child Health Questionnaire

Dear Participant:

We invite you to participate in this research study by answering the following questions about ***your child's health and medical history***.

The purpose of this research is to find ways that nurses can provide families with helpful and accurate information about their health, home, and the neighborhood where they live.

If you have questions about this project, please call us. We can be reached at (406) 994-5098; please let us know that you are a participant in the ERRNIE project. Our offices are in Sherrick Hall (by the duck pond) at MSU. We also work closely with the Gallatin City-County Health Department and the public health nurses there.

Thank you for your time. Your experiences and ideas are the most important part of this research.

Sincerely,

Dr. Patricia Butterfield
Montana State University-Bozeman

Education and Risk Reduction Through Nursing Intervention and Epidemiology
College of Nursing, 206 Sherrick Hall
Montana State University – Bozeman
Bozeman, MT 59717

Please complete one health history form for each child (ages 0 through age 6) currently living in your home. These questions ask about your child's health history and daily activities.

Part A. About Your Child's Health

Has a doctor ever told you that your child has any of these **medical conditions**? *(please check yes, no, or don't know for each condition)*

A.1 Asthma	Yes❒	No❒	Don't know❒
A.2. Anemia	Yes❒	No❒	Don't know❒
A.3. Attention Deficit Hyperactivity Disorder (ADHD)	Yes❒	No❒	Don't know❒
A.4. Arthritis	Yes❒	No❒	Don't know❒
A.5. Cancer? If so, what type_____	Yes❒	No❒	Don't know❒
A.6. Diabetes	Yes❒	No❒	Don't know❒
A.7. Ear infections	Yes❒	No❒	Don't know❒
A.8. Eczema (skin problems)	Yes❒	No❒	Don't know❒
A.9. Heart problems	Yes❒	No❒	Don't know❒
A.10. Lead poisoning	Yes❒	No❒	Don't know❒
A.11. Sleep problems or severe insomnia	Yes❒	No❒	Don't know❒
A.12. Urinary infections	Yes❒	No❒	Don't know❒
A.13. Other? If so, please list_____	Yes❒	No❒	Don't know❒
A.14. Other? If so, please list_____	Yes❒	No❒	Don't know❒

A.15. Please list any **prescription medication** your child is currently taking.

Name of medication	Dose and frequency	Reason for medication

A.16. Please list any **over-the-counter medication** your child is currently taking.

Name of medication	Dose and frequency	Reason for medication

A.17. Please list any allergies your child has to food, medications, and/or environmental factors such as ragweed, pollen, dust, pet hair, etc.

A.18. During the past year, how many times has your child been seen (by a doctor or nurse) **for well child care**? *(fill in the blank)*

_____ number of times

A.19. During the past year, how many times has your child been at the clinic or doctor's office for a **health problem**? *(fill in the blank)*

_____ number of times

A.20. During the past year has your child been seen in the **emergency room?**

Yes ❒ No ❒

☞If yes, please list reason(s)_____

A.21. During the past year, how many times has your child been admitted to the **hospital?** *(fill in the blank)*

_____ number of times

☞Please list reason(s)_____

A.22. During the past year, have you needed to call **poison control** for this child?

Yes ❒ No ❒

☞If yes, please list reason(s)_____

A.23. Do you have any **other health concerns** related to this child?

Yes ❒ No ❒

If yes, please list health concern(s)_____

A.24. In the past 12 months has your child had an illness that you think was **caused by something in the air or water** where you have ever lived or worked, not something he/she caught from others?

Yes ❒ No ❒ Don't know ❒

A25. Do you think it was something in the air, the water, or both?

Air ❒ Water ❒ Both ❒

Don't know ❒

Part B. About Your Child's Daily Activities

Does your child have any of the following **habits**? *(check yes or no for each habit)*

Does your child have any of the following **habits**? *(check yes or no for each habit)*

B.1. Use a blanket	Yes ❒	No ❒
B.2. Suck a thumb or fingers	Yes ❒	No ❒
B.3. Use a pacifier daily	Yes ❒	No ❒
B.4. Put everything in his/her mouth	Yes ❒	No ❒
B.5. Teeth on a particular item consistently	Yes ❒	No ❒
B.6. Other? Please list_____	Yes ❒	No ❒
B.7. Other? Please list_____	Yes ❒	No ❒

B.8. Does your child spend over 4 hours a day **in a basement room**? *(check one choice)*

Yes ❒ No ❒

☞ If yes, please describe room setting_____

B.9. In **which room** does your child sleep? *(check one choice)*

Living room ❒ Own bedroom ❒ Parents' bedroom ❒

Other ❒ ***If other, please describe***_____

B.10. Where does your child **prefer to sleep** most nights?

In a bed ❒ On the couch ❒ On the floor ❒

Other ❒ ***If other, please describe***_____

B.11. Do any **pets** sleep in your child's room?

Yes ❒ No ❒

☞ If yes, please list type of pet(s)_____

B.12. Does your child usually go to **childcare** (at a home, school, or daycare) during the day?

Yes ❒ No ❒

☞ If yes, see question B.13.

☞ If no, skip to question B.15.

B.13. What type of **childcare program** does your child usually attend? *(check the one best choice)*

A relative's home ❒	Daycare center ❒	Daycare plus school ❒
In-home daycare ❒	Public school ❒	Private school ❒

B.14. About how many **hours per week** does your child spend in daycare? *(fill in the blank)*

_____ hours per week

B.15. What is the best description of **your child's diet**? *(check all that apply)*

Infant formula ❒	Baby food ❒
Breast milk ❒	Adult food ❒
Other type of food? ❒ If so, please list_____	

B.16. Does your child have any **unusual eating habits**? (eating chalk, glue, dirt, etc.)

Yes ❒ No ❒

If yes, please explain_____

B.17. Is your child **around cigarette smoke**?

Yes ❒ No ❒

☞If yes, go to question B18.
☞If no, skip to question C1.

B.18. In what types of places is your child **around cigarette smoke**? (check all that apply)

Our home ❒	Relative's home ❒
Childcare ❒	Car ❒
Other place? ❒ If so, please list_____	

Part C. About Your Child

C.1. **How tall** is your child? *(fill in the blanks)*

About _____feet _____inches tall

C.2. How much does your child **weigh**? *(fill in the blank)*

About _____ pounds

C.3. What is this child's **date of birth**? *(fill in the blanks)*

_____Month (January-December)

_____ Day (1-31)

_____Year (1997-2003)

C.4. Is your child **male or female**?

Male❒ Female❒

C.5. What **racial background** best describes your child? *(please check the one best answer)*

White ❒	Black / African American ❒	Asian or Pacific Islander ❒
Native American, Eskimo, or Aleut ❒	Other ❒ If other, please list_____	

C.6. Is your child of Hispanic ethnicity**?** ***(check the one best answer)***

Yes ❒ No ❒

C.7. What type of **health insurance** does your child have? *(check the one best choice)*

They have no health insurance ❒	They have CHIP health insurance ❒
They have Caring Program for Children insurance ❒	I have private health insurance (for example, Blue Cross) ❒
I don't know ❒	

The end—thanks so much for your time and effort. 

Please supply the following information.

Any information provided on this page will be detached from the answers you have provided in this questionnaire in order to protect your privacy.

Name of Child: _____

Name of Parent: _____

Home Phone Number: _____

Some items have been adapted from the questionnaire “Opinions About Arsenic in Well Water: A Survey of Households in Winnebago and Outagamie Counties,” by Dolores J. Severtson, RN, MS

APPENDIX C

PROCESS PROTOCOLS

ERRNIE HOME VISIT PROTOCOL

Before you go to the home:

- ❑ Check nursing bag to make sure all the contents of the supply list are present and adequate.
- ❑ Make sure you have the name, address, and phone number of the client.
- ❑ Make sure the water kit is properly stocked and that you bring it with you.

When you arrive at the residence:

- ❑ From your car check for any outdoor hazards (dogs, things you don't want to run over).
- ❑ If the resident is not home leave a postcard reminder to reschedule.

Beginning the household assessment:

- ❑ Introduce yourself and meet all members of the family that are present.
- ❑ Ask if the client had any questions about the questionnaire or if there were any questions in the questionnaire that they found confusing or unclear.
- ❑ If the client has lost the questionnaires, give them new copies and suggest that they will probably have time to do them while you run your tests.
- ❑ Go over any questions the client had about the questionnaire.
- ❑ Give the client the $15 voucher when they are completely finished with the questionnaires.
- ❑ Put the completed questionnaires in your bag.
- ❑ Explain how long the testing will take and offer the client the option of observing you or doing their own thing during this time.
- ❑ Turn down the water heater.
- ❑ Ask the client for permission to use table, counter, or other space for your work.
- ❑ Wipe down the surface and spread out paper towels.

The urine sample:

- ❑ Explain the process and reasons for conducting the urine collection. (Have ERRNIE publications folder ready for reference)
- ❑ Put pediatric bag on non-potty trained child **or**
- ❑ Give the mother a collection cup to use when a potty-trained child is ready to use the bathroom.

The water sample:

- ❑ Explain the process and reasons for gathering the water samples. (Use publication folder.)
- ❑ Explain that the process takes a little time and that the client is free to observe the process or just go about their own business for a few minutes.
- ❑ Follow well screen protocol

The CO sample:

- ❑ Explain the process and reasons for gathering the carbon monoxide data. (Refer to publications folder.)
- ❑ Follow carbon monoxide protocol

The radon sample:

- ❑ Explain the process and reasons for gathering the radon sample. (Use publication folder).
- ❑ Explain the entire test process and how to mail in the radon sample using the outline provided for the client in the publications folder.

The lead sample:

- ❑ Explain the process and reasons for gathering the blood for the lead sample. (Use publication folder.)
- ❑ Spend a few minutes talking and/or playing with the child
- ❑ Explain to the child what will happen
- ❑ Follow Blood Lead protocol.

If the urine sample has not yet been collected

- ❑ Review the collection process with the mother using the protocol included in the publications folder.

Repacking equipment

- ❑ Check to make sure that the blood lead test is filled out and placed in nursing bag.
- ❑ If the urine test has been completed, check to make sure test is in mailing box, correctly filled out, and in the nursing bag.
- ❑ Check to make sure all of the water test material is in the kit.
- ❑ Clean up your work area and bring all sharps and other waste materials home in a Ziploc bag for disposal.

Finishing up

- ❑ Thank the client for their time and cooperation.
- ❑ Explain that the results will take from 4-6 weeks to come back and that we will notify them right away if any unsafe levels are found.
- ❑ Direct the client's attention to the business card in the left-hand pocket of the publications folder and invite them to call if they have any questions or concerns during the next few weeks.
- ❑ Remind the client to mail in the urine test (if not yet completed).
- ❑ Remind the client to mail in the radon test in two days.
- ❑ Check to make sure you are walking out the door with your nursing bag and your well screen kit.

When you return to the office

- ❑ Dispose of waste materials and sharps properly.
- ❑ Mail urine test.
- ❑ Mail filter paper blood lead test.
- ❑ Mail well screen.
- ❑ Restock nursing bag.
- ❑ Restock well screen kit.

ABNORMAL CARBON MONOXIDE PROTOCOL

Action level for carbon monoxide is 9ppm over an eight-hour period. Any carbon monoxide levels detected at 9 or above will be considered a health risk and the following procedure will be instituted:

1. Record excess value in client folder and record which appliances have the corresponding values.
2. Notify the physician of record, the health department, and the client of the abnormal value.
3. Prescribe that the client not use the appliance(s) until it has been retested by the fire department or by Northwest Energy (this is a free service) and encourage him/her to call immediately. Northwest Energy 1-888-467-2427. Fire department 1(406) 582-2350.
4. Advise the client that his/her appliance(s) is not properly burning its fuel and that he/she will need to get the appliance(s) fixed or replaced if the retest is positive for unsafe levels of carbon monoxide. ERRNIE cannot pay for further tests, replacement of appliances, and/or remediation.
5. Advise the client to ventilate the home, especially near sources of carbon monoxide.
6. Encourage client to read further information about carbon monoxide provided in the ERRNIE packet received from the ERRNIE staff person during this visit.

ABNORMAL LEAD PROTOCOL

The action level for lead is 10ug/dL. There is some speculation, however, that even lower levels can cause health risks. Therefore, for this study we will consider anything over 5ug/dL a necessary retest. Any results measuring above 5 will initiate the following procedures:

1. Record the excess value in the client file.
2. Notify the physician of record, the health department and the client of the elevated value.
3. Issue physician's order and place in client folder.
4. Schedule client for retest of lead and counsel him/her to read lead information provided by the ERRNIE staff during the home visit.
5. Upon receiving the retest results, call the physician of record, the health department and client about lead retest values.
6. If the value falls in the normal range, advise client that his/her child is probably coming in contact with a direct source of lead, but is not exposed on a consistent basis. The first test probably detected surface contamination on the child's finger.
7. If the value falls in the abnormal range, advise the client to make an appointment with a public health nurse to do a venipuncture as a confirmation (avoids surface contamination) of an elevated level. From here, if the lead value is high again the health department will do an environmental assessment in the home to test for sources of lead.

ABNORMAL RADON PROTOCOL

Action level for radon is 4.0pCi/L. Average indoor radon concentrations measure 1.3. Any radon level reported to be in excess of 4.0 will be subjected to the following procedures:

1. Record the excess value in the client file.
2. Notify physician of record and health department of abnormal value.
3. Issue physicians order and place in client folder.
4. Notify client of abnormal value and counsel client to read radon information provided by the ERRNIE staff during the home visit.
5. Prescribe long-term (90 day) radon test for confirmation of consistently abnormal radon values and advise the client to have all family members sleep in the highest level of the house (i.e. not in the basement), providing as much ventilation as possible.
6. Deliver the long-term test to the client within one week and advise that he/she place it in the same testing location as the original test. Fill out the accompanying paperwork for the client.
7. Advise the client to mark the stop date on his/her calendar (3 months from today) and to mail in the radon sampler on that same day. Mark this date on the ERRNIE office calendar as well.
8. Record the client's address and the sampler number (found on the back of the radon sampler) on the GCCHD results data sheet.
9. Call client on 90th day as a reminder to mail in test.
10. Upon receiving long-term test results, call physician of record, health department, and client about radon values.
11. **If values fall in normal range**, advise client that radon levels are fluctuating in the home environment and that the original test probably represents one of their highest values. Advise to consider keeping the house well ventilated.
12. **If values fall in abnormal range**, advise client to take remediation action. Refer them the phone numbers and agencies noted on the ERRNIE information pages of the packet provided by the ERRNIE staff, and to the numbers and agencies provided by the brochures included in the same packet. ERRNIE can not pay for any remediation or further testing.

ERRNIE PROJECT – BLOOD LEAD FILTER PAPER COLLECTION PROTOCOL

- ❑ Wipe down table or working area with clean washcloth.
- ❑ Fill out Requisition Form and write client's name on the filter paper test strip. (Do not touch the blood collection area on the filter paper.)
- ❑ Lay out supplies in test kit on paper towel.
- ❑ Wash and dry your own hands with soap and water. Then put on gloves.
- ❑ Instruct client to thoroughly wash hands with moist towelette.
- ❑ Do not allow the client to touch anything with the left hand. (Lead the child by the left wrist back to the table or working surface.)
- ❑ Remove filter paper from Ziploc bag by grasping the area that has printing on it.
- ❑ Partially open lancet wrapper.
- ❑ Thoroughly scrub the client's finger, with an alcohol prep pad. Make sure the area is dry before sticking.
- ❑ While still holding and isolating the area to be punctured, remove the lancet and firmly stick the prepared area.
- ❑ Hold the patient's finger above the filter paper circles. Put one dime-sized drop in each circle. Only put one drop of blood on each circle. **Don't layer blood**.
- ❑ Set filter paper aside for 2-20 minutes while the blood drops dry.
- ❑ Clean and bandage child's finger.
- ❑ When blood on filter paper is dry, return specimen form to Ziploc bag. Seal the bag and write the client's name on the outside label of the Ziploc bag.
- ❑ Remove only the last page of the analysis requisition form and keep it for ERRNIE records.
- ❑ Staple the Ziploc-sealed bag to the Requisition Form and put it in the postage paid envelope from the lab. You can put more than one client specimen with its corresponding Analysis Request Form in the same prepaid envelope.
- ❑ Mail specimen to the Lab.

ERRNIE CARBON MONOXIDE PROTOCOL

- ❑ Make sure all doors and windows are closed.
- ❑ Ask client about primary and secondary heating sources. The primary heat source is the source of heat they use most of the time. The secondary heat source is the source of heat they sometimes use in combination with the primary heat source alone when not using the primary heat source.
- ❑ Identify which appliances in the home are gas appliances.
- ❑ Turn down water heater so it will turn on later when you want it to.
- ❑ Press the ON/OFF button on the monoxer to turn the power on.
- ❑ Evaluate Primary Heat Source
  1. Make sure CO monitor reads 0 in the upper left hand corner.
  2. Make sure heat source is on.
  3. Take one reading 4-6 inches from flue hood opening. (Record reading and time to stabilize monoxer on record sheet.)
  4. Zero the monitor by taking the monitor to a CO-Free environment (outside). In three minutes the monitor should have a stable reading of 0PPM. If the display read 1 to 9PPM, adjust the zero by pressing the INDEX button until it reads CAL0. Press the STORE and ENTER keys at the same time. Index the menu back to the home position. The display should now read 0PPM. If other questions arise there are directions on the back of the monoxer or in the storage box.
  5. Take a second reading 3 feet from the floor, 2 feet away from the appliance. (Record reading and time to stabilize.)
- ❑ Evaluate Secondary Heat Source
  1. Reset CO monitor to 0.
  2. Make sure heat source is on.
  3. Take one reading 4-6 inches form flue hood opening. (Record reading and time to stabilize monoxer on record sheet.)
  4. Zero the monitor.
  5. Take a second reading 3 feet from the floor, 2 feet away from the appliance. (Record reading and time to stabilize.)
- ❑ Evaluate Gas Water Heater
  1. Reset CO monitor to 0.
  2. Make sure water heater is on.
  3. Take one reading 4-6 inches from flue hood opening. (Record reading and time to stabilize monoxer on record sheet.)
  4. Zero the CO monitor.
  5. Take a second reading 3 feet from the floor, 2 feet away from the appliance. (Record reading and time to stabilize.)
  6. Zero the CO monitor.
  7. Take a third reading 4-6 inches from gas burner opening. (Record reading and time to stabilize.)
- ❑ Evaluate Gas Range Top
  1. Reset CO monitor to 0.

2. Turn on gas range top
3. Take one reading 4-6 inches above burner. Watch for loose clothing or hair. (Record reading and time to stabilize monoxer on record sheet.)
4. Zero the CO monitor.
5. Take a second reading 3 feet above the floor and 2 feet away from the range. (Record reading and time to stabilize.)
6. Zero monitor.
7. Take a third reading with all four burners on, 4-6 inches above the burners. Watch for loose clothing or hair. (Record reading and time to stabilize.)
8. Zero the monitor.
9. Take a fourth reading 3 feet above the floor and 2 feet away from the range. (Record reading and time to stabilize.)

- ❑ Evaluate the Gas Oven
  1. Reset CO monitor to 0.
  2. Turn on gas oven.
  3. Take one reading near the middle rack inside the oven. (Record reading and time to stabilize monoxer on the record sheet.)
  4. Zero monitor.
  5. Take a second reading 3 feet from the floor and 2 feet from the oven (With the door open or closed???????) (Record reading and time to stabilize.)
- ❑ Evaluate Gas Dryer
  1. Reset CO monitor to 0.
  2. Turn on gas dryer.
  3. Take one reading three feet from the floor and 2 feet away from the dryer. (Record reading and time to stabilize monoxer on the record sheet.)
- ❑ Induce the Entire System
  1. Turn on all the burners and the oven. Ask the mother to stay near the stove for safety of the children.
  2. Turn on water heater.
  3. Turn on primary and secondary heat sources.
  4. Turn on dryer.
  5. **Repeat entire protocol with each heat source or appliance.**

HOW TO COLLECT A URINE SAMPLE FROM YOUR CHILD

If your child is potty trained…

1. Wash your hands with soap and water. If you are a smoker, wash your hands again.
2. When you and your child are in the bathroom, take the sample cup out of the plastic bag.
3. Allow a little of your child's urine to go into the toilet before placing the cup under the stream of urine.
4. Allow your child to fill the cup to at least the 2 ml mark (3ml if possible).
5. Screw the lid tightly back onto the cup and with a pen or marker print your child's full name on the label. Write today's date next to his/her name and also write the time that you collected the sample on the cup label.
6. Put the cup in the freezer right away.
7. Call us on the morning of the next business day (Monday – Friday, 8a.m.-5p.m.).

If your child is not potty trained…

1. Take the pediatric urine bag out of its packaging and remove your child's diaper.
2. Take off the protective covering over the sticky opening at the top of the bag.
3. Place the sticky opening of the bag entirely over your child's genitals. Do not cover the anal area.
4. Put your child's diaper back on. Give him/her some juice or water to drink.
5. Allow the bag to remain on your child until they have filled it about half full of urine. (This may take about an hour.)
6. When the bag is half full, carefully and quickly remove it from your child (this may hurt a little) and pour the contents into the plastic sample cup.
7. Screw the lid tightly back onto the cup and with a pen or marker print your child's full name on the label. Write today's date next to his/her name and also write the time that you collected the sample on the cup label.
8. Put the cup in the freezer right away.
9. Call us on the morning of the next business day (Monday – Friday, 8a.m. – 5p.m.).

Thank you!

If you have any questions, please feel free to call Megkian Penniman at (406) 994-5098.

ERRNIE PROJECT – FULL WELL SCREEN PROTOCOL

Order test kit one week prior to scheduled testing date. (406) 444-2642

The day before:

- ❑ Freeze ice packs as flat as possible

Before you leave for the client's residence:

- ❑ Get ice packs from freezer
- ❑ Check to see that well kit includes:

2 – 100ml plastic coliform bacteria bottles 2 – 1 liter plastic bottles 2 – sets of glass vials (3 vials per set) 2 – amber glass bottles 1 – test order form (test kit includes 2 well screens)

- ❑ Check to see that the utility kit includes:

1 – sponge 1 – bottle of 95% ethanol 1 – pair of pliers 1 – sharpie 1 – roll of paper towels 1 – GPS Unit Notices of Entry Notices of Visit for Absent Clients (Reschedule)

- ❑ Make sure you have the clients address and phone number

When you arrive at the client's residence:

- ❑ From your car check for any outdoor hazards (dogs, things you don't want to run over)
- ❑ Turn on your observation and people skills
- ❑ Take care of any introductions, paper work, info gathering

If the client is absent:

- ❑ Check to see if you have authorization to enter the home in their absence
- ❑ Leave a Notice of Entry if you do have authorization
- ❑ Leave a Notice of Visit (Reschedule) if you do not have authorization

Before you begin the well screen collecting:

- ❑ Clean up work area (area where you will set your equipment and the sink basin)
- ❑ Remove faucet screen/aerator with pliers if possible (not wise in some cases)
- ❑ Let *cold* water run for 5 minutes or longer (faucet should feel cold)
- ❑ Clean entire surface of faucet and interior of faucet mouth with ethanol, and let ethanol dry completely
- ❑ Turn on cold water again and adjust flow to pencil-sized stream

When you are ready to begin bacteria screen:

- ❑ Remove top of 100ml plastic collection bottle, making sure not to touch inside of cap or bottle. (Use aseptic technique, recommend holding cap in one hand and bottle in the other)
- ❑ Without rinsing the bottle, fill it **to the 100 ml mark**; leave the white powder or pill in the bottle (this is a de-chlorinating agent in case chlorine is in the water).
- ❑ Cap the bottle firmly and mark your name and the sample ID on the bottle with the sharpie.
- ❑ Fill the 250ml bottle (or the 1-liter bottle) **to the neck** in the same manner. This bottle does not contain a pill or powder. Mark sample ID on bottle with sharpie.
- ❑ Pack both bottles in the cooler.

When you are ready to begin petroleum and herbicide/pesticide screens.

- ❑ *Do not rinse amber bottles or glass vials; all contain preservatives*.
- ❑ Uncap the quart amber bottle, being careful not to touch the inside of the cap or bottle.
- ❑ Fill the quart amber bottle full **to the neck** and cap tightly. Mark sample ID on bottle with sharpie.
- ❑ Uncap small amber bottle without touching inside of cap or bottle.
- ❑ Fill the small amber bottle **2/3 full** and cap tightly. Mark sample ID on bottle with sharpie.
- ❑ Take out the set of three vials. One is already full. Do not do anything with this vial. The other two vials have a few drops of liquid in them, but are sealed.
- ❑ Break the seal on the first vial and fill just to overflowing or until a meniscus forms above the vial's rim. (Do not flush out the quick-dissolving preservative and do not touch the inside of the cap or bottle.)
- ❑ Cap the vial tightly and shake vigorously for one minute.
- ❑ Invert the vial to see if any air bubbles are trapped in the vial.
- ❑ If you observe any air bubbles, even very small bubbles, uncap the vial and fill with a few more drops of water.
- ❑ Cap vial, shake, and recheck for bubbles until none are apparent.
- ❑ Mark sample ID on the vial with a sharpie.
- ❑ Repeat these steps again for the second vial.

- ❑ Pack amber bottles and vials in cooler.

When you have finished the complete well screen:

- ❑ Fill out the entire information sheet included with the kit (order form).
- ❑ Repack the cooler so that bottles will not hit each other during the transit.
- ❑ Make sure your work area is clean and wiped dry.
- ❑ Record GPS coordinates.
- ❑ Thank the client for the opportunity to test their water or leave a Notice of Entry if they are not home when you finish the test.

When you are finished testing:

- ❑ Make a photocopy of completed order form and file copy.
- ❑ Make sure all bottles, packing material, ice packs, and order form are in cooler.
- ❑ Make sure bottles are secure in cooler and are not able to move around during shipping. (Add more packing material if necessary, i.e. newspaper, styrofoam, etc.)
- ❑ Tape the cooler securely shut. *See shipping instructions below*.
- ❑ Place cooler inside cardboard box. Tape box securely shut.
- ❑ Tape Environmental Lab address label securely on center of top of box**.**
- ❑ Tape Sample ID label on top of box to the left of the address label.
- ❑ Take box to Culbertson by 10:30 for UPS pick-up or to UPS store between 3 and 6pm. *Tests need to be shipped within 20 hours. If there is any delay in shipping, place samples in a refrigerator until ready to pack and ship. Boxes cannot be shipped later in the week than Wednesday.*

After mailing well screens:

- ❑ E-mail Judy at lab to notify her that cooler has been sent. jhalm@state.mt.us
- ❑ Make a copy of shipping receipt and file copy.
- ❑ Turn original shipping receipt in to Linda or put in her mailbox.

Physician's Order

Date: _____

Patient: _____

Radon Level: _____

Called Mike Spence and reported elevated radon level.

T.O. Repeat radon test with long-term (90-day) radon test.

Dr. Wade Hill, Ph.D., R.N.

Dr. Mike Spence, M.D., Physician of Record

HOW TO PERFORM YOUR RADON TEST

1. **Do not open** the inner plastic bag containing the radon testing unit until you are ready to do the test.

2. **Review open and closed home conditions with the client**. Give this advice: Make sure that all windows and doors are kept shut for at least 12 hours before the test and for the next 48 hours while the radon test is being completed. Feel free to go in and out of your house as you normally would, but don't ventilate your home by leaving doors or windows open.

3. When you are ready to do the test open the plastic bag and remove the radon sampler, postcard, and postage envelope.

4. Put ERRNIE in the first boxes on the postcard asking for the last name. In the boxes for the first name write in the client's last name. Fill in the ERRNIE information on the postcard that asks for address, phone, etc.

5. Fill in the ERRNIE fax number (406) 994-6020.

6. Fill in the test kit serial number that is on the back of the Radon Sampler. The number should begin with AE.

7. Fill in the ERRNIE name and address as the return address on the envelope.

8. Open the bag the Radon Sampler is in and remove the Radon Sampler.

9. Place the Radon Sampler **paper side up** on a flat surface two or more feet above the floor in the lowest level of the house that is lived in. (Generally it is best to put the test high enough that children and/or pets cannot reach it.) For example, if the client has a bedroom or a den in the basement, you would put the test somewhere in the basement. Be careful not to tear or puncture the Radon Sampler or disturb it during the next 48 hours.

There are a couple of places you shouldn't put the sampler:

- Near heat or air conditioning registers or other places where moving air will always be passing over the Sampler.
- Where it will get wet or in places where there is high humidity, like in a crawlspace or a sump.
- In direct sunlight or near heat sources.

10. Record the time that it is right now on the postcard as the Test Start Time. Also mark the floor in the home where you did the test. Select the correct box for the structural type of the home and write in box letters on the last line the name of the room where you set up the test.

11. If the client will keep the house closed up during the entire test except for coming in and going out, mark "Y" where the card says, "Were closed house conditions observed during the test?"

12. Advise the client to leave the test where it is for 48 hours.

13. Direct the client to mail the Radon Sampler in 48 hours. Tell them to place the Radon Sampler in the postage envelope, but **DON'T seal it**.

14. Direct the client to record the time that it is when they put the Sampler in the envelope as the Test Stop Time on the postcard. (It is helpful to highlight this line on the card as a reminder.)

15. Direct the client to put the completed postcard in the postage envelope with the Radon Sampler and seal the envelope.

16. Advise the client to mail the kit that same day if possible. If it is too late in the evening to mail the envelope, make sure it gets out the very next day.

17. Leave a sticky note for the client with the date the test should be stopped and mailed and place it somewhere it will be seen often (i.e. on the fridge door).

18. Remind the client that if any questions arise, he/she can call the ERRNIE office for instructions.

If you have any questions please call Megkian Penniman at (406)994-5098.

How to Disinfect a Private Well System Using Liquid Household Bleach

If your PRIVATE well water has tested positive for coliform bacteria you can safely disinfect the well system using household bleach by carefully following the instructions below. When it comes to adding chlorine to your well system, more is not better. **Be aware that these procedures may loosen sediment, rust, and biofilm deposits within the well system, causing temporary problems with sediment, rust particles, discoloration and plugging of filters and screens. The use of household bleach for disinfecting PUBLIC water supplies is not allowed.**

CAUTIONS: Liquid chlorine bleach can be hazardous! It is a strong oxidizing agent. Prolonged contact of concentrated bleach can cause corrosion of well casing and well equipment. Wear eye protection and rubber gloves when handling liquid chlorine bleach. Never mix liquid chlorine bleach with other household cleaners! It will react with many common household products, including toilet bowl cleaners, rust removers, vinegar, acids, and ammonia based products, producing highly toxic chlorine gas or other toxic chlorine compounds. If you have questions regarding the procedures below, or the safe handling of liquid chlorine bleach, contact the Gallatin Local Water Quality District at 582-3148 for assistance.

INSPECT YOUR WELL SYSTEM BEFORE DISINFECTING: Non-sanitary well caps, poorly sealed well casings, poor drainage around you well, and failing well system equipment can result in continued bacterial contamination of your well system. Inspect the exposed part of the well casing (wellhead) for signs of damage, and to make sure that ground depressions and open holes around the well casing are not allowing stormwater to pond around the well. Inspect your well cap to determine if your well cap is a sealed “sanitary” cap or an unsealed “non-sanitary” cap. A sanitary well cap has one or more rubber seals and a screened air vent.

CAUTIONS: *If your well cap is a non-sanitary type, it is highly recommended that you replace it with a sanitary well cap prior to disinfecting your well system. If you see exposed (uninsulated) wires or connections, or the ground wire is not connected, it is recommended that you have a well service company or electrician inspect the wiring to make sure it is safe prior to disinfecting the well.*

Step by Step Instructions

Step 1: Store some water for use while disinfecting the well system-Fill several clean containers with water for use in washing dishes, flushing toilets, etc. Do not use this water for drinking unless it is boiled for at least 5 minutes. Consider purchasing bottled water for drinking while disinfecting your well system.

Step 2: Disconnect or bypass any treatment systems you have connected to your well system- If you have a water softener, filtration system, or other water treatment unit, it is best to bypass these systems when disinfecting your well system. Consult the treatment system manufacturer or supplier to find out if bypassing the system is necessary and if so what the procedures are for bypassing the system(s).

Step 3: Prepare a solution of bleach and water to pour inside the well casing- Referring to Table 1 below, mix the recommended amount of regular (un-scented) liquid bleach containing sodium hypochlorite with clear water. Use a clean five-gallon plastic bucket (not metal), adding no more than ½-gallon of bleach per five gallons of solution. Mix several batches of solution if more than ½ gallon of bleach is required. ***CAUTION: There are bleach products on the market that don't contain sodium hypochlorite. Make sure you use only regular sodium hypochlorite based bleach without additives.***

Table 1

Recommended Amounts of Bleach for Well Disinfection*

Total Well Depth (feet)	Cups of Bleach for treatment Of Coliform Bacteria
0 to 50	5
51 to 100	7
101 to 150	10
151 to 200	12
201 to 250	14
251 to 300	16
301 to 350	18

*** 1 gallon = 16 cups, amounts are based on standard bleach. Use 25% less if using concentrated "Ultra" bleach.**

Step 4: Pour the bleach solution into the well and mix it with the well water-Pour the five-gallon bucket(s) of disinfection solution into the well taking care to pour the solution down all sides of the well. Run a hose from the nearest outside tap to the well. Allow the hose to run on the ground until you smell chlorine, then place the hose into the well casing and rinse the inside of the well with the disinfection solution for several minutes. You will be recirculating chlorinated water through the pump system and back into the well. ***CAUTION: Never pour pure (concentrated) liquid chlorine bleach directly down your well, the liquid is corrosive and can damage the well system.***

Step 5: Fill your distribution system (water lines and fixtures) with the chlorinated well water-Starting with the fixtures closest to the well, run water through every tap in the water system, including all faucets, tubs, utility sinks, showers, and toilets, until you smell chlorine. Include both hot and cold taps in this process. Let the chlorinated water sit in the lines for a minimum of 12 hours, preferably 24 hours. Do not use the chlorinated water for pets, houseplants, bathing, or clothes washing. ***CAUTION: It is important to run the chlorinated water through each and every line in the system. Leaving even one line out of the procedure can allow contamination to remain in the system.***

Step 6: Flush the well system of chlorine solution-After 12 to 24 hours; flush your well and distribution system. Starting with the outside taps, run water until you can no longer smell chlorine. Discharge the used chlorinated water in a safe place outside, avoiding lawn areas and other areas where the solution may kill plants. After draining the outside taps and flushing the chlorine from the well casing, flush the inside taps and fixtures. The smaller amounts of chlorinated water left in the inside lines and fixtures should not hurt your septic system. ***NEVER discharge the used solution into streams, ditches, lakes, or ponds***

Step 7: Retest your well for coliform bacteria- After using the well for about five days submit a coliform bacteria sample to a State of Montana approved laboratory for analysis to confirm that disinfection has been complete and that the water is suitable for drinking.

Prior to retesting consider drinking bottled water in case the well water is still contaminated. In severe cases or if these procedures are not followed carefully, your well water may continue to show bacteria contamination. If this occurs carefully repeat these procedures and re-test the water again. If problems still persist, call the Gallatin Local Water Quality District at 582-3148 for assistance.

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Adapted from materials created by Mr. Alan English at the Gallatin Water Quality District, Gallatin County, Montana
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APPENDIX D

EDUCATIONAL INTERVENTION

FOLLOW-UP RESEARCH NEEDED TO ENTER INTO INTERVENTION PLANNING PHASE

ERRNIE: Lessons in the Development of a Learner-Appropriate Intervention

Introduction

The household environment is a significant, yet understudied, contributor to childhood health and well-being and is directly linked to the prevalence and severity of both long and short-term illness in children (Swartz, Callahan et al. 2004). For 1999 - 2000 the EPA reported that approximately 430,000 children ages 1-5 had blood lead levels exceeding 10ug/dL. During this same time 6 out of every 1,000 children were diagnosed with mental retardation and 7 out of 100 children were diagnosed with attention-deficit/hyperactivity disorder (Statistics 2002). Research estimates that 3% - 8% of babies born in the U.S. have or will develop neurodevelopmental disorders including mental retardation, ADHD, or autism (Weiss and Landrigan 2000). In 2001, 6.3 million children were reported to have asthma, the most common chronic disease among children, with the prevalence of asthma doubling between 1980 and 1995 (Sciences 2000). 43% of children in the U.S. grow up exposed to ETS in their own homes (Green, Courage et al. 2003), and compounding this exposure, 6 million homes in the U.S. have radon concentrations above 4 pCi/L ((ATSDR) 1995). Additionally, the incidence of childhood cancer, the second most common cause of death in children after injuries and accidents, increased every year from 1975 to 1990 where it finally leveled off and is currently maintained (Reis, Smith et al. 1999). Statistics like these justify intensive tracking of environmental exposures and the prevalence of related diseases, and even

more importantly, they emphasize the need for effective interventions to improve and even eliminate preventable health effects.

The Environmental Risk Reduction through Nursing Intervention and Education Program

The Environmental Risk Reduction through Nursing Intervention and Education (ERRNIE) program is a five-year research project which was designed to confront the problems of multi-agent exposure to children (ages 0-6) within their home environments. The ERRNIE program addresses radon, carbon monoxide, lead, environmental tobacco smoke (ETS), and well-water contamination and collects biomarker and attitudinal data related to each agent. In addition the program focuses specifically on measuring the effectiveness of a public health nurse-delivered intervention addressing these environmental agents of concern. As the planning phases for the intervention approached and more in-depth research into the nature of interventions was pursued, ERRNIE researchers found that the methods used in the creation of interventions tend to fall into three categories: traditional (antiquated according to current educational trends), haphazard, or under-evaluated (McMillan 1994).

Developing Successful Interventions

While the importance of interventions is well established in environmental health practice, whether or not the effects of interventions are as significant as they could be or actually translate into health benefits for children is understudied. Additionally, it has been found that often appropriate evaluation necessary for planning successful prevention programs has not been undertaken (McMillan 1994). Realizing that problematic areas

such as these are prevalent within delivery programs, ERRNIE researchers asked the question, “While research shows that interventions do have a positive effect on health practices, are these effects maximized within the intervention or does the format of the intervention actually limit the effect it is able to achieve?” In other words, is it possible for even poorly constructed interventions to have some measurable effect? Generally speaking, any introduction of new knowledge will result in some level of cognitive processing which will most likely have some influence on recipient action, but efficacy studies are rare and there has been no systematic review of psychoeducational interventions (Bradlyn, Beale et al. 2003). If our goal, however, is to create a lasting and optimally successful intervention, what level of understanding do we, as environmental health researchers, need to access in order to utilize cutting-edge educational methods and strategies? For the ERRNIE project the answer lay in having a comprehensive and working knowledge of educational assessment processes and how these relate to adjustments for learning level, modality preference, and delivery and retention propensities. Other studies of a psychoeducational nature have drawn similar conclusions, with one study noting that, “It makes sense conceptually to analyze psychoeducational interventions in terms of psychoeducational principles, especially if the purpose is to illuminate the learning processes involved (Bradlyn, Beale et al. 2003).” When study was undertaken to gain a thorough grasp of psychoeducational concepts, ERRNIE researchers began to realize that advances in educational assessment are not being effectively or accurately translated into other disciplines, like the environmental health discipline, outside of the field of academic education. Likewise, Bradlyn noted

from the health care perspective that the psychoeducational literature currently available seems to have made very minimal contact with relevant principles and practices that have been developed outside of the domain of health psychology (2003). Although many professionals are familiar with academic measurement, application of the inferences derived from these measurements may not accurately reflect the original educational intent of a given measurement, nor make accurate distinctions between types and/or levels of knowledge, differing learner profiles, and differing instructional procedures designed to target these varibilities (Schwartz and Reisberg 1991; McLoughlin 1999).

Barriers to Creating Effective Interventions

One important example of these misguided assessments within the field of health education can be isolated and observed in the accepted processes for health information transfer. The common practice for dissemination of health education materials is to distribute print information, usually in the form of brochures or handouts, that provides information on everything from preventative precautions to medication procedures to insurance policies, among a great many other issues essential to reacting within the current health care system. While education in these areas is fundamentally important for patients, the current mode of presenting the content domain within this system is based on an incorrect interpretation of an educational assessment because print methods seem to "raise the problem of matching the readability of the printed material to the literacy of the intended audience (Butow, Brindle et al. 1998; Mossman, Boudioni et al. 1999)."

According to Zarcadoolas, a researcher in environmental studies, "At least three cultural circumstances have converged to make environmental health information critical,

yet highly inaccessible, to many Americans: 1.) the declining literacy levels of almost half the population, 2.) the growing cultural diversity of the population, and 3.) the complexity of environmental health information and science (Zarcadoolas, Timm et al. 2001)." While health educators and researchers can meet the needs of culturally specific populations with a little sensitivity and willingness to consider alternate world views, it is also possible to meet disparities in the first and third circumstances by evaluating current methods of conveying environmental health information. The environmental health discipline is acutely aware of the disproportionate effects of environmental hazards on persons and families of lower socioeconomic status (Preston, Warren et al. 2000), and yet, unwittingly the information produced and supplied to combat this inequity aims well above the abilities and interests of the targeted audience. Why is this happening?

The Myth of Literacy Evaluations

Health education is missing the mark with its interventions because these interventions are rooted in written formats and based on the idea that using words that reflect a seventh-grade reading level will solve the problems faced by low-literacy individuals, who in general experience poorer health. This approach, while well intentioned, is failing because the assessment of reading level was never intended to measure functional ability, the ability to respond on an independent basis to complex information written in seventh-grade words. In general attempts made within the healthcare system to meet the needs of less than proficient readers, a group comprised of the majority of U.S. high school graduates, consist of drafting documents which are then

processed through any computer's word tools and reformatted to avoid words with a rating of 8th grade or above ((NCES) 2001). While this process may ensure that targeted readers will be able to recognize the words within the document it does not guarantee that they will be able to understand what is presented or be able to apply this information to their own situations.

While many residents classified in the "low-literacy" category can read at the 7th grade level, low literacy does not pertain to a single skill deficiency in the area of reading ((NCES) 2001). Therefore the belief that adjusting to the assessed measure of reading level will solve the problems of poor health information communication is inherently false because literacy is a measure of everyday functioning, rather than an academic measure of word readability. The solution to this misinterpretation of assessment results is to evaluate what the term "low-literacy" actually implies. When this is done, it is easy to see that reading level assessment is not the best measurement to apply in improving the success of health educational and intervention programs.

In 1994 the International Adult Literacy Survey defined literacy as "the ability to understand and employ printed information in daily activities at home, at work, and in the community, and its usage in order to achieve one's goals and to develop one's knowledge and potential." In order to assess this definition of literacy, the IALS also defined three domains of literacy that would be combined to form a comprehensive measure of functional literacy. These domains included 1.) prose literacy, 2.) document literacy, and 3.) quantitative literacy ((NCES) 2001). A five-level scale was then developed to reflect the measurement of these domains such that levels one and two reflect very limited and limited literacy and level three is considered "the necessary minimum to cope with the

demands of everyday life and work in modern society ((NCES) 2001)." The National Center for Educational Statistics reports that more than half of all Americans score at either level one or two on the literacy scale in all three domains (2001). Based on this statistic we can assume that half of all U.S. citizens have either very limited or limited abilities to understand and use information from texts including editorials, manuals, news stories, etc. and to locate and use information contained in various formats including job applications, payroll forms, transportation schedules, maps, tables, graphs, prescription instructions, etc. ((NCES) 2001). Clearly, the literature shows that "the literacy demands of material encountered by patients exceeds the literacy abilities of the readers (Rudd, Moeykens et al. 1999)." Obviously, this means we cannot continue to present important health information according to current practice and expect to advance our successes in health education.

Surmounting Literacy-Related Obstacles

In order to acknowledge the links between health and literacy and to properly address these links, health professionals who understand the protocols used in healthcare need to begin collaborating with educators who understand the learning process and work to enrich the interventions provided by health services (Rudd, Moeykens et al. 1999). Those who have attempted to design effective health-related interventions have acknowledged that what seems to be absent from initial research into intervention design is a clear theoretical model that is rooted in learning theory (Bradlyn, Beale et al. 2003). However, a few studies regarding more effective methods for communicating health

information have been employed and have experienced relatively high levels of success. One study tested the effectiveness of educational materials designed by lay-people and found that these materials could induce a high degree of awareness about health risks and that these materials produced a higher recall of recommended action, higher readability and tone ratings, and increased action on the part of the patient (Rudd and Comings 1994). Another study in 1996 used cartoons to convey medical instructions and found that patients who received instructions in this format were more likely to read the instructions, more likely to answer questions about the instructions correctly, and more likely to follow the instructions daily (Delp and Jones 1996). Fouad and colleagues designed a health intervention program that used visual methods, games, and incentives to encourage behavior modification and found that health improvement following this intervention were statistically significant (Fouad, Kiefe et al. 1997). Marcario, Emmons, Sorensen, Hunt, and Rudd (Marcario, Emmons et al. 1998) used focus groups to provide nutritional information and concluded that "patients with low literacy skills turned first to family members and friends for health information." This lead them to believe that effective interventions should concentrate on patients' social networks, be delivered in visually interactive formats, and be culturally appropriate.

Studies like these show that some health professionals are beginning to understand that producing documents that only take reading level into account does not address the true nature of literacy-related problems. Increased familiarity with other forms of educational assessment based on the functional concepts of learning and instructional design supported by literature would significantly improve the ability of the health profession to produce effective educational interventions that utilize "cutting-

edge" theories of educational practice and prevent the apparent lag that occurs between progressive educational ideas and health information communication mechanisms (Bradlyn, Beale et al. 2003).

Applying What We've Learned

For these reasons the ERRNIE project is working to achieve maximized learner outcomes by utilizing progressive educational methods to deliver intervention materials. The materials, consisting of one seven-page, interactive activity module with a corresponding coloring book, were formatted to access multiple learning modalities by not only providing visual (written) stimulation, but also auditory and kinesthetic prompts designed to effect participant expectations, treatment credibility and acceptability, treatment adherence, perceptions of attitude, participation in health care, decision making, risk judgement, and risk behaviors as recommended by Bradlyn, Beale, and Kato (Beale, Bradlyn et al. 2003). The materials are also designed to be delivered within the culture of the home environment acknowledging that all of the families served by the ERRNIE project have young children present. Other studies have shown that cultural considerations influence the efficacy of intervention methods because they determine preferences for information source (Harris, Harris et al. 1991) as well as the active modes for seeking information (Martinson, Leavitt et al. 1999). Therefore, the ERRNIE intervention allows for the incorporation of each child's actual likeness into the learning materials to facilitate more rapid connection and personal investment in the material presented. Furthermore, ERRNIE materials are utilized in such a way that they require

interaction between parent and child in order for delivery to occur. Although further research is needed, information transfer methods that are highly interactive and individualized are seen as having the best potential (Bradlyn et al., 2003). In addition to the above stated strategies, ERRNIE intervention materials contain photographic representations of text portions as well as graphical tools that enable parents to evaluate their own home environments as experts. During the delivery of these intervention materials strategies such as drill and practice and guided inquiry, similar to those used in progressive classrooms, are employed to ensure a high level of long-term retention. ERRNIE researchers hope to achieve the following objectives through the implementation of this public-health-nurse-delivered intervention.

The participants will be able to:

1. Define each agent, its properties, and its source.
2. Identify the major health effects associated with each agent.
3. Identify the activities which increase exposure to each agent.
4. Comprehend and use the vocabulary specific to environmental health.
5. Evaluate the home environment for sources of environmental hazards.
6. Take independent protective actions within the home to decrease exposure to environmental agents.

In order to test the effectiveness of this intervention a pre and post test is administered to each primary respondent in the home allowing the research team to assess not only the impact of the intervention, but its influence on knowledge as it is tied to behaviors and attitudes about environmental health. ERRNIE researchers believe that implementing psychoeducational intervention measures like these will ensure a

successful means of delivery that will produce long-term and consistent practices that promote healthy home environments.

Conclusions and Implications

In conclusion, this research supports periodic evaluations of the affective scope of environmental health communication practices as essential to guaranteeing that future research provides society with significant and meaningful outcomes. Therefore it is the obligation of environmental health educators and researchers to go above and beyond standard practices of communication for risk and prevention information dissemination, and to thereby contribute not only to the execution of valuable research, but also to provide applicable benefits to the participating and dependent community.

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