



Environmental factors contributing to Parkinson's disease in rural Montana
by Janis Mae Majerus

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Nursing
Montana State University

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Abstract:

Parkinson's disease is a neurodegenerative disorder that reduces muscular control. There are many theories about the cause of Parkinson's disease, but at this time the cause or causes remain unknown. An exploratory, descriptive study design was used to explore the history of Parkinson's clients and to enrich health care professionals' understanding and awareness of the importance of environmental factors associated with Parkinson's disease.

Martha Rogers' conceptual model was used to help guide the study. The aim of this study was to explore the relationship of exposure to herbicides/pesticides, rural living and consumption of well water to the onset of Parkinson's disease. The study was conducted during a two-month period in 1992.

Study participants included 70 Parkinson's disease clients. Participants were accessed through the Montana Chapter of the American Parkinson Disease Association located in Great Falls, Montana. In addition to demographic questions, data were obtained by utilization of the "Parkinson's Disease Tool" adapted with permission from Dr. Wm. Koller. Demographics and the Parkinson's Disease Tool were descriptively analyzed for the entire sample.

Findings from the study revealed the majority of the sample had Parkinson's disease 25 years or more and had worked or lived on farmland. In the study over half of the participants had been exposed to herbicides/pesticides and had not worn protective equipment of any kind when mixing or applying herbicides/pesticides. Well water consumption was found difficult to measure, specifically the number of years the participant had ingested well water.

Implications of this study pertain to the need for nurses to include the environmental dimension in the individual's assessment. The client's use of herbicides/pesticides and/or chemicals in general should be evaluated. Use of protective equipment should be discussed and reinforced. Further research is needed to examine the magnitude and nature of environmental factors that may contribute to Parkinson's disease.

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A thesis submitted in partial fulfillment
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APPROVAL

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This thesis has been read by each member of the graduate committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date

November 29, 1994

This work is dedicated to my parents, Francis
and Lorna Majerus, and to my sons,
Matthew and Michael.

VITA

Janis Mae Majerus, the daughter of Francis and Lorna Majerus, was born February 22, 1954, in Great Falls, Montana. She received her secondary education from Charles M. Russell High School, Great Falls, Montana. She graduated from Montana State University's College of Nursing with a Bachelor of Science in Nursing in 1976.

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ABSTRACT

Parkinson's disease is a neurodegenerative disorder that reduces muscular control. There are many theories about the cause of Parkinson's disease, but at this time the cause or causes remain unknown. An exploratory, descriptive study design was used to explore the history of Parkinson's clients and to enrich health care professionals' understanding and awareness of the importance of environmental factors associated with Parkinson's disease.

Martha Rogers' conceptual model was used to help guide the study. The aim of this study was to explore the relationship of exposure to herbicides/pesticides, rural living and consumption of well water to the onset of Parkinson's disease. The study was conducted during a two-month period in 1992.

Study participants included 70 Parkinson's disease clients. Participants were accessed through the Montana Chapter of the American Parkinson Disease Association located in Great Falls, Montana. In addition to demographic questions, data were obtained by utilization of the "Parkinson's Disease Tool" adapted with permission from Dr. Wm. Koller. Demographics and the Parkinson's Disease Tool were descriptively analyzed for the entire sample.

Findings from the study revealed the majority of the sample had Parkinson's disease 25 years or more and had worked or lived on farmland. In the study over half of the participants had been exposed to herbicides/pesticides and had not worn protective equipment of any kind when mixing or applying herbicides/pesticides. Well water consumption was found difficult to measure, specifically the number of years the participant had ingested well water. Implications of this study pertain to the need for nurses to include the environmental dimension in the individual's assessment. The client's use of herbicides/pesticides and/or chemicals in general should be evaluated. Use of protective equipment should be discussed and reinforced. Further research is needed to examine the magnitude and nature of environmental factors that may contribute to Parkinson's disease.

CHAPTER 1

INTRODUCTION

The environmental awareness of the 80's and the identification of harmful chemicals has brought a renewed interest in the cause of Parkinson's disease. Although the cause of Parkinson's disease is yet unknown (Tanner & Langston, 1990), most of the breakthroughs have been in the last 20 years (Duvoisin, 1991). Parkinson's disease is a disorder of the nervous system that reduces muscular control. The onset is so insidious that often it is many years before the individual is diagnosed with the disease. Although the disorder can cripple its victims, it is rarely a direct cause of death.

Purpose

The purpose of this descriptive study was to explore the use of identified pesticides, consumption of water from a well source, and rural living with Parkinson's disease. Exploring the history of Parkinson's patients will enrich the understanding of and may contribute to the delineation of the relationship between the environment and Parkinson's disease. The elements of the conceptual model for this study are derived from Martha Rogers' representation of

person-environment. Rogers identified human beings and their environments as the central focus of her conceptual system.

Relevance to Nursing

"Nurses constitute the largest group of health professionals in the workplace" according to U.S. Congress, Office of Technical Assistance Report (cited in Butterfield, 1992). By virtue of the rural nurse's capacity for initial contact with rural residents, previous environmental relationships and exposures may be explored firsthand. Nurses need to utilize the opportunity to become investigators and environmental advocates through the use of preventive health teaching. By modifying and teaching agricultural workers awareness of potential risks involved in the use of pesticides, nurses will impact rural dwellers and their working habits. This preventive education will reduce personal risk and protect the person working in the rural environment. Rural nurses find themselves continually dealing with the rural farmer and rancher's sense of invincibility regarding their life style as stewards of the land. Rural nurses functioning in agricultural disease prevention illustrate Rogers' symphonic interaction with the environment. By working in close harmony with the county extension service and weed control departments, rural nurses can raise the level of

awareness regarding pesticide use and risks. This illustrates a modification environment which could prevent disease within the human-environment field. The identification of relationships between person and environment provides for an ordering of knowledge and for the development of nursing's hypothetical generalizations and unifying principles.

Statement of the Problem

The impact of environmental factors on Parkinson's disease in Montana is not known. Factors associated with occurrence of Parkinson's disease in analytic and descriptive epidemiology studies include rural habitation, farming and the consumption of well water from a private well (Barbeau, Roy, Bernier, Campanella & Paris, 1987; Granieri, Carreras, Casetta, Govoni, Tola, Paolino, Monetti, & Bastiani, 1991; Ho, Woo, & Lee, 1989; Koller, Langston, Hubble, Irwin, Zack, Golbe, Forno, Ellenberg, Kurland, Ruttenber, Spencer, Tanner, Tetrud, Wilcox, Roman, Mayeux, Smith, & Goetz, 1990; Rajput, Stern, Christ, & Laverty, 1984; Rajput, Utti, Stern, & Laverty, 1986; Tanner, Chen, & Wang, 1989) (cited in Hubble, Cao, Hassanein, Neuberger, & Koller, 1993) and exposure to pesticide products (Golbe, Farrell, & Davis, 1990; Semchuk, Love, & Lee, 1992). General categories of pesticides or specific agents are being researched (Coye, Lowe, & Maddy,

1986). Various researchers, for example, Semchuk, Love, & Lee (1992), propose that if Parkinson's disease is caused by an environmental herbicide/pesticide, continuous exposure to the chemicals may be associated with an increased risk of Parkinson's disease.

Conceptual-Theoretical Framework

A paradigm shift is taking place in regard to health and disease. The majority of conceptual models in the nursing literature have been based on a view of the patient as a person in good or bad health and needing more or less help from nursing to regain a state of health or well-being. Rogers' (1986) view represented a turning point in the conceptualization of person-environment interaction. Rogers' (1980) model represents an absence of boundaries between person and environment and the emphasis is on "mutual simultaneous interaction of person-environment." The old paradigm was focused on the identification of problems and the development of strategies to solve the illustrated problem. The new paradigm illustrated by Rogers' model is relational. Rogers is not trying to change a person's being but to recognize it and relate to it in an actual way.

Definition of Terms

Demographic Data: Include sex, age, occupation, prior history of medical problems, and residence of the family when the patient was born.

Energy Field: Made up of the human being and environment. A field is open to interaction with other fields and is characterized by pattern and organization.

Environment: Riehl and Roy (1980) describe Rogers' environment as a continuous and mutual exchange of matter and energy.

Farm: Refers to land cultivated for the purpose of agricultural production (Pederson, 1985).

History of Disease: Rogers (1980) identifies disease as a disruption in the interaction between the human being and their environment.

Pattern: Description of a predictable relationship between the human being and the environment. Rogers (1980) describes this as a helicy, and lacking boundaries.

Ranch: An extensive farm on which herds of cattle, sheep, horses, and other agricultural animals are raised (Pederson, 1985).

Risk Factors: Any influence that could result in a possibility of loss, injury, disadvantage or destruction, dangerous element or factor; to expose to hazard or danger (Webster, 1981).

Rural Environment: A city or town under 49,999 population with homes located more than 31 minutes, but less than 59 minutes from a hospital of more than 100 beds (Lee, 1989).

Urban Environment: A city of 50,000 or more population with homes located less than 30 minutes from a hospital of more than 100 beds (Lee, 1989).

Limitations

A convenience sample was used in this study and may not have been an accurate representation of the population of north central Montana. The sample size was limited to the north central area of Montana. Use of a mailed questionnaire does not allow researchers to collect data on the environmental risks of those people who did not respond to the questionnaire. Personal interviews can provide more data than questionnaires and would have let the researcher know more about the topics questioned. The nature of a level one study using a select sample makes it difficult to generalize to the universal population. When using questionnaires, the accuracy of respondents' recall tends to weaken the information gained.

CHAPTER 2

LITERATURE REVIEW

In 1817, James Parkinson gave the first full clinical description of the disease which bears his name (Parkinson, 1955). Parkinson's disease is characterized by progressive rigidity of the limbs, trunk, and face, and by a regular 4 to 6 per second tremor present in repose and diminishing with increasing movement. Associated with the rigidity and tremor are stooping posture, autonomic dysfunctions, a paucity of semiautomatic spontaneous movements, and difficulty initiating voluntary movements termed akinesia (England & Schwab, 1961). The disease appears to be associated with catecholamine (dopamine) depletion. It occurs in middle life, around ages 40 to 60, and males are affected more than females (Stern & Lees, 1983).

There are many theories about the cause of Parkinson's disease, including viral encephalitis, which damages the extrapyramidal nervous system (Duvoisin, 1991). Many such cases of Parkinson's disease occurred during a worldwide epidemic between 1918 and 1932. However, there is no evidence to confirm that Parkinson's disease is related to an infectious process (Koller et al., 1990).

The cause of Parkinson's disease is unknown although recent evidence suggests that the interaction between age and certain environmental factors may underlie the pathogenesis of Parkinson's disease (Dulaney et al., 1990). Ward's work (cited in Vieregge, Schiffke, Friedrich, Muller, & Ludin, 1992) "gave a low concordance rate in monozygotic twins and thus could not establish a major genetic contribution to the etiology" (p. 1453). Parkinson's disease involves degeneration of the basal ganglia, particularly the substantia nigra and corpus striatum, and is associated with deficiency of dopamine, a neurotransmitter required for control of posture, support, and voluntary motion.

Researchers have identified that a neurotoxin may be a factor in development of Parkinson's disease. A number of drug addicts in northern California, mostly young adults, inadvertently injected themselves with a drug contaminated with 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) and developed full-blown symptoms of Parkinson's disease within days. The discovery of MPTP suggests that a similar neurotoxin may cause Parkinson's disease (Koller et al., 1991). In the early 1980's, MPTP was discovered to cause Parkinson's symptoms by destroying dopamine-producing cells in the substantia nigra. Since then, scientists have uncovered numerous compounds, both natural and man-made, which have a chemical structure

similar to MPTP (Ballard, Tetrud, & Langston, 1985). These include specific pesticides and agricultural herbicides which have a chemical similarity to MPTP and may enter through ground water, resulting in the presence of toxins in rural well water (Langston & Ballard, 1984; Mesaros, 1990). Studies have implicated these compounds as the cause of Parkinson's disease and/or Parkinson-like symptoms in certain individuals (Langston, 1990; Rajput, Uitti, Stern, & Laverty, 1986; Semchuk, Love, & Lee, 1992). Previous studies have implicated rural living, well water use, proximity to industrial chemicals, and exposure to pesticides as risk factors for developing Parkinson disease (Tanner & Langston, 1990). Drinking well water in childhood and early adulthood increased the risk of Parkinson's disease when well water was evaluated as a single variable (Koller et al., 1990). "It is possible that ingesting of a neurotoxin through drinking water may be related to the development of Parkinson's disease. . . . Many agricultural chemicals are leached from soil into ground water, where concentrations may build since there is relatively little turnover of ground water" (Koller et al., 1990, p. 1220).

The disease affects 100 to 150 persons in every 100,000 (Hamilton, 1988). Carlsson and Winblad, in 1976, and McGreer, McGreer, and Suzuki, in 1977, (cited in Koller et al., 1990) found "age-related loss of the nigrostriatal

dopamine system occurs, but is insufficient to cause parkinsonism" (p. 1218). The disease has been identified as having a distinct geographic pattern, specifically in the northern tier of states (roughly above 37 degrees north latitude). Those in the north contract the disease at a higher rate than those living in the southern part of the United States (Lux & Kurtzke, 1987). Researchers report that they can furnish a list of environmental toxins that people could avoid and substantially reduce, perhaps eliminate, their chances of developing Parkinson's disease (Campanella, Roy, & Masson, 1988). Over the past five years, scientists have noted a connection between rural living, the drinking of well water, pesticide exposure, and possibly farming as increasing the risk factors for developing Parkinson's disease (Koller et al., 1990). The U.S. Congress, Office of Technology Assessment (cited in Butterfield, 1992) summarized the situation:

In recent years, concern about the neurotoxic effects of chemicals has increased as evidence has become available linking exposure to chemicals and drugs with long-term changes in the nervous system More than 65,000 chemicals are in the U.S. Environmental Protection Agency's inventory of toxic chemicals; and the agency annually receives approximately 1,500 notices of intent to manufacture new substances The number of substances that pose a significant risk to public health and the extent of that risk are unknown because the potential neurotoxicity of only a small number of chemicals have been adequately evaluated.
(pp. 3-4)

The search for an environmental cause for Parkinson's disease is greatly complicated because of the possibility that a variety of risk factors are at play and that no single factor by itself is sufficient to cause the disease. Other risk factors such as alcohol, head trauma, and diet have been identified. The toxin is never present in quantities sufficient to cause acute toxicity syndrome (Rajput et al., 1987).

A recent study done by Butterfield, Valanis, Spencer, Lindeman, and Nutt used a multivariate approach and examined the relationships between Parkinson's disease and water source, rural residency, pesticide exposure, and participation in farming. This study "found a significant relationship between certain types of pesticide exposures and Parkinson's disease" (Butterfield et al., 1993, p. 1154). A study in Montana has not been done (to date) examining exposure to environmental factors, well water use, and herbicide/pesticides by individuals with Parkinson's disease. This study will contribute to the body of data that has been collected from Canada and the United States.

Conceptual Framework

Environmental factors influencing Parkinson's disease illustrates a conflict with Rogers' promotion of symphonic interaction between person and environment (Rogers, 1986).

Symphonic interaction is meant to strengthen the coherence and integrity of the human field, and to direct and redirect patterning of the human and environmental fields for realization of maximum health potential. In the case of Parkinson's disease, it is hypothesized that there is an interruption between person and environment by risk factors such as pesticide use.

Rogers explains that each environmental field is specific and unique to its given human field. The human field is theorized to have its boundary continuous with the boundary of the environment. The environment is, itself, an energy field electrical in nature. Both change continuously, mutually, and creatively. Rogers proposed two general principle qualities of the human field: (1) the principle of helicy and (2) the principle of resonancy (Rogers, 1980).

Principle of Helicy

Helicy claims that field changes are innovative, probabilistic, acausal, patterned, qualitative, and characterized by increasing diversity of field patterns. This study explores person and the environment in relation to the history of Parkinson's disease. The principle of helicy states that the development of diseases such as Parkinson's are facilitated by interaction with the environment, and in turn the human who develops a disease

such as Parkinson's alters and impacts their environment. These field factors are characterized by increasing diversity of human field and environmental field pattern and the result of Parkinson's disease simultaneously interacting between the human and environmental fields. This research focused on a study of the relationship between pesticide and well water use as an interaction between human and environmental fields.

Principle of Resonancy

The principle of resonancy proposes that change in pattern and organization of the human field and the environmental field is communicated by waves (Rogers, 1980). When a disease process, such as Parkinson's, enters a human being's life, a multiplicity of waves surround the human being, creating a resonance of change from a state of health to disease. An example of Rogers' view of disease is evident when a Parkinson's patient can process information but their mind does not receive the appropriate data because of the unbalanced dopamine function of the brain. The nature of the wave pattern changes continuously from low frequency to higher frequency patterns. This change in the human being's health relates to the resonance of change as a continuously propagating series of waves between person and environment (Rogers, 1980). Parkinson's disease represents an invariance of environmental waves and

reflects a change in a human being's health status. Parkinson's disease reduces and distorts the person's sensory ability of movement within their environment.

The study methodology is designed to facilitate a search for potential environmental pesticides that would possibly contribute to Parkinson disease. Rogers' theoretical model was chosen to complement the structure of research in order to maintain perspective of the perception of human being predominantly subjected to multiple negative waves (pesticide influences) with pathological outcomes (Parkinson's disease).

Implicit in Rogers' view of human being is the responsibility of the nurse to value with compassion each person's individuality. Researching the possible influencing factors of Parkinson's disease and the frustration of the human being not being in tune with their environment supports Rogers' theory of interchange between person and their environment. For the purpose of this project the central concept is person in his/her entirety. In other words, human behavior reflects the merging of physical, biological, psychological, social, cultural, and spiritual attributes into an indivisible whole; a whole in which the parts are not distinguishable (Rogers, 1980). Nursing seeks to care for human beings in accordance with its science that is emergent and based on research and logical analysis of the principles of homeodynamics.

Nursing science seeks to describe, explain, and predict so that nursing's goal of maximization of health potential is achieved consistent with its ever-changing nature. Nursing then has as its goal maximum health potential for the unitary person, achievable by artfully applying emerging science based on the principles of homeodynamics.

CHAPTER 3

METHODOLOGY

The research design used in this study was descriptive and exploratory. Descriptive designs are created in order to make accurate statements about the characteristics of individuals, situations, or groups (Castles, 1987). Exploratory designs are created in order to become familiar with the variables of interest and to gain insight into their relationships (Castles, 1987). The survey method was selected to elicit information from a subset of a population about environmental factors within the Parkinson's population. This particular design was chosen due to the ease of distribution and administration to a broad geographic area, north central Montana; data were collected using a mailed survey.

The questionnaire was printed as a booklet, questions were not printed on the cover pages and the size was reduced to half pages of 8½" x 11" paper (see Appendix A). The booklet was reproduced on white paper. These recommendations resulted in a questionnaire that was pleasing to the eye and readable to most people. The paper was folded in the middle and stapled to form a booklet that fit in a standard Monarch-size or business reply envelope.

The questionnaire that is mailed to potential respondents must speak for itself (Woods & Catanzaro, 1988). In this case the investigator was not present to answer questions, allay anxiety, or clarify items; therefore, clear directions were necessary. Use of the mailed questionnaire had several advantages. It was less time consuming and more cost effective than a personal or telephone interview in a state as vast as Montana. Participants were able to remain anonymous and therefore may have been more willing to answer personal questions about their Parkinson's disease if they felt they could not be identified.

The descriptive, exploratory survey research method also has its limitations. The questionnaire was unable to explore Parkinson's disease issues in great depth without becoming too lengthy. Respondents could omit or disregard any item they chose without giving an explanation. The amount of information gathered by the questionnaire was limited to those who were literate, but the respondents were given the choice of having someone else help complete the questionnaire for them. The participants who did return the questionnaire may not have provided a representative sample of the target population. Since the mailed questionnaire required self-administration, care was taken to make instructions and questions as clear and unambiguous as possible.

Pilot Testing

The questionnaire was subjected to pilot testing with a small sample of persons ($n=10$). Pilot activities were designed to gather subject feedback on the clarity and comprehensiveness of the questionnaire and to obtain an estimate of questionnaire completion time. The pilot testing was conducted in two stages, first with health care professionals ($n=4$) followed by Parkinson clients ($n=6$) residing in Great Falls, Montana. The health care professionals were chosen to establish validity of the questionnaire. The Parkinson clients were selected to determine the length of time required to complete the questionnaire and to ascertain and clarify unclear directions, items, and print size. Pilot testing focused on garnering professionals' and clients' overall impressions of the questionnaire and difficulties encountered with any particular items. Results from the pilot test revealed unclear wording of three questions. Seven of the pilot testing participants said the questionnaire was clear and easy to read. The participants reported that it took an average of thirty (30) minutes to complete the questionnaire. The recommendations were implemented and the questionnaire was changed according to the pilot study suggestions.

Population and Sample

Target Population

The target population for this investigation consisted of north central Montana residents who had been diagnosed with Parkinson's disease and were members of the Montana Parkinson Association. Through contact with the Montana Parkinson Association, a convenience sample of study participants was obtained via the American Parkinson Association (Appendix B). The accessible population for this investigation were members of the Montana Parkinson Association (Appendix C).

Sample

The sample was purposive, random, and convenient. This type of sample was suitable for the purpose of establishing a beginning-level descriptive data base about environmental factors influencing Parkinson's disease. A random sample was selected from recipients of the Montana Parkinson Association newsletter. Because the sample list included others besides individuals diagnosed with Parkinson's disease, the list was carefully sorted by the executive director of the Montana Parkinson Association. The executive director eliminated educators and others not diagnosed with Parkinson's disease. The number of people receiving this newsletter was approximately 700. A random sample of 200 was chosen after the list was purged of

educators. The use of random sampling procedures is the optimal way to ensure that the sample is indeed representative of the underlying population (Woods & Catanzaro, 1988). No discrimination was made on the basis of age, race, occupation, education, or family income. Subjects for this study were 40 males and 30 females. The 70 subjects who responded represented a 35% response rate. The average age of those responding was 73 years. Eighty-four percent of the subjects were born in Montana. A majority of the respondents, 68%, lived in rural and frontier Montana.

Location of Study

The study was conducted in the north central Montana region, the farthest north being a participant from Cut Bank and the closest being a resident of Great Falls. Montana is the fourth largest state. This north central geographic area covers over 1000 square miles and primarily includes agriculture, manufacturing, and mining based industry.

Data Collection Procedure

The Montana Parkinson Association was contacted to obtain a random sample of study participants. An introductory letter (Appendix D) was sent via the Montana Parkinson Association monthly newsletter indicating the

association's endorsement of the study and encouraging participation in the survey. The newsletter issue was received by Montana Parkinson Association potential study participants 2 to 3 days prior to the mailing of the questionnaire. A cover letter provided information about the study including the purpose, risks and benefits, and an assurance of anonymity was mailed with the questionnaire to study participants (Appendix D). Questionnaires were mailed to 200 of 700 members on the mailing list. The questionnaire was completed by the participant in an environment of his/her choosing and returned within 2 weeks of receipt. A follow-up reminder postcard was sent one week after the mailing of the questionnaires. Those incapable of completing the questionnaire were encouraged to have a friend or family member help them. Participants were instructed to rest as much as needed during completion of the questionnaire. The questionnaire took approximately 30 minutes to complete. A follow-up notice was included in the August issue of the Montana Parkinson Association newsletter, reminding participants to return the questionnaire. Upon completion, the respondent returned the questionnaire in the stamped, addressed envelope provided. Questionnaires were distributed from June 5, 1992 to August 5, 1992. A two-month cut-off date was established for return questionnaires. A thank you letter was written by the researcher and published in the Montana

Parkinson Association newsletter two weeks after completion of the data collection.

Human Subjects Protection

Three key ethical principles of protecting human rights in scientific research are informed consent, freedom from harm, and confidentiality (Polit & Hungler, 1987). This study was reviewed and approved in writing by the Montana State University College of Nursing Human Subjects Review Committee (Appendix E). Participants were informed by a written explanation of the study which accompanied the questionnaire (Appendix F). Participation in this study was voluntary and without monetary compensation. Participants' responses were kept anonymous by asking participants not to write their names anywhere on the questionnaires. Questionnaires were not coded prior to mailing. The potential participants were informed that the study held no direct benefits for them, but the information obtained would be used to gain further understanding of the factors that influence the onset of Parkinson's disease. Participation in the study did not represent a risk, but it may have been an inconvenience because of the time needed to answer the questions. Data obtained from the questionnaire were reported as group data and did not identify the participants personally in any way. The data were kept in a locked cabinet and only the

investigator and members of the thesis committee had access to the data. The questionnaires did not include the participants' names, only identification numbers which were used to track the participants. Only the investigator had access to the list that linked the participants' names with their identification numbers. The list was destroyed following data collection. Written consent was not obtained; consent was implied by return of the completed questionnaire.

Instrument

The questionnaire included 20 background questions created by the investigator and a modified version of the Parkinson's Disease Study Instrument (Koller, 1988). This questionnaire was used to collect data measuring the environmental factors influencing Parkinson's disease and contained questions concerning pesticide use and water source. It was developed for use in a study by William C. Koller, M.D., Ph.D., Professor and Chairman of the Department of Neurology, University of Kansas Medical Center, titled "Environmental Risk Factors in Parkinson's Disease." Written permission was obtained from Koller to utilize his instrument (Appendix G). Reliability and validity were not available for this specific instrument at the time of this study. Rural living and drinking well water were significant variables in the Parkinson's

patients in Koller's study. Koller's study also identified that drinking well water was dependent on rural living and that there were no significant differences between cases and controls for farming or any measure of exposure to herbicides or pesticides. Koller and associates' data contribute to evidence that an environmental toxin could be involved in the etiology of Parkinson's disease. This instrument was the only one known at the time of this research that addressed rurality in relation to Parkinson's disease. Background questions were added that addressed basic demographics including date of birth, age, gender, month and year Parkinson's disease was diagnosed, and initial Parkinson's symptoms (Appendix A).

Data Analysis

Data were coded and entered into the computer by Montana State University College of Nursing Office of Applied Research Service. Each question was individually coded for analysis depending on the item. The Parkinson's symptoms were coded numerically. The individual responses to the open-ended questions were coded when encountered with each returned questionnaire. Descriptive statistics were used to describe the demographic characteristics of the participants in the study. The independent variables of well water and pesticide use were examined for

association with the dependent variable, onset of Parkinson's disease.

CHAPTER 4

RESULTS

Data collection began in mid-1992 and was finalized in November of 1993. During the data collection period, one additional data collection site was added in order to increase the potential sample size. Of the 200 questionnaires distributed, 76 questionnaires were returned for a response rate of 38%. Four questionnaires were not used in the data analysis because the questionnaires were not completed. Two questionnaires were returned as undeliverable. The study sample consisted of 70 respondents.

Description of Sample

The average age of those responding was 73 years. Participants were born between 1907 and 1972. Eight respondents did not give their age. Fifty-eight percent ($n=40$) of the respondents were male, 42% ($n=30$) indicated they were female. Thirty-four of the 70 subjects were born and had lived at their place of birth for over 20 years. Eighty-four percent ($n=58$) of the subjects were born in Montana. When asked what other places the participant had lived the longest, rural and frontier Montana continued to

dominate the study, with 68% (n=47) of the respondents continuing to reside in Montana an additional 15 to 45 years.

Disease Characteristics of Participants

When asked when the respondent had first noticed any Parkinson's symptoms, the range of years from 1933 to 1980 was identified. This represents a range for recognition of symptoms from 13 to 60 years ago. The most frequent recall of the 70 respondents' initial symptoms were 25 years ($\underline{n}=4$) to 30 years ($\underline{n}=4$) ago.

Seventy-one percent ($\underline{n}=50$) of those responding identified tremor-shakiness as their initial Parkinson's symptom. The next most frequent symptom, experienced by 62% ($\underline{n}=44$) of the participants, was slowing of movement. Thirty-eight percent ($\underline{n}=27$) stated they had experienced rigidity or stiffness (see Table 1).

Table 1. Initial Symptoms of Parkinson's Disease Reported by Respondents.

Symptom Experienced	Frequency	Percentages
Tremor - shakiness	50	70.4
Slowing of movement	44	62.0
Rigidity	27	38.0

Occupations of Participants

Eighteen percent ($\underline{n}=13$) of the respondents reported their occupation as a farmer or rancher. Other careers of participants included office manager/management, 16% ($\underline{n}=11$); laborer, 14% ($\underline{n}=10$); housewife, 13% ($\underline{n}=9$); nurse, 9% ($\underline{n}=6$); salesman, 6% ($\underline{n}=4$); grocery clerk and produce manager, 6% ($\underline{n}=4$); exterminators, 3% ($\underline{n}=2$); and 8% ($\underline{n}=6$) listed "other" in regards to occupation. Five percent ($\underline{n}=7$) did not answer in regard to their occupation (see Table 2).

Table 2. Occupation of Respondents.

Response	Percentage	Frequency
Farmer or Rancher	18	13
Office Manager/Management	16	11
Laborer	14	10
Housewife	13	9
Nurse	9	6
Salesman	6	4
Grocery Clerk/Produce Manager	6	4
Exterminator	3	3
Other	8	5
Did not answer	7	5
Total	100	70

Exposure to Herbicides/Pesticides

Seventy percent ($\underline{n}=49$) of the study subjects indicated they had worked or lived on farmland. Forty-nine percent ($\underline{n}=34$) of the respondents ($\underline{n}=70$) reported they had been

exposed to herbicides/pesticides being applied to crop-ground/pasture land. Of those exposed to herbicides/pesticides ($n=34$), 30% ($n=10$) had mixed and prepared the herbicides themselves, and 40% ($n=14$) had applied the herbicide/pesticides themselves. Thirty percent ($n=10$) of the exposed sample ($n=34$) indicated that someone else usually mixed and prepared the herbicides the participants used.

One respondent had been stationed in Vietnam and had served for three months in an area where herbicides had been applied. This participant did not believe he became ill from any exposure to herbicides while in the military.

When asked if any of the exposed sample had used any protective equipment when mixing or applying the herbicides/pesticides, interestingly, 62% ($n=21$) of the 34 persons exposed had not worn any protective equipment when mixing or applying herbicides/pesticides, 17% ($n=6$) had used rubber gloves, 16% ($n=5$) had worn protective coveralls, 5% ($n=2$) wore masks (see Table 3).

Table 3. Protective Equipment Used.

Type of Equipment	Frequency	Percentages
None	21	62
Rubber gloves	6	17
Coveralls	5	16
Face masks	2	5
Total	34	100

The subjects ($n=70$) indicated they had used numerous methods to apply herbicides/pesticides and were instructed to indicate all methods used to apply herbicides/pesticides. The method most frequently reported as being used to apply herbicides/pesticides was tractor mounted or mist blower spray ($n=21$). The second most common method of applying herbicides/pesticides was spreading by hand ($n=17$). Forty-six percent ($n=13$) indicated they utilized a backpack or hand sprayer. Thirty-two percent ($n=8$) of respondents indicated they had participated in application of herbicides/pesticides by airplane. Thirteen percent ($n=3$) applied herbicides/pesticides via 4-wheeler vehicle. Twenty-six percent ($n=7$) related they had applied herbicides/pesticides by pouring. Twenty-five percent ($n=6$) of the sample had applied herbicides/pesticides by a hose-end mixer. Other methods less frequently used for application of herbicides/pesticides were: cyclone spreader ($n=2$), stump painting ($n=1$), and notching ($n=1$) (see Table 4).

Twenty-seven percent ($n=8$) of the sample had been exposed to herbicides/pesticides for 40 years or more, 10% ($n=3$) reported exposure 25 years or more, and 16% ($n=5$) had reported some contact with herbicide/pesticides for at least 10 years. Therefore, 53% of those who were exposed to herbicides/pesticides had reported an exposure of 10 years or more (see Table 5).

Table 4. Method of Application of Herbicides/Pesticides.

Method	Frequency	Percentages
Tractor mounted or Mist blower spray	21	67
Spread by hand	17	51
Airplane	8	32
4-wheeler vehicle	3	13
Pouring	7	26
Hose-end mixer	6	25
Cyclone spreader	2	8
Stump painting	1	4
Notching of trees	1	4

Table 5. Years Exposed to Herbicides/Pesticides.

Years	Frequency	Percentages
40 years or more	8	27
25 years or more	3	10
10 years or more	5	16
30 days per year	4	13
10 days per year	4	13
No Exposure	7	21
Total	34	100

Forty-eight percent ($\underline{n}=34$) of the 70 participants stated they had handled and or laundered clothing exposed to herbicides/pesticides. Ninety-two percent ($\underline{n}=64$) did not believe they had ever become ill from any exposure to herbicide/pesticides; 8% ($\underline{n}=5$) believed they had become ill from an exposure to herbicides/pesticides. Sixty-seven percent ($\underline{n}=23$) of the 34 respondents exposed to herbicides/pesticides indicated that the herbicide 2-4D®

was the name of the herbicide most commonly used on the crop-growing land. Other herbicides identified infrequently were Round-Up® (n=9), Banvel, II S6P® (n=1), and arsenic (n=1). When asked if the participants had ever used herbicides/pesticides at home in yard work or for other purposes not previously discussed, 68% (n=43) of the total sample (n=70) indicated that they had used weed killers or defoliants at home. Those herbicides identified were 2-4D® (n=7), Round-Up® (n=8), and Weed-Be-Gone® (n=11). The most frequently reported number of days participants used herbicide on their yards was 3 days (n=10) and the next most frequent was 10 days (n=7).

Source of Drinking Water

Identifying the source of drinking water is a current environmental research topic. The participants' source of drinking water at their place of birth was identified by three choices: city, well, and cistern water. The study indicated well water to be the source of drinking water at their birth place of 52% (n=33) of the participants. Forty percent (n=26) reported city water and 5% (n=3) indicated cistern water as their source of drinking water (see Table 6).

Table 6. Source of Drinking Water.

Source	Frequency	Percentages
Well water	33	52
City water	26	40
Cistern	35	5

The respondents were asked to identify up to four places they had resided, beginning with the place they had lived the longest (see Table 7).

Table 7. Sources of Drinking Water at Four Places of Residence of Respondents.

Source	Frequency	Percentages
<u>Place No. 1</u>		
Well water	29	45.3
City water	28	43.8
Cistern	4	6.3
<u>Place No. 2</u>		
Well water	14	30.4
City water	28	69.9
Cistern	4	8.7
<u>Place No. 3</u>		
Well water	9	36.0
City water	16	64.0
Cistern	0	0.0
<u>Place No. 4</u>		
Well water	4	20.0
City water	16	80.0
Cistern	0	0.0

Other Possible Causative Events

Finally, researchers continue to look for possible causative events in Parkinson's disease; therefore, a head trauma question was asked of the subjects. Fifteen percent (n=10) had suffered serious head trauma injuries with loss of consciousness (see Table 8).

Table 8. Age Head Trauma Occurred.

Years Old	Frequency	Percentages
7	1	.7
8	1	.7
9	1	.7
10	1	.7
11	1	.7
12	1	.7
14	2	1.4
16	1	.7
37	1	.7
47	1	.7
Total	11	7.7

In summary, the majority of the subjects were born in Montana and the dominant occupations were farming and ranching. Most respondents had resided or worked on farmland and had been exposed to herbicides/pesticides being applied to crop-ground/pasture land. Over half identified well water as their source of drinking water. These data suggest that a combination of rural environment, exposure to herbicides/pesticides, and drinking well water

may have been risk factors for developing Parkinson's disease.

CHAPTER 5

DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

Discussion

The discussion provides an interpretation of findings for the sample studied and a comparison of the findings by the researcher. The risk characteristics chosen for this study were identified in the literature by other researchers. The purpose of this descriptive study was to explore the use of identified pesticides, consumption of water from a well source, and rural living with Parkinson's disease. The present study endeavored to (1) increase knowledge of etiologic importance of rural environmental and occupational factors, (2) identify environmental factors which appear to be common in patients with Parkinson's disease, (3) identify environmental factors that may contribute to neurologic disorders, and (4) increase awareness and preventive behavior in rural and urban areas. The findings in relation to the study's purpose and conceptual framework are summarized in this chapter. Implications for nursing and recommendations for future research are included. By examining the history of Parkinson's patients, this knowledge will enrich the

understanding of how the environment may influence the onset of Parkinson's disease. The theoretical framework used to guide this study was based on Martha Rogers' representation of human being-environment. A descriptive, exploratory study was conducted which included a sample size ($n=70$) that was purposive and random. The participants were members of the Montana Parkinson Association. Data were collected using a mailed self-administered questionnaire. The "Parkinson Disease Tool," adapted with permission by Dr. William Koller from the University of Kansas Medical Center, Kansas City, Kansas, was used to identify Parkinson's disease participants' history of environmental exposure to herbicides/pesticides, rural living, and consumption of well water. Participants identified three symptoms most often experienced. These recognized symptoms are in alignment with other similar studies. Investigating factors of place of residence, source of drinking water, and environmental and occupational exposure to various agricultural chemicals identified a diverse rural population that have experienced extensive exposure to herbicides/pesticides during their lifetime. These participants did not extensively utilize protective equipment when handling chemicals, and this factor might have escalated their absorption of harmful chemicals. Results of this study substantiate findings from previous research that

environmental exposure to chemicals may potentiate the development of Parkinson's disease.

Disease Characteristics of Participants

Parkinson's disease is a disorder of the nervous system that reduces muscular control and usually occurs more frequently in men than in women. The study ratio of 40 men and 30 women closely approximated the national ratio of 6 to 4 (Tanner & Langston, 1990). The majority of the sample had Parkinson's disease for 25 years or more. According to the literature, the progression of Parkinson's disease is so slow that the person is seldom able to recall its onset (Golbe, 1990). Three symptoms were identified by the participants, those being tremor-shakiness, rigidity-stiffness, and slowing of movement. These three characteristics were the most frequently mentioned symptoms in other studies and support the findings of Stern and Lees (1983) and Kessler (1972).

Rural Living

A large percentage of this sample indicated they had lived or worked on farmland and had resided in Montana since birth. These findings support research that has consistently found those with Parkinson's disease are more likely to have lived in a rural environment. In Koller et al. (1990), for example, the "findings suggest that some

factors associated with living in rural environments increase the risk for developing Parkinson's disease" (p. 1219). Koller continues to believe it possible that certain occupations such as farming may increase the risk of developing Parkinson's disease. However, the relationship of occupations to Parkinson's disease has not been adequately studied (Golbe, 1990; Koller et al., 1990). Because of the lack of rural research and the uniqueness of this study, the researcher finds very little addressed in the scientific arena at this time. Rural living may not be the only factor but may provide a link to other variables causing Parkinson's disease.

Herbicides/Pesticides

In this study, 49% of the participants had been exposed to herbicides/pesticides. The literature does not support a definitive association between exposure either to specific farm chemicals or to herbicides/pesticides in general and Parkinson's disease. However, Koller (1990) states, "Since it is likely that only certain chemicals are responsible for Parkinson's disease, these contradictory results may reflect variations in farming practices in different areas, with consequent exposure to different chemicals or chemical combinations" (p. 1220). Most commonly used herbicides identified in this study were 2-4D®, Banvel, II®, and Round-Up®. Whereas 2-4D® is a

slow-acting herbicide killing within seven days, Round-Up® is an emergent, fast-acting herbicide. Toxicity is determined by a large number of factors; therefore, variations in any of these factors might explain differences in results in different studies (Koller, 1990). Although generalizations cannot be made from this study, the findings do support the theory that herbicides and pesticides may have a causative effect on illness.

Over half of the individuals stated they had not worn protective equipment of any kind when mixing or applying herbicides/pesticides, which is supportive of the assumed invincibility of the rural dweller and their environment. An overwhelming number felt they had never become ill from any exposure to herbicides/pesticides.

"The search for a putative neurotoxin in the environment as an etiologic agent for Parkinson's disease will be difficult. It is thought that there may be a long preclinical phase associated with Parkinson's disease" (Koller, 1990). Koller continues, "Chronic, low-dose exposure may account for a slow progression of the disease process" (p. 1220). In the present study, only direct exposure was investigated, and it is possible that individuals were exposed to these chemicals through drinking well water, ingesting exposed food, aerial spraying, or by some other mechanism. If the association between environmental exposure to chemicals and Parkinson's

disease is substantiated, many chemicals, such as those identified in this study and others with similar mechanisms of action, may be responsible contributors.

Well Water

Using the Parkinson's Disease Tool, it was not possible to measure the number of years the participant had ingested well water. This study did support Tanner and Langston's (1990) suggestion that some factors associated with rural life and/or drinking well water may predispose to the early onset of Parkinson's disease. The majority of participants (52%) identified well water to be their source of drinking water. Since turnover of ground water and leaching of chemicals into the ground water may take several decades, chemicals used in agriculture may be concentrated in well water by the time rural dwellers consume the water. Rural living and well water consumption may contribute to the development of Parkinson's disease. Specific water testing mechanisms are in place through the State of Montana Health Department and Water Division. However, attempting to identify a toxin in well water without a specific candidate is technically overwhelming.

Environmental Factors

The challenges of investigating environmental factors as causative agents are greatly compounded in highly industrialized societies. Individuals in such societies tend to be highly mobile, while rural residents tend to stay in one geographic area for a longer period of time. Studies such as this one represent a rural population and may be more reliable for investigating environmental factors.

Another consideration that greatly complicates the search for an environmental cause for Parkinson's disease is the possibility that a variety of risk factors are at play and no single factor is sufficient to cause the disease. However, this study indicated that a high number of rural dwellers diagnosed with Parkinson's disease have been exposed to herbicides/pesticides.

Limitations

The primary limitation of this study was the small sample size; 70 rural, frontier dwellers from Montana are not enough to be able to generalize the findings to other groups and geographic areas. The use of an urban control group would have strengthened the study. Using figures of disease magnitude and distribution based solely on urban

dweller lead to erroneous theories concerning the rural etiology of Parkinson's disease.

Use of a mailed questionnaire does not allow researchers to collect data on the Parkinson's disease clients who did not respond. The questionnaire was unable to probe Parkinson's disease participants in depth without becoming too lengthy. The amount of information gathered by the questionnaire was limited to those who were literate. The sociodemographic information of persons belonging to the Montana Parkinson Association is not collected by the parent organization; therefore, the characteristics of the non-respondents were not available. Problems with this design include the retrospective nature of the material and the lack of physician verification in the mail survey. The ability for recall can prove to cause unreliable information, and rural and frontier dwellers may, in fact, reflect a poorly remembered exposure to agricultural chemicals (Campanella, Roy, & Masson, 1988). The findings of this study are in accordance with the current emphasis of public awareness and environmental influences on illness and disease.

Implications for Nursing

An ultimate goal of nursing is prevention of health problems through the facilitation of health-promoting behaviors. The results of this study have important

implications for the practice of nursing. No other health care discipline is in a more opportune position to assess and educate the individual who may be at risk for Parkinson's disease. Rural and frontier dwellers many times do not have health care educational opportunities because they rarely seek medical attention unless an emergency occurs.

Nurses are frequently involved in situations that are associated with environmental conditions. This study identified environmental characteristics of Montana rural and frontier communities. The environment has been a major concept in the domain of nursing knowledge and also plays a central role in the conceptual framework of Martha Rogers. Rogers (1980) defined environment as the patterned wholeness of all that is external to an individual and is considered to be the "constant interchange of matter and energy between the human being and environment" (p. 54). Age of the respondent was one of the characteristics which contributed to defining Rogers' field. The identification of tremor-shakiness, slowing of movement, and rigidity or stiffness illustrated the Rogerian concept of disease being a disruption in the interaction between human beings and their environment. Other examples of possible disease causing disruption were herbicide and pesticide exposure. Self-protective interventions such as rubber gloves, coveralls, and face masks demonstrate Rogers' concept of

what strategies need to occur to eliminate negative interactions from the environment. Inconsistent use of protective equipment increases the risk of disturbances between the human being and their environment. Well water consumption represents Rogers' link between the external environment and the internal human being. The participant that had been stationed in Vietnam, where herbicides had been applied, represented an international exposure to substances which could cause a disease. Nursing research is strengthened by developing a sound knowledge base in relation to health and well being. Nursing assessment, which views the person holistically, allows for early identification and management of problems which may put a person at risk for Parkinson's disease. Assessment is a process of collecting both subjective and objective data about the individual's life style. A comprehensive assessment should include an evaluation of the person's use of herbicides/pesticides and/or chemicals in general and safe use of protective equipment. The majority of study subjects indicated they did not wear protective equipment when mixing or applying herbicides/pesticides. A discussion with an individual can determine their life style and provide an opportunity for the nurse to educate not only the person but their family in safe handling of chemicals on the farm or ranch.

The following nursing strategies can be implemented to decrease the knowledge deficit about the importance of safe use of herbicides/pesticides. The nurse can teach the individual about the significance of influencing factors and risks and provide a list of protective equipment that should be worn with farm chemicals. Nurses should continue to emphasize the preventive aspects of health care, especially environmental factors affecting rural and urban dwellers lives. Nurses need to assess groups of people belonging to county extension groups and other rural organizations and provide them with environmental safety programs. In addition, chemical companies and licensing bureaus need to be made aware of the increased need for consumer education to prevent the risks of unsafe, unprotected handling of chemicals.

Nurses need to strive to provide information, in a holistic manner, that will encourage health-seeking actions by rural individuals and their families. Increased liaison between nurses and community resource workers could facilitate more and better educational services to meet the needs of persons at risk for Parkinson's disease.

Identifying Potential Environmental Factors

There are approximately 2,000 people in the state of Montana with Parkinson's disease (Montana Parkinson Association, 1990). The possible environmental cause of

Parkinson's disease is an important and vital link between rural, frontier dwellers and their practices of herbicide/pesticide use and well water consumption. As the causes of Parkinson's become clearer, the prospects for preventing Parkinson's disease can only improve. Nursing science can be instrumental in identifying people at risk and environmental factors contributing to Parkinson's disease. Identified early, a potential Parkinson's victim could avoid known hazards, and identifying these factors could prove instrumental in preventive health for future generations. "Nurses can play a key role in the identification of chemicals with neurotoxic potential and in the design and implementation of measures to protect rural workers from the serious consequences of exposure" (Butterfield, 1992, p. 20). The findings from this descriptive study confirm there are potential factors influencing Parkinson's disease, and there are probably other diseases that may be linked with environmental factors yet to be determined. This study emphasizes the need for further analysis and increased public awareness of environmental factors influencing health.

Identifying Educational Needs of Nurses

A review of nursing curriculum finds little subject matter addressing environment health. Traces of environmental information may be found in community health

textbooks but appears in statistical form and lacks inclusion of environmental assessment skills and history taking of past herbicide/pesticide use. Butterfield (1992) states, "There is a profound need for expanded nursing education in this area of environmental health" (p. 21). Research and preventive education will increase nursing's knowledge base in environmental health. Nursing educational institutions, hospitals, and clinics should develop, evaluate, and improve classes educating the nursing profession about the risks of rural living. Nursing textbooks need to be rewritten to reflect the new environmental awareness of health. Nurses will practice in new settings where environmental factors are adversely affecting the population's health. The findings from this study will be disseminated among those interested in rural health issues on a local as well as a national level.

Recommendations for Future Study

This study examined how the environment may influence the relationship between the use of identified herbicides/pesticides, consumption of well water, and rural living and Parkinson's disease. These same three risk factors have been identified by other researchers. Based on the findings in this study, comparative studies need to be conducted in urban and rural sites to examine the differences between environmental factors and Parkinson's

disease. Replication studies need to be conducted in rural and urban sites using larger samples to confirm the significance of the findings in this study. It is recommended that a different measurement tool be utilized or that the Parkinson's Disease Tool be made more specific in order to analyze the data more efficiently.

Environmental factors influencing Parkinson's disease have not been extensively studied using the Parkinson's Disease Tool or any other measurement tool. Therefore, it is recommended that the study be expanded to examine the effects of the selected demographic variables and hereditary history. Longitudinal studies should be conducted to determine any differences in environmental factors as individuals progress through Parkinson's disease. It is important to conduct multiple-site research and to share findings. Examining risk factors over time would also help determine what activities put individuals at risk during their lifetime. Environmental factors are an important aspect of human life and should be given serious consideration, especially when a debilitating disease such as Parkinson's is encountered. As the causes of Parkinson's become clearer, the prospects for preventing it can only improve. Removing offending chemicals from the environment is an unlikely approach; there may be hundreds, even thousands. But researchers are optimistic about identifying susceptible people before they experience the

potential symptoms of Parkinson's disease. Developing measurements that accurately evaluate an individual's risk profile could aid early identification of potential Parkinson's clients and help them avoid known risks and hazards. Many educational programs could be provided; however, assessing the effects of these educational programs on rural people's attitudes and practices is not usually done. Exploration of rural living attitudes and the practice of safe handling of farm chemicals would provide valuable information about whether such programs change attitudes or practice.

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APPENDICES

APPENDIX A
QUESTIONNAIRE

**Environmental Study:
A Survey Of
Environmental Factors and
Parkinson's Disease
In Rural Montana**



Thank You For Your Help!

**Janis Mesaros
Parkinson's Disease
Montana State University
College of Nursing
P. O. Box 5013
Great Falls, Montana 59405**

Please read each of the questions and CIRCLE the number that is most appropriate for you. Please do not write your name on the questionnaire.

First, I'd like to ask you a little bit about your health.

1. When did you first have Parkinson's symptoms?

____ / ____
Month Year

2. Have you ever been diagnosed with Parkinson's by a doctor?

1 Yes

2 No

3. What were your initial Parkinson's symptoms?

(Circle all that apply)

1 Tremor-Shakiness

2 Rigidity-Stiffness

3 Slowing of Movement

4 Other symptoms - please explain on line below

I'd like to ask about your occupation.

4. What was your usual occupation during most of your adult life, that is, the job you held the longest?
-

5. Have you ever been a farmer or been employed on a farm?

1 Yes

2 No

6. Did you ever work or live on farmland?

1 Yes

2 No

The following questions are concerning herbicides and pesticides.

7. Have you ever been around herbicides/pesticides being applied to crop-ground/pasture land?

1 Yes

2 No → Go to question 15, page 5.

8. Who usually applied the herbicides/pesticides, you or someone else?

1 Yourself

2 Someone else

9. How were the herbicides/pesticides applied?

(Circle all that apply)

1 Aerial-plane

2 Backpack or Hand Sprayer

3 4-Wheeler Application

4 Tractor Mounted or Mist Blower Sprayer

5 Stump Painting

6 Notching

7 Hose-End Mixer

8 Cyclone Spreader

9 Pouring

10 Spreading by Hand

11 Other - Please Explain _____

12 Don't Know

10. Who usually mixed and prepared the herbicides, you or someone else?

1 Yourself

2 Someone Else

11. Did you use any of the following protective equipment when mixing or applying the herbicides/pesticides?

(Circle all that apply)

1 Didn't Mix or Apply Herbicides/Pesticides

2 None

3 Rubber Gloves

4 Masks

5 Coveralls

6 Others - Please Explain _____

12. About how many days per year were you usually exposed to herbicides/pesticides being applied to the crop-growing land?

Days/Year

13. How many years were you around herbicides/pesticides usage?

Years

14. What are the names of the herbicides that were used on the crop-growing land? _____

15. Did you handle and/or launder clothing exposed to herbicides/pesticides?

1 Yes

2 No

16. Did you ever use herbicides/pesticides, that is, weed killers or defoliants, at home in yard work or for other purposes not previously discussed?

1 Yes

2 No → GO to question 19, page 6.

17. What were the names of the herbicides or weed killers you used in the yard? _____

18. About how many days per year did you use herbicides on your yard?

Days Per Year

19. Do you believe you have ever become ill from any exposure to herbicides/pesticides?

1 Yes

2 No

Now I'd like to ask some questions about you.

20. Were you ever based or stationed in Vietnam?

1 Yes

2 No → Go to question 24, page 7.

21. Did you serve in areas where herbicides had been or were being applied?

1 Yes

2 No → Go to question 24, page 7.

22. How many months did you serve in these areas?

Months

23. Did you ever become ill from any exposure to pesticides while
in the military service?

1 Yes

2 No

24. What is your birth date? / /
Mo Day Year

25. Are you male or female?

1 Male

2 Female

26. Have you ever had serious head trauma, injuries with loss of
consciousness?

1 Yes

2 No

If "yes" what age? Age

- Years

31. Source of drinking water: **Circle one:** 1 City
2 Well
3 Cistern

32. Has water ever been tested at this site to your knowledge?

1 Yes

2 No

3 Assumed it had been tested.

Any problems identified in the water? _____

33. Place #2: _____

What years did you live there? _____

34. Source of drinking water: Circle one: 1 City

2 Well

3 Cistern

35. Has water ever been tested at this site to your knowledge?

1 Yes

2 No

3 Assumed it had been tested.

36. Any problems identified in the water? _____

37. Place #3: _____

What years did you live there? _____

38. Source of drinking water: Circle one:

1 City

2 Well

3 Cistern

39. Has water ever been tested at this site to your knowledge?

1 Yes

2 No

3 Assumed it had been tested.

Any problems? _____

40. Place #4: _____

How long did you live there? _____

41. Source of drinking water: **Circle one:** 1 City
2 Well
3 Cistern

Has water ever been tested at this site to your knowledge?

1 Yes

2 No

3 Assumed it had been tested.

Any problems? _____

If more list on back.

43. I filled this questionnaire out by myself.

1 Yes

2 No - I had help.

Anything else you'd like to tell me about Parkinson's disease that I haven't asked about?

Your contribution in this effort is greatly appreciated!

Parkinson's Disease Tool
(1988) Adapted with permission 2/18/92 from
Dr. Wm. Koller, University of Kansas Medical Center,
Kansas City, Kansas 66103

APPENDIX B
REQUEST TO USE MAILING LIST

February 11, 1992

Gianpaolo Maestroni, D.V.M.
American Parkinson Disease Association
P.O. Box 050-067
Staten Island, New York 10301-0005

Dear Dr. Maestroni:

I am a Graduate student completing my Master's in Nursing at Montana State University. My thesis proposal is "Environmental Factors Influencing Parkinson's Disease in Rural Montana. Therefore I am working with the Chapter Referral Center in Great Falls, Montana.

I have been referred to you by Ester Lantz, M.N., R.N. of the Montana Chapter of the American Parkinson Disease Association Referral Center, in Great Falls, Montana. I am inquiring in regard to utilizing the mailing list of the Montana Chapter to distribute an adapted questionnaire of Dr. William Koller, University of Kansas Medical Center. I would like to mail out randomly 200 questionnaires to Parkinson clients.

I welcome any comments or suggestions regarding my proposal and questionnaire. I have communicated closely with Dr. Wm. Koller and he feels the data generated from a study of this kind would certainly be contributing to the body of knowledge about Parkinson's disease.

Upon your review of the proposal and questionnaire, if this is acceptable, I would appreciate a letter of consent to use the mailing list of the Montana Chapter, American Parkinson Disease Association for Human Subjects Review purposes.

Thank you for your consideration and I look forward to your reply.

Sincerely yours,

Janis M. Mesaros, B.S.N., R.N.
Graduate Student
2191 Millegan Road
Cascade, Montana 59421 w (406)-727-3333 ext.59581

APPENDIX C
CONSENT TO USE MAILING LIST



The American Parkinson Disease Association, Inc.

60 Bay Street • Staten Island, New York 10301

(718) 981-8001

(800) 223-2732

March 11, 1992

Janis M. Mesaros, BSN, RN
2191 Millegan Road
Cascade, MT 59421

Dear Ms. Mesaros,

This will acknowledge your February 11th request to use the mailing list of the APDA Montana Chapter for your survey of Parkinson's Disease in Montana. Permission to use such list is granted, provided that the confidentiality provision is respected throughout the study.

I would appreciate receiving a letter in reference to such confidentiality commitment by the professor at Montana State responsible for your thesis.

Please advise if we can be of any further assistance.

Yours truly,

G. Maestroni, DVM
Director of Scientific
& Medical Affairs.

GM/gi

cc: John Holland, Pres. APDA Montana Chapter
John Pillarella, Assist. Dir. of Development



College of Nursing

Billings Campus
EMC Campus Box 574
Billings, Montana 59101

Telephone 406-657-2912
FAX 406-657-1715

March 13, 1992

G. Maestrone, DVM
Director of Scientific & Medical Affairs
The American Parkinson Disease Association, Inc.
60 Bay Street
Staten Island, NY 10301

Dear Dr. Maestrone:

I would like to thank you for allowing Janis Mesaros, Graduate Student at Montana State University College of Nursing, to use the APDA Montana Chapter mailing list. I am chair of her thesis committee.

Confidentiality will be protected in her study. The mailing list will only be used for this one survey. The list will be kept locked and only Ms. Mesaros, and possibly myself, will have access to it. The list will only be used for tracking the respondents and it will be destroyed following completion of the data collection and analysis. No names will be included on the questionnaires or in the reporting of the data; only aggregate data will be reported.

If I can be of further assistance, please contact me.

Sincerely,

Mary E. Burman, RN, PhD
Assistant Professor

APPENDIX D
INVITATION TO PARTICIPATE

April 20, 1992

Dear American Parkinson Disease Association-
Montana Chapter Member:

As you well know, Parkinson's disease is a health problem in our country, particularly for middle age to older adults. However, we don't know much about Parkinson's disease, particularly in rural areas. My interest as a graduate student at Montana State University in Parkinson's disease is to explore the impact of a variety of factors on the onset of Parkinson's disease.

As a Montana Chapter member your name has been given to me, with permission of the American Parkinson Disease Association, for the purpose of research. You will be receiving a questionnaire in the next few weeks. Your answers will be important to help me understand more about Parkinson's disease.

I would appreciate you filling out the questionnaire, instruction will be included. Your participation is voluntary and the questionnaire will be treated with complete confidentiality.

Your answers will certainly add to the body of knowledge about Parkinson's disease. So, be looking for your packet in the mail soon!

Thank you in advance to participating in this study!

Sincerely,

Janis M. Mesaros, R.N.

APPENDIX E
PERMISSION TO COLLECT DATA



College of Nursing

Great Falls Campus
1101 26th Street South
Great Falls, Montana 59405

Telephone 406-455-5610
FAX 406-454-2526

3-13-92

Janis Mesaros
Graduate Student
Montana State University
College of Nursing

Dear Jan,

The Great Falls Campus Human Subjects Committee has completed the review of your revised thesis proposal and the additional materials which you provided. Everything has been approved and your study is classified as "exempt" relative to Federal Guidelines. This means that you may begin implementation of your research study three days after the forms have reached the Bozeman campus. These will go into the mail 3-13-92 and you may check with Julie Johnson's office if you wish to verify her review.

I assume that you will have Mary Burman, your chair, send the letter of commitment to the APDA committee.

If we can be of further assistance as you continue your thesis please let us know. We believe that your thesis is very interesting and highly significant and are anxious to hear of your final conclusions.

Sincerely,

Daryl T. Ries, PhD., R.N.
Chair
Human Subjects Committee
Great Falls Campus

MONTANA STATE UNIVERSITY
COLLEGE OF NURSING

UNIVERSITY HUMAN SUBJECTS COMMITTEE SUMMARY

Name of Proposal: Environmental Factors Contributing to Parkinson's Disease in Rural Montana.

Name of Investigator/s: Jan Mesaros
(Circle one: undergraduate student/s, graduate student/s, faculty member/s)

Faculty Advisor (if student research): Eleanor Yurkovich

Date of College of Nursing Review: Dec. 20, 1991

Reviewed by:

(List College of Nursing reviewers involved by names and type of committee, e.g. J. Doe, Great Falls Extended Campus Committee)

Daryl T. Ries, PhD, RN Chair Great Falls Campus Committee

Sharon Hovey, MN, RN Great Falls Campus Committee

Michelle Smith, MN, RN Great Falls Campus Committee

Approved by:

Campus H.S.R. Committee

Daryl T. Ries, PhD 3/13/92

Education Director

Connie P. Jensen

Brief Description of Subjects (age, sex, health status, etc.)
(To Be Completed by the Investigator/s)

Subjects will be identified as having Parkinson's Disease, Age Range 40-80 yrs old, Both sexes.

Page 2 of 3
FORM B

Brief Description of Procedure (what is to be asked of or done to subjects)
(To Be Completed by the Investigator/s)

Subjects will be asked to complete a questionnaire and return by mail
Subjects will be contacted through the Montana Parkinson's Newsletter
mailing list. Confidentiality will be protected.

☒ Exempt Under Federal Reg. 45 CFR 46
46.101 (2) (b) 3.
(Insert number and letter as appropriate)

OR

☐ Questionable or Ruled Not Exempt Under Federal Reg. 45 CFR 46

*Proposal sent to College of Nursing Dean for Review
on _____

APPENDIX F

COVER LETTER SENT WITH QUESTIONNAIRE

October 6, 1992

Dear American Parkinson Disease Association-
Montana Chapter Member:

Parkinson Disease is a health problem in our country, particularly for middle age to older adults. However, we don't know much about Parkinson's Disease, particularly in rural areas. Thus the purpose of this study is to explore the impact of a variety of factors on the onset of Parkinson's disease.

You are one of 200 persons selected randomly for participation in this study of Parkinson's disease. You were selected because you are a recipient of the Montana Chapter Parkinson Association newsletter. Your answers are important to help me understand more about Parkinson's disease. It should take about 30 minutes to complete. If you should become tired while completing the questionnaire, please stop and rest. If you need assistance answering the questionnaire please encourage the person assisting you to only use your answers.

If you are willing to participate in this study, completion of the questionnaire will be considered your consent. Participation in this study should not represent a risk to you, but it may be an inconvenience because of the time needed to answer questions. Although you may not directly benefit from participating in this study, your answers will certainly add to the body of knowledge about Parkinson's disease.

Participation in this study is voluntary. You are free to not answer any questions that you feel are an invasion of your privacy. The questionnaire will be treated with complete confidentiality. For mailing purposes, there is an identification number on each questionnaire. However, this is only so that I can keep track of each questionnaire by checking your name off the mailing list when your questionnaire is returned. Your name will never appear on the questionnaire. In reporting the findings, you will not be identified personally in any way. No link will be made between you and your community. Upon completion of this research, study results will be available in the Montana State University, College of Nursing Libraries, located at Bozeman, Great Falls, Billings and Missoula, Montana. I will be happy to answer any question you may have. Please feel free to call me at (406) 866-3318 or write me at 2191 Millegan Road, Cascade, Montana, 59421. You may keep this letter explaining the nature of your participation.

Thank you for participating in this study.

Sincerely,

Janis Mesaros, R.N., B.S.N.
Graduate Student, Montana State University

APPENDIX G

PERMISSION TO USE QUESTIONNAIRE

The University of Kansas Medical Center

Dewey K. Ziegler, M.D., Professor Emeritus.
 Arthur R. Dick, M.D., Prof.
 Chi-Wan Lai, M.D., Prof.
 Sander L. Glatt, M.D., Assoc. Prof.
 Richard Dubinsky, M.D., Asst. Prof.
 Patrick W. Jamieson, M.D., Asst. Prof.
 Jean Hubble, M.D., Asst. Prof.

School of Medicine
 Department of Neurology
 William C. Koller, M.D., Ph.D.
 Professor and Chairman

Philip A. Singer, M.D., Prof.
 Barry W. Festoff, M.D., Prof.
 K. Paul Poulou, M.D., Prof.
 Louis T. Giron, M.D., Assoc. Prof.
 Ramachandran Venkatesh, M.D., Asst. Prof.
 Steven J. Huber, Ph.D., Asst. Prof.
 Sharon G. Lynch, M.D., Asst. Prof.

February 18, 1992

Janis M. Mesaros, B.S.N., R.N.
 5958 Columbus Hospital
 Great Falls, MT

Dear Janis:

Thank you very much for your letter of February 10th. You're certainly welcome to use the questionnaire. Therefore, you have my formal permission to use the questionnaire with your proposal. I hope this letter is adequate for your Human Subjects Review Committee.

As an addendum, I'll be in Great Falls at the end of September to address the Parkinson's disease group. Perhaps we'll have an opportunity to meet at that time. In the meantime, I will more closely review your proposal and get back to you at a later date.

Sincerely yours,

Bill

William C. Koller, M.D., Ph.D.
 Professor and Chairman
 Department of Neurology

WCK/jp

