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Transformational Educational Leader as Organizer and Administrator of a Movement Disorders Program

Alice P. Gerber

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THE TRANSFORMATIONAL EDUCATIONAL LEADER AS
ORGANIZER AND ADMINISTRATOR OF A MOVEMENT DISORDERS
PROGRAM

by

ALICE P. GERBER

(Under the Direction of Meta Harris)

ABSTRACT

One person in every thousand develops Parkinson's Disease. There is no known cause, no known cure and no existing definitive test for Parkinson's Disease. Qualified neurologists and movement disorders specialists make a diagnosis on the basis of their knowledgeable observations. If a cause is found, a cure will follow.

The Savannah Parkinson Support Group has existed for fifteen years. It has a membership of 250 people with Parkinson's Disease, their relatives and caregivers. The North Dakota Parkinson Support Group has a smaller population but there are many commonalities between the two groups. This descriptive study attempts to discover the commonalities of the people within each group as well as the commonalities between the two groups. Two control groups, one in Savannah and one in North Dakota, consisting of males and females of similar ages without Parkinson's Disease were also recruited for this study.

Current literature and studies find as potential causes of Parkinson's Disease: genetic factors and gene mutations, aging, trauma, viruses, environmental toxins, agricultural pesticides and herbicides, exposure to home pesticides and industrial chemicals and oxidative stress that contributes to nerve cell death.

Ninety-seven people replied to the developed questionnaire that compared age, medical history, past and present demographics, occupations, traumatic events, environmental toxin exposure, medical history, family history and hereditary factors . Statistics showed several environmentally significant variables among the participants. These were family water supply, years living in a rural area, being born on a farm and exposure to chemicals. The use of crop and lawn pesticides was statistically insignificant.

Occupational variables found to be statistically significant included the occupational history of the participants and the occupational history of their parents. In both of the Parkinson's Disease groups the unusual numbers were the amount of parents and grandparents who were farmers. Almost twice as many as all other occupations. In the control groups there were only a few parents who were farmers.

Medical variables that were found to be significant included a history of head trauma and a history of having the flu shortly prior to symptom manifestation development. No statistical significance was found to exist between participants with Parkinson's Disease and family history of Parkinson's Disease.

INDEX WORDS: Parkinson's disease, Movement disorder

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Electronic Version Approved:
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DEDICATION

I dedicate this dissertation to my late husband, Marx Gerber, who suffered with Parkinson's Disease and to the members of the Savannah Parkinson Disease Support Group, who so willingly helped me with my research and encouraged me to continue in this doctoral process.

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	7
LIST OF TABLES	10
CHAPTER	
1 INTRODUCTION	11
General Introduction.....	11
History.....	11
Causes and Studies	13
Statement of the Problem.....	15
Research Questions.....	16
Significance of the Study	17
Summary	19
2 REVIEW OF THE LITERATURE	20
Introduction	20
Definitions and Symptoms	21
Genetics as a Risk Factor	21
Farming, Rural Living and Well Water as Risk Factors	23
Pesticides, Herbicides and Insecticides as Risk Factors	26
Industrial Pollutants as a Risk Factor	29
Environmental Metals as a Risk Factor	31
Head Trauma as a Risk Factor	32
Viruses as a Risk Factor.....	33

	Summary	33
3	METHODOLOGY	36
	Introduction	36
	Research Questions.....	37
	Methodology	38
	Summary	40
4	REPORT OF DATA AND DATA ANALYSIS	41
	Introduction	41
	Descriptive Results	41
	Research Questions.....	43
	Summary of Results.....	46
5	SUMMARY, CONCLUSIONS AND IMPLICATIONS	47
	Summary	47
	Discussion of Research Findings.....	47
	Summary and Recommendations.....	53
	REFERENCES.....	54
	APPENDICES	62
	A TABLES.....	63
	B INSTITUTIONAL REVIEW BOARD APPROVAL AND CONSENT	
	LETTER.....	76
	C SURVEY INSTRUMENT	80

LIST OF TABLES

	Page
Table 1: Sufferers of Parkinson’s Disease by Use of Crop Pesticides.....	64
Table 2: Sufferers of Parkinson’s Disease by Family Water Source.....	65
Table 3: Sufferers of Parkinson’s Disease by Lawn Herbicides.....	66
Table 4: Sufferers of Parkinson’s Disease by Years Living in Rural Area Versus Urban Area	67
Table 5: Length of Time Sufferers of Parkinson’s Disease Lived at Same Residence.....	68
Table 6: Sufferers of Parkinson’s Disease by Occupation of Self.....	69
Table 7: Sufferers of Parkinson’s Disease by Exposure to Chemicals	70
Table 8: Sufferers of Parkinson’s Disease by Being Born on a Farm.....	71
Table 9: Sufferers of Parkinson’s Disease by Incidence of Head Trauma.....	72
Table 10: Sufferers of Parkinson’s Disease by Experiencing the Flu Prior to Parkinson’s Disease	73
Table 11: Sufferers of Parkinson’s Disease by Family History of Parkinson’s Disease ..	74
Table 12: Age of Sufferers of Parkinson’s Disease at Time of Onset of Symptoms.....	75

CHAPTER 1

INTRODUCTION

General Introduction

Is it possible that alien abduction could be a risk factor for Parkinson's disease? In his commentary, Dr. Joseph H. Friedman, M.D., (Friedman, 2003) talks about most epidemiological research focusing on identifying risk factors for a disease. He says, "Much epidemiology research focuses directly on the question of "relative risk", finding exposures that are more (or less) common in a disease group compared to a non-diseased group" (Friedman, 2003). He says the problem with these studies is that they do not relate to the vast majority of people with Parkinson's disease. In each study, he says, they have omitted a major factor, alien abduction. He selected for his study a target population in Southern California since more alien abductions have occurred there than in any other known region on earth. He concluded from his study that people who do not have Parkinson's disease might reduce their risk of developing Parkinson's disease by being abducted by aliens. His article, of course, was "tongue in cheek" but it aptly illustrates the great lack of information as to the cause of Parkinson's disease.

History

Parkinson's Identification

Dr. James Parkinson described this disease, which now bears his name, almost 200 years ago in his "Essay on Shaking Palsy" (Parkinson, 1817). Parkinson's disease is a chronic, progressive, disabling, neurodegenerative disorder (McNaught, Pearl, Brownwell et al. 2004). It is the second most common neurodegenerative disorder and affects more than 1 million Americans over the age of 60 (Steece-Collier, Maries &

Kordower, 2002). The risk for Parkinson's disease is associated with advancing age, but onset may occur as early as the teenage years. An estimated 1% of the United States and European population under 60 have Parkinson's disease (Maher, Golbe, Lazzarini et al. 2002). Despite many years of focused research, the causes of this disease remain unknown. Understanding the causes of Parkinson's disease is critical as that knowledge could lead to further research that will develop new and potent therapies.

Medical Description of Parkinson's disease

When a person decides to make a particular movement, the thinking part of the brain sends instructions to a part of the mid-brain called the basal ganglia, which coordinates a series of messages and sends them down to the nerves and to the muscles. The brain and nervous system consists of cells in series, so that nerve impulses must jump from one 'wire' to the next. The body makes chemicals called neurotransmitters to fill in the gaps. In the brain these chemicals are typically dopamine, acetylcholine and noradrenaline. The area of the brain that is most affected in Parkinson's disease is the substantia nigra. The cells in the substantia nigra that produce dopamine die off, leading to nerve control problems that produce the classical symptoms of Parkinson's disease (Calne, 2002). After 80% of the striatal dopamine in the brain is lost, patients exhibit the classical symptoms of Parkinson's Disease including bradykinesia (slowness of movement), rigidity, resting tremor, and postural instability (impaired balance) and coordination (Conley & Kirschner, 1999).

Causes and Studies

Pertinent Information

Whereas the cause of Parkinson's disease remains unknown the preponderance of the evidence points toward multiple risk factors involving both genetic, inherited agents and environmental, acquired agents (Steece-Collier et al. 2002). A number of environmental and genetic factors have been implicated in the etiology of Parkinson's disease, yet none have been unequivocally identified as causal agents. Studies have shown that there is an interrelationship between some risk factors and Parkinson's disease (Steece-Collier et al. 2002; Taylor, Saint-Hilaire, Cupples, et al. 1999). The risk factors that have been hypothesized to affect the production of dopamine in the substantia nigra portion of the brain include:

1. genetics (Lesage, Durr, Tazir, et al. 2006; Sun, Latourelle, Wooten, et al. 2006; Oliveira, Scott, Martin, et al. 2003; Skipper & Farrer, 2002; Maher et al. 2002; Skipper & Farrer, 2002; Steece-Collier et al. 2002; Dela Fuente-Fernandez, 2000; Marjama-Lyons, 2002; Sveinbjornsdottir, Hicks, Jonsson, et al. 2000; Jarman & Wood, 1999; Taylor et al. 1999; Board, Meenegon, Blackburn, et al. 1998)
2. farming (Purdey, 2004; Marjama-Lyons, 2002; Petrovitch, Ross, Abbott, et al 2002; Kirkey, Johnson, Rybicki, et al. 2001; Ritz & Yu, 2002; Purdey, 2001; Tuchen & Jensen, 2000; Taylor et al. 1999; Gorell, Johnson, Rybicki, et al. 1998; Morano, Jimenez-Pimenez, Molina, et al. 1994; Butterfield, Valanis, Spencer, et al. 1993; Semchuk, Love, & Lee. 1992; Ho, Woo & Lee, 1989)
3. rural living (Marjama-Lyons, 2002; Dela Fuente-Fernandez, 2000; Gorell et al. 1998; Butterfield et al. 1993; Golbe. 1992; Koller, Vetere-Overfield, Gray, et al. 1990)

4. drinking well water (Gorell et al. 1998; Semchuk et al. 1992; Wong, Gray, Hassaneim, et al. 1991; Koller et al. 1990)
5. pesticide and herbicide exposures (Ascherio, Chen, Weisskopf, et al. 2006; Ritz & Yu, 2002; Tuchen & Jensen, 2000; Guillette, Meza, Aquilar, et al. 1998; Butterfield et al, 1993; Semchuk et al. 1992; Chapman, Sauter, Henning, et al. 1991; Wong et al. 1991; Koller et al. 1990; Ho, Woo & Lee, 1989; Ferraz, Bertilucci, Pereira, et al. 1988; Ballard, Tetrud & Langston, 1985)
6. industrial pollutants (Pezzoli, Canesi, Antonini, et al. 2000; Tetrud, Langston, Irwin, et al. 1994; Uitti, Snow, Shinotoh, et al. 1994; Tanner, Chen, Wang, et al. 1989)
7. metals (Purdey, 2004; Gorell, Johnson, Rybicki, et al. 1997; Seidler, Hellenbrand, & Robra, 1996)
8. head trauma (Bower, Maraganore, Peterson, et al, 2003; Taylor et al. 1999)
9. viruses (Dickman, 2001)

Rates of Parkinson's Incidence

Parkinson's disease occurs worldwide. Numerous studies have been done in foreign countries that report Parkinson's incidence rates and explore the relation of those rates with age and gender. Ho and others did such a study in Hong Kong (Ho et al. 1989). Tuchsén and Jensen did a study in Denmark (Tuchen & Jensen, 2000). Morano et al. (1994) and Fuente Fernandez and Calne (2002) studied the prevalence of Parkinson's disease in Spain. Sveinbjornsdottir et al. (2000) did a study of Parkinson's disease patients in Iceland and Tanner, Ottman and Goldman (1999) undertook a study of prevalence and incidence of Parkinson's disease in China.

Estimates of the prevalence of Parkinson's disease in the United States range from 79 to 187 per 100,000 people. The incidence of Parkinson's in the United States varies from state to state with no knowledge of why this occurs (Taylor et al. 1999). Iowa, Minnesota, Nebraska and North and South Dakota have the greatest incidence, Delaware and Hawaii have the least and Georgia is somewhere in the middle (Lieberman & William, 1996). In an attempt to find a reason for this disparity this researcher will study two groups of Parkinson's disease patients and two groups of non-Parkinson's Disease patients in Georgia and North Dakota, as to their demographic commonalities and differences.

Demographics

Comparing demographic commonalities and differences in sufferers and non-sufferers may suggest whether this disease is more common in rural or urban settings, more prevalent in men than women or related in any way to genetics, age, source of drinking water, pesticide or chemical use, nutritional factors, trauma or unusual illness. If any of these risk factors are found to be common among Parkinson's disease patients it could encourage important further study and research.

Statement of the Problem

One person in every one thousand develops Parkinson's disease, a debilitating neurological disease for which there is no known cause, no known existing definitive test, and no known cure. Qualified neurologists and movement disorder specialists make a diagnosis on the basis of their knowledgeable observations. Until we know the cause, there can be no cure. If a cause is found, then a cure will have a good chance of following.

Incidence rates of Parkinson's disease vary from state to state within the United States, with no understanding of why there are differences. While there seem to be some demographic commonalities, there have been no studies that have been able to isolate any clear relationships between those commonalities and the onset of the disease.

There have been surprisingly few studies of any groups of Parkinson's disease patients as to their past and present demographic commonalities and differences. A descriptive study of comparable groups of Parkinson's disease sufferers and non-sufferers from states of the nation with various rates of incidence could help identify demographic commonalities and differences. Valuable clues as to the etiology of Parkinson's disease might arise from such a study. Therefore, the purpose of this study is to examine the demographic information for those with Parkinson's disease and a similar group without Parkinson's disease in each of two communities in order to suggest possible demographic information needing further study, and thereby adding more pertinent information to what is already known about Parkinson's disease.

Research Questions

In order to address the lack of information regarding the cause of Parkinson's disease, the following overarching question will guided the researcher in the completion of this work. Are there differences in the demographic characteristics of sufferers of Parkinson's disease and non-sufferers of Parkinson's disease in each of two United States communities?

The following sub-questions will further define the research:

Research Question Number One

1. What are the demographic characteristics of sufferers versus non-sufferers of Parkinson's disease in each of two United States communities?

Research Question Number Two

2. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when environmental factors such as exposure to crop pesticides, home water supply, length of time living at a rural residence, use of lawn pesticides, and exposure to chemicals are examined?

Research Question Number Three

3. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when occupational factors such as participant's occupation and their parent's occupation are explored?

Research Question Number Four

4. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when the study participant's medical histories such as family history of Parkinson's disease and a history of head trauma are examined?

Significance of the Study

The incidence Parkinson's disease has increased worldwide. Although it occurs mostly in the elderly segment of the population, it is now being diagnosed more frequently in the younger segment as well. Most Parkinson's disease is termed "Idiopathic" Parkinson's disease because it has no known cause. There have been many breakthroughs in understanding and treating this disease, including new drugs and

surgical procedures to enhance the patients' quality of life. Yet, while there are massive studies of Parkinson's disease and possible cures, very few studies have been done relating to the cause. Perhaps finding a clinical cause is so difficult because there is such a great interval between the pathological process and recognizable symptoms.

Parkinson's Disease occurs in all races, sexes and geographic areas. This researcher feels therefore, that comparing the commonplace demographic and environmental factors in two varied communities in the United States might lead to clues that can help to find the cause. How wonderful it could be for the medical community and the Parkinson's Disease patients in the South Georgia Parkinson's Support Group and the Grand Forks, N. Dakota Parkinson's Support Group and Parkinson's patients everywhere if they knew which demographic and environmental factors to avoid. This researcher has worked with Parkinson's patients for fifteen years, both young and old and seen them suffer, deteriorate and die. Many prominent people in this world such as Pope John Paul II, Janet Reno, Representative Morris Udall, Actor Michael J. Fox, boxer, Muhammad Ali, Reverend Billy Graham, Spanish dictator Francisco Franco, Artist Salvador Dali, Actresses Estelle Getty and Katherine Hepburn, British actors, Sir Michael Redgrave and Terry Thomas, Canadian politician Pierre Trudeau, Governor George Wallace, photographer Margaret Bourke White and Palestinian politician Yassar Arafat have suffered and are suffering from this devastating illness (Casson, 1984). A clue to the cause of Parkinson's disease could be a great blessing for all of mankind (Lieberman & William, 1993).

Summary

Although scientists have known about and studied Idiopathic Parkinson's Disease for almost two decades and although many new procedures and drugs have been developed, no cure or cause has been found. Neither is there a definitive test for Parkinson's Disease. It is diagnosed by the observations of a qualified neurologist. This review of the literature involved in Parkinson's Disease Research explores demographics, genetics, farming, rural living, drinking well water, exposure to environmental toxins such as pesticides, herbicides, insecticides, MPTP, industrial pollutants and metals, head trauma and viruses as risk factors for Parkinson's Disease world wide.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

It has been almost two decades since English physician James Parkinson described a "shaking palsy" (Parkinson, 1817). Still doctors are baffled by this condition called Parkinson's disease.

In most people, a small-blackened portion at the base of the brain, called the substantia nigra is crammed with over a half-million neurons that produce a chemical called dopamine, a messenger that controls body movements. But in Parkinson's patients more than two thirds of these neurons have died (Perkins, 1998).

Parkinson's Disease has generally been an illness attributed to people over 60 years old. However in recent years it is occurring more frequently in the younger population. It is difficult to get an accurate count of people with Parkinson's disease because many people assume that their symptoms are the result of health problems or the normal aging process. Since there is no definitive test that physicians can give for Parkinson's disease it make diagnosis even more difficult. It affects men slightly more than women and knows no social, ethnic, economic or geographical boundaries (Morganle, Rocca, DiRosa, et al. 1992). After decades of research, scientists are still struggling with many unanswered questions, such as who is vulnerable and what is killing the dopamine neurons?

To enhance understanding of the factors involved, this chapter provides an overview of research involving the causes of Parkinson's disease. The areas explored are,

genetics, farming, rural living, well water, pesticide and herbicide exposure, industrial pollutants, and head trauma.

Definitions and Symptoms

Parkinson's Disease of unknown cause is referred to as idiopathic Parkinson's disease. The necessary signs and symptoms for the diagnosis of idiopathic Parkinson's disease are bradykinesia (slowness of movement), rigidity, resting tremor and postural instability or impaired balance and coordination (Bennett, Beckett, Murray, et al. 1996).

Parkinson's Disease is a common neurological disorder that causes gradual and progressive loss of control over movement. There is a loss of the neurotransmitter dopamine in the brains of these patients. People with Parkinson's disease who suffer severe movement disabilities, lack dopamine-making neurons in key brain regions (Calne, 2002; Travis, 2000).

Genetics as a Risk Factor

The discovery of genetic forms of Parkinson's disease demonstrates conclusively that Parkinson's disease can occur through inheritance (Steece-Collier et al. 2002).

It has been estimated that five to ten percent of Parkinson's disease is familial. Genetics seems to be more important when the disease begins on or before 50 years of age, also known as young-onset Parkinson's disease. Three genes have been found to be associated with inherited Parkinson's disease. These are Protein Alpha-Synuclein (SNCA), Parkin and UCH-L1 (1-9). Four additional loci have also been described as involved (Steece-Collier et al. 2002; Jarman & Wood, 1999).

Despite the lack of knowledge of the function of the Alpha- Synuclein proteins, their importance in Parkinson's disease came from the discovery that they are the main

component of the Lewy bodies found in Parkinson's disease patients. Further research is now being directed at trying to understand the biological role of this protein as well as its contribution to neuro-degeneration (Steece-Collier et al. 2002).

A study of a tribe of Navajo Indians in New Mexico, in which a cluster of patients with Parkinson's disease appeared, showed many common familial factors including shared places of birth, shared food, drinking water and occupations. Twenty-seven percent of the Parkinson's disease patients showed a family history of Parkinson's disease. This high rate makes it likely that theirs was an inherited form of Parkinson's disease (Marjama-Lyons, 2002).

A recent Gene Parkinson's Disease study in the United Kingdom, which included one hundred and eighty three families with Parkinson's disease, affected sibling pairs or one or more family members with Young-onset Parkinson's Disease found twenty-three families with mutations of the Parkin gene (Sun et al. 2006). In another study of unrelated North African Arabs, scientists found that twenty-three of the fifty patients with Parkinson's Disease were carriers of the LRRK2 (G2019S) gene mutations as compared to only two of the sixty-nine healthy control patients. In a similar study in New York City of one hundred and twenty Ashkenazi Jewish patients with Parkinson's disease, scientists detected LLRK2 (2019S) gene mutations in twenty-two patients as compared to four of the 317 healthy control patients (Lesage et al. 2006).

This apparently high frequency of gene mutations among North African patients and Ashkenazi Jewish patients with Parkinson's disease suggest a likely Middle Eastern origin for the LRR2K (G2019S) gene mutation (Ozelius, Senthil, Sanders-Pullman, et al. 2006). A further study by Board et al and another by De La Fuente-Fernandez and Calne

(2002) in Spain concludes that individuals with Parkinson's gene mutations can be especially susceptible to development of Parkinson's disease if exposed to environmental mitochondrial toxins. These are chemicals in the environment that interact with the mitochondrial electron transport chain and trigger the death of brain cells (Board et al. 1998). Identifiable familial forms of Parkinson's disease were found in only a portion of the affected population. A critical question that has not yet been answered is whether the alterations in one or more of the genes discussed is sufficient to cause the death of dopamine cells by themselves or if it requires both a gene mutation and environmental insult. There is evidence for both.

Farming, Rural Living and Well Water as Risk Factors

Farming, rural living and well water have long been considered risk factors for Parkinson's disease. Scientists theorize that it may be something in the soil or the frequent handling of pesticides and insecticides on crops (Taylor et al. 1999). The study of a cluster of Parkinson's Disease patients in a Navajo Indian tribe in New Mexico showed that all of the patients were born, raised and currently living in rural four corners of the Southwestern United States. All drank well water or natural water sources since their birth. Most had occupations of sheep dipping into containers of insecticide, farming and working at agricultural plants. Although no environmental agent was proven to be a cause of their Parkinson's disease, several environmental factors may be involved (Marjama-Lyons, 2002). In a study of one hundred and fifty Parkinson's Disease patients and 150 healthy controls at the University of Kansas Movement Disorders Clinic, results showed a significant difference in the number of years the Parkinson's Disease patients spent living in a rural environment as compared to the healthy controls. The greatest

differences occurred in the first decade of life. The mean number of years that they drank well water was also significantly greater in the Parkinson's disease patients. Their data confirmed the increased risk of Parkinson's disease in a rural environment as well as drinking well water in childhood and early adulthood (Koller et al. 1990).

Scientists studying a group of elderly Parkinson's Disease patients in Hong Kong, who were long duration residences of rural areas; farmers with previous use of herbicides and pesticides and habitual consumers of raw vegetables showed a significantly increased risk of Parkinson's Disease. This study supports the hypothesis that environmental factors directly or indirectly related to agricultural activities are associated with the development of Parkinson's disease (Ho, Woo, and Lee, 1989).

A study selecting a group of 144 Parkinson's Disease patients from an urban/suburban area of metropolitan Detroit found that many of these patients had previously lived in a rural or farm setting and still a greater percentage were exposed to well water from birth until twenty years of age. This study found that farming, as an occupation, was significantly associated with Parkinson's disease (Gorell et al. 1998).

Studying 7986 Japanese Americans born between 1900 and 1919 on the Hawaiian Island of Oahu with 30 years of follow up, scientists found 116 men who developed Parkinson's Disease. The incidence of Parkinson's disease increased significantly in men who had worked for more than ten years on a plantation. Although well water was not directly assessed in this study, 92% of water used in Oahu is well water (Petrovitch et al. 2002). In a population-based case-control study of occupational categories of 144 Parkinson's Disease patients and 464 healthy controls in Detroit, a group of scientists concluded that working in an agricultural occupation increased estimated Parkinson's

disease risk and they recommended further investigation focusing on lifestyle factors and environmental exposures within the agricultural category (Kirkey et al. 2001).

A study exploring mortality data for specific neurodegenerative diseases in 27 states from 1982 to 1991 found significant occupational clustering for Parkinson's disease in agricultural workers. Part of the problem however in the study was the use of information on death certificates, since 60% of the certificates listed Parkinson's disease as involved and only 30% listed Parkinson's disease as the underlying cause (Stern, Dulaney, Gruber, et al. 1991).

A large scale study of 2,273,872 men and women in Denmark from 1981-1983 including all of the Parkinson's Cases in that country during those years found a high risk for men and women in agricultural and horticultural occupations. In a thirteen-year follow up, 611 men and 338 women were admitted to the hospital with Parkinson's disease. A significantly higher risk for Parkinson's disease was found for male self-employed farmers. A similar pattern was found for female self employed farmers and wives assisting farmers (Tuchsen & Jensen, 2000).

To address the question, "Is Idiopathic Parkinson's Disease caused by genetic or environmental factors?" scientists in northwestern Spain studied 299 unrelated Idiopathic Parkinson's Disease patients taken from an epidemiological study of 218,749 inhabitants from April 1997 to May 1999, and found that an environmental model was a better fit than a genetic one. They concluded that the cause of most cases of Idiopathic Parkinson's Disease, both sporadic and familial, was the accumulation of a small number of transient environmental events, randomly distributed throughout life. They found that the age of the child when the mother developed symptoms of Idiopathic Parkinson's Disease

determined the risk for the child. They reasoned that the younger the child, the higher the risk since younger children spend more time at home (Fuente-Fernandez, 2002).

A further study of 150 patients with Parkinson's disease and 150 healthy controls in Kansas, determined that there was a statistically significant difference in the number of years that the Parkinson's disease patient spent in a rural environment as compared to the controls. They also found that drinking well water in childhood and early adulthood increased the risk of Parkinson's disease when evaluated as a single variable. They suggest that Parkinson's disease may be occurring at a younger age of onset because environmental factors are becoming more common (Koller et al. 1990).

Pesticides, Herbicides and Insecticides as Risk Factors

The high risk of Parkinson's disease development in farmers and agricultural workers in both in the United States and other countries may be attributed to their consistent use of environmental toxins such as pesticides, herbicides and insecticides. In a study of rural California residents, scientists found that 250 million pounds of pesticides were used annually and two-thirds of these were herbicides. Using California mortality records, the California Pesticide Use Registry and data obtained from the Agricultural census from 1984 to 1994, scientists found Parkinson's disease mortality rates, as an underlying cause of death, higher in agricultural pesticide use counties than in the non-pesticide use counties. They also found that Californians who died from Parkinson's disease during those years on an average were more often white males. The California regions with the highest prevalence of Parkinson's disease were predominately agricultural and were characterized by intensive market gardening and high pesticide use (Ritz & Yu, 2002). A 1992 large-scale cancer prevention study reported on 7,864

participants who were exposed to pesticides, including 1,956 farmers, ranchers and fisherman. They found those individuals who were exposed to pesticides had a 70% higher incidence of Parkinson's Disease than those not exposed supporting the hypothesis that exposure to pesticides may increase risk for Parkinson's Disease (Ascherio et al. 2006). In a study in Palo Alto California, as presented by Lorene Nelson of Stanford University to the American Academy of Neurology in 1992, scientists questioned 496 people newly diagnosed with Parkinson's Disease and 541 without the disease about their past use of pesticides, herbicides and fungicides in their homes and gardens. These investigators found that home exposure to pesticides and herbicides were associated with an increased risk of Parkinson's disease. Fungicide exposure was not linked with increased risk of the disease. Individuals with high-level herbicide exposure had a 70 % increased risk compared to those who were not exposed. People who used insecticides in their gardens showed a 50% increased risk compared to those who had never been exposed to home pesticides of any type. In-home use of insect killing chemicals was associated with a 70% increased risk of Parkinson's disease compared with no in-home use of pesticides (Stephenson, 2000).

The case-control study by Ho, Woo, and Lee (1989), that examined 561 elderly patients of which many were from Southern China, explored those who came in contact with herbicides and insecticides for extended periods. This study grouped their sample into participants who were 20 years of age, 20 to 40 years of age, and those over 40 years of age. Findings from this study supported the existing scientific evidence that environmental toxins related to herbicides and insecticides are among the possible candidates in causing Parkinson's disease. These investigators concluded that subjects

with direct or indirect exposure to toxic substances contained in herbicides or insecticides have a higher risk of developing Parkinson's disease (Ho, Woo, and Lee, 1989).

In the study of young-onset Parkinson's disease patients in Oregon and Washington State, Butterfield et al. (1993) found Parkinson's disease significantly associated with three variables representing three different categories of pesticides. These included 1) exposure to herbicides; 2) previous residency in fumigated houses and 3) exposures to insecticides. The exposure of the Parkinson's disease patients was five times that of the healthy controls. Findings from this study point to a significant relationship between certain pesticide exposures and Parkinson's disease (Butterfield et al. 1993).

An important occurrence in Parkinson's disease research took place in the 1970's and 1980's. A group of drug addicts injected themselves with a homemade narcotic drug known as MPTP and developed Parkinson's disease symptoms. Within a few days, all drooled, moved slowly, trembled and spoke softly. Within two weeks all had advanced Parkinson's Disease with bradykinesia, rigidity, resting tremor, postural instability, a shuffling gait, micrographia, loss of associated movement, masked faces and freezing. MPTP is the protoxin n-methyl-4-phenyl-1, 2,3,6-tetrahydropyridine. From this event scientists were able to inject MPTP into monkeys, cause Parkinson's disease symptoms and do much needed research. This strengthened the hypothesis that Parkinson's disease has an environmental etiology. It was later discovered that MPTP was not only the breakdown of some obscure drug but also the active ingredient of the herbicides Cyperquat and Paraquat and very closely related to many other pesticides (Ballard, Tetrad, and Langston, 1985).

An interesting study by Guillette et al, (1998), with children in northwestern Mexico, concluded that children exposed to pesticides have difficulties in movement, less stamina and perform poorly in activities that require gross or fine eye-hand coordination. All of these are early symptoms of Parkinson's disease. Also studying the agricultural herbicide connection, Ferraz et al. (1998), Ho, Woo, and Lee (1989), Koller et al. (1990), Chapman, (1991), Wong et al. (1991), and Semchuk et al. (1992), found that people with a history of field crop or grain farming and those using herbicides on a long term basis have an increased risk of developing Parkinson's disease. In a further study Thiruchelvan, Richfield, Baggs, et al. (2000) injected a combination of two agricultural chemicals into mice twice a week for six weeks and found reduced motor activity and Parkinsonian effects in the dopamine system.

Industrial Pollutants as a Risk Factor

Other environmental toxins have also been shown to induce Parkinson's disease. Intense exposure to certain industrial chemicals other than pesticides, herbicides and insecticides have been linked to Parkinson's disease. In a case study in China in 1989, Tanner et al studied seventy-seven men and twenty-three women with Parkinson's disease with a mean age of 57.2 years and 200 controls, free of the disease with a mean age of 56.8 years in Beijing and Guangzhou. They found that an increased risk for Parkinson's disease was associated with occupational or residential exposure to industrial chemicals. Industrialization is a more recent occurrence in China, so most subjects were exposed to these chemicals only in adulthood. The study however, did not resolve the question of a critical age of exposure to industrial toxins that could lead to the development of Parkinson's disease. The study concluded that the data collected suggests that industrial

toxin exposure immediately prior to the onset of Parkinson's disease may be sufficient to cause the Parkinson's disease (Tanner et al. 1989).

In another case controlled study scientists compared 990 patients with Parkinson's Disease who had a positive exposure to hydrocarbon solvents to 188 Parkinson's Disease patients who were not exposed to these solvents. It was found that there were more men in the exposed group that developed a type of Parkinson's disease that responded poorly to treatment and experienced worse symptomology than the group who were not exposed to these solvents (Pezzoli et al. 2000).

Uitti et al in a 1994 study followed a 29-year-old woman, who had inhaled and ingested a container of lacquer thinner. After a few minutes she experienced a loss of strength, shaking and stiffness. Within two days, she was described as having Parkinson's disease. She was confused, zombie like, drooling, had moderate to severe bradykinesia, spoke softly, and had resting tremor, rigidity and postural instability. The study concluded that she had developed Parkinson's disease secondary to the lacquer thinner abuse. Although unlikely, the scientists say it may have been the factor responsible for the Parkinson's disease was present only in that one container of lacquer thinner (Uitti et al. 1994).

Commercial lacquer thinners are composed of concentrations of several constituents, two of which are methanol and n-hexane both toxins which have been associated with cases of Parkinson's disease. Lacquer thinners also contain toluene, a toxin that is used frequently in industry and science. Animal studies of toluene use indicate that it decreases the plasma concentrations of tyrosine and tryptophan in rats. Since tyrosine is a precursor for dopamine and norepinephrine, it is possible that the

toluene has the same effect in humans as in the rats causing Parkinson's disease (Uitti et al. 1994).

A further study in 1994 reports on a twenty year old laborer who developed Parkinson's disease after accidentally ingesting a petroleum waste mixture. Some of the features of his case resemble the Parkinson's disease syndrome induced by MPTP. Since this patient had no history of ill health or illicit drug abuse, scientists in this study concluded that a relatively small quantity of ingested petroleum could result in damage to the dopaminergic nigrostriatal system and cause Parkinson's disease. They were however unable to find the neurotoxin present in the petroleum mixture and recommended further study (Tetrud et al. 1994).

Environmental Metals as a Risk Factor

Occupational exposure to a number of metals has also been associated with Parkinson's disease. Some metals such as iron, copper manganese and lead are transported across the blood-brain barrier and have shown the potential to generate free radicals that cause oxidative stress (Gorell et al. 1997).

Gorell et al, in a 1997 Detroit study examining the association of Parkinson's Disease and occupational exposure in adult life to iron, copper, manganese, mercury, zinc and lead, found a significant and striking association with Parkinson's Disease and occupational exposure to manganese for more than twenty years. The study also found a significant association of Parkinson's disease for more than twenty years exposure to copper and a marginally significant association with lead after twenty years exposure. There was no indication of an association with Parkinson's disease with mercury, zinc or iron. However they did find that when a combination of lead and copper, lead and iron,

and iron and copper was analyzed, the association with Parkinson's Disease was greatly increased suggesting that a combination of these metals may act together to increase the risk of Parkinson's Disease (Gorell et al. 1997).

A further case-controlled study in Germany of 380 Parkinson's Disease patients and 379 healthy controls showed statistically significant for lead exposure. These scientist recommended further study include genetic factors and precise exposure determination (Seidler et al. 1996). A study of the relationship of Parkinson's disease and Manganese found a similarity between Parkinson's disease and Manganese. Notably both showed a presence or generalized bradykinesia and widespread rigidity (Calne, 1994). Another study in 1997 in Taiwan found occupational exposures to heavy metals not significantly associated with the risk of Parkinson's disease (Liou, Tsai, Chen, et al. 1997).

Head Trauma as a Risk Factor

Taylor et al (1999) in a Boston study of 140 Parkinson's disease patients and 150 healthy controls found head injury a strong factor associated with the increase risk for Parkinson's disease. Twenty five percent of the study case versus seven and a half percent of the controls had a history of head trauma. The average age of the first head injury occurred at the age of 16 and the average interval between the head injury and the first symptoms of Parkinson's disease was 37 years (Taylor et al. 1999). In a more recent study at Mayo Clinic in Rochester, Minn. of 196 subjects with Parkinson's Disease from 1976 through 1995 and 200 controls, scientists found the frequency of head trauma overall was significantly higher in cases than in the controls. They found that the

population attributable risk for Parkinson's disease is only five percent, because head trauma is a relatively rare event (Bowers et al. 2003).

Viruses as a Risk Factor

The idea that Parkinson's disease might be caused by a virus comes largely from the observations of Dr. Constantin Von Economo during and after the worldwide 1918 influenza epidemic. After he collected and analyzed thousands of cases, Dr. Von Economo called this new disease encephalitis lethargica which was later called Post-encephalitic Parkinsonism. Circumstantial and epidemiological evidence links Post-encephalitic Parkinsonism with Idiopathic Parkinson's Disease however, a causal link was never formally proven as the pandemic occurred before the advent of modern virology (Dickman, 2001).

Summary

To date the cause of Parkinson's disease is unclear and not well defined. However epidemiological studies point to a variety of causal factors believed to be associated with an elevated risk. Genetic, environmental and viral factors have been implicated as risk factors for the development of Parkinson's disease. The genetic factors occur only in a small percentage of families in the affected Parkinson's disease population. Elevated risks for developing Parkinson's disease appear three to four times more often in individuals with first or second-degree relatives who have the disease. Genes that have been identified with Parkinson's disease include Protein Alpha-synuclein, Parkin and UCHL. More recently a new gene mutation, LLRK2 has been found to account for Parkinson's disease in Middle Eastern families (Ozelius et al. 2006).

Yet another theory proposes that Parkinson's disease occurs in association with farming, rural living and drinking well water. Studies investigating groups of Parkinson's Disease patients in Detroit, Hawaii, Kansas, New Mexico, Denmark and Spain who live in rural areas, farm and drink well-water, showed significantly increased risks for developing Parkinson's Disease. Scientists theorize that it might be the frequent use, inhalation and absorption through the skin of the pesticides, herbicides and insecticides heavily used in these rural areas. The use of pesticides, herbicides and insecticides, especially on smaller farms and gardens, over and over again in many studies were found to dramatically increase the incidence of Parkinson's disease both in males and females (Hubble, Cao, Hassanen, et al. 1993). Studies of exposure to pesticides, herbicides and insecticides in California, Oregon, Washington State, Mexico and China found Parkinson's Disease patients who were exposed to these toxic substances either directly or indirectly, at a high risk for developing Parkinson's Disease. They found this especially true for Young-onset Parkinson's Disease patients (Golbe et al. 1992).

The agricultural toxins most strongly suspected at present are those associated with MPTP. MPTP has been found to rapidly produce Parkinson's disease symptoms in human beings and animals of any age and sex. MPTP is also an active ingredient in the herbicides Cyperquat and Paraquat and is closely related to many other pesticides. Industrial chemicals were also found linked to Parkinson's disease. A case study in China found that occupational or residential exposure to industrial chemicals increased the risk for development of Parkinson's disease. Studies involving solvents, lacquer thinners and petroleum waste mixtures found these toxins prominent factors in cases of Parkinson's disease (Ballard et al. 1985).

Other studies also found significant and striking association with Parkinson's Disease from exposure to a number of heavy metals. Metals that were explored in these studies included iron, copper, manganese, lead and mixtures of lead and copper, iron and lead and iron and copper (Olanow, Good, Shinotoh, et al. 1996).

Head trauma, although a relatively rare occurrence, was also found to be associated with an increased risk for Parkinson's disease. Another medical association included the 1918 influenza epidemic, viral causes of Parkinson's disease have been suspected because many of the survivors of that epidemic developed symptoms of Parkinson's disease. This syndrome was called Post-encephalitic Parkinson's Disease (Bower et al. 2003).

All of the above inquiries have been conducted primarily via case-control studies to examine associations between various risk factors and Parkinson's disease. Further research and study may lend additional support that the etiology of Parkinson's disease is multi-factorial.

Chapter 3

METHODOLOGY

Introduction

In 1817 Dr. James Parkinson described "shaking palsy" in his patients. This illness now bears his name. It is called Idiopathic Parkinson's disease because it has no known cause. Parkinson's disease has increased worldwide. It occurs mostly in the elderly but also in the younger population. In the younger population it is called Young-onset Parkinson's disease. Despite many breakthroughs in understanding and treating this disease, including new drugs and surgical procedures to enhance the patient's quality of life, much is still unknown about its cause and cure. Some of the etiological theories implicate genetic factors, environmental factors such as farming, rural living, drinking well water, pesticides, herbicides, insecticides, industrial pollutants, heavy metals, head trauma and viruses or a combination of these factors. Of the many studies of Parkinson's disease surprisingly few surveys have been done of groups of Parkinson's patients themselves as to their past and present commonalities and differences. In the search for the cause of Parkinson's disease, valuable clues may arise from such a study.

The purpose of this study was to examine demographic information collected in two communities from sufferers of Parkinson's disease and non-sufferers of Parkinson's disease. Using descriptive and inferential statistics, the researcher explored whether a statistical significance would be found between study variables and the presence of Parkinson's disease in study participants.

In addition to providing a description of the study design, this chapter outlines how the study was completed. The chapter organization includes the study questions, research design, participants, instrument development, methods of data collection, and proposed data analysis.

Research Questions

Research Question Number One

1. What are the demographic characteristics of sufferers versus non-sufferers of Parkinson's disease in each of two United States communities?

Research Question Number Two

2. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when environmental factors such as exposure to crop pesticides, home water supply, length of time living at a rural residence, use of lawn pesticides, and exposure to chemicals are examined?

Research Question Number Three

3. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when occupational factors such as participant's occupation and their parent's occupation are explored?

Research Question Number Four

4. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when the study participant's medical histories such as family history of Parkinson's disease and a history of head trauma are examined?

Methodology

Research Design

An exploratory design was used to examine demographic factors that have been identified to be associated with sufferers of Parkinson's disease. In addition to using descriptive statistics to explore the population group and study participants, inferential statistics were used to examine whether relationships existed between sufferers of Parkinson's disease and the variables examined.

Sampling and Participants

A cluster sampling design was used to recruit study participants. Two study groups were selected, one from a South Georgia Parkinson's support group and one from a North Dakota Parkinson's support group. Study participant volunteers were recruited from 300 members of the South Georgia Parkinson's disease group, North Dakota Parkinson's disease group. In the South Georgia sample, 74 sufferers of Parkinson's disease volunteered and a small control group of ten non-sufferers of Parkinson's disease agreed to complete the study questionnaire. In the North Dakota sample, eight sufferers of Parkinson's disease volunteered and seven non-sufferers agreed to complete the study questionnaire. Despite researcher efforts to enhance study participation, the North Dakota sample remained small. Control group participants were drawn from the geographical areas that surrounded the Parkinson's disease support groups.

Instrument development

The researcher evaluated several instruments from previous research studies on Parkinson's disease. No appropriate instrument was found to address the study questions. A literature review was utilized to identify significant variables to incorporate into the

study questions. Variables were developed and collapsed into similar categories including demographic factors, environmental factors, occupational factors, and participant medical histories. The demographic factors included age, ethnicity, gender, and sex (Fuente-Fernandez, 2002). Environmental factors included exposure to pesticides, home water supply, length of time living at a rural residence, use of lawn herbicides, and exposure to chemicals. Occupational factors included study participants' occupation and parent's occupation. Participant's medical histories included family history of Parkinson's disease and head trauma. The identified variables were used to prepare the study questionnaire. The dissertation committee members and methodologist reviewed the instrument for clarity and readability and instrument revisions were made.

Data collection

Following approval from the Georgia Southern University Institutional Review Board (IRB) data collection was begun. Potential study participants were identified from a South Georgia Parkinson's support group. Study questionnaires and informed consent letters were mailed to approximately 250 South Georgia Parkinson's disease support group members including sufferers and non-sufferers of Parkinson's disease. Fifty study questionnaires with informed consent letters were mailed to members of a North Dakota Parkinson's disease support group. The researcher assisted some participants in completion of the questionnaire when needed.

To enhance survey response, an addressed, stamped envelope was included with the questionnaire and consent letter and cards were mailed two weeks later. Telephone follow-up calls were made two weeks after cards were mailed. Ninety-seven (32%) completed surveys were returned by study participants.

Methods of Analysis

The Statistical Package for Social Sciences (SPSS) was used to calculate study participants. Descriptive and inferential statistics were utilized to answer the research questionnaires. Independent sample chi-square tests were used to study where relationships existed between study variables and presence of Parkinson's disease. Since the variables were primarily nominal with non-equal sample sizes, chi-square analysis was an appropriate statistical choice (Shavelson, 1996).

Limitations of the Study

Study limitations include non-equal and small sample size. In addition, cluster sampling can lead to study bias. Due to the limitations inherent in causal comparative research, caution is used when interpreting the results of causal comparative research.

Summary

An exploratory study design was used to examine whether a relationship existed between demographic, environmental, occupational, and personal health factors, and persons with Parkinson's disease. Survey questionnaires were distributed or mailed to a cluster sample of study participants. Reminder cards and follow-up phone calls were done to enhance study participation. Descriptive and inferential statistics were used to examine study variables and explore research questions. Chapter four will present study results.

CHAPTER 4

REPORT OF DATA AND DATA ANALYSIS

Introduction

This study explored different variables associated with the presence of Parkinson's disease in a South Georgia and a North Dakota community. The variables explored included age, race, sex, rurality, farm born, pesticide use, water supply, family history of Parkinson's disease, head trauma, number of years living in the same address, occupations of parents and self, exposure to chemicals, and knowledge level of study participants related to Parkinson's disease.

Descriptive Results

Sample Characteristics

The survey questionnaires were distributed to members or caregivers of a South Georgia Parkinson's support group and mailed to members or caregivers of a North Dakota Parkinson's support group. Ninety-seven (36%) usable surveys were received and analyzed. Some participants left some items on the survey unanswered so some response categories had less than 97 responses. Variables explored included age, gender, sex, race, occupation, environmental toxins, and medical history.

In the South Georgia Parkinson Disease Support Group it is interesting to note that there are equal amounts of people in the 20-69 group and the 70-80 group. There are almost twice as many men as women. In the North Dakota Parkinson's Disease Support Group there are equal amounts of people in the 50-69 group and the 70-89 group, just as in the South Georgia Group. In this group, however, there are slightly more women than men. In the South Georgia Control Group there are twice as many people in the 70-89

group than in the 50-69 group and only a few more men than women. In the North Dakota Control Group there is only one more male than female in the 40-49 group and males and females are equal in the 70-79 group. In the South Georgia Parkinson Support Group more people were born in an urban setting than in a rural setting. About half as many were born on farms as in the city. In the North Dakota Parkinson Support Group, more people were born in urban areas than were born in rural areas. In both the South Georgia Control Group and the North Dakota Control Group, the results are the same - more people from urban places than rural.

When questioned about the crops on the farms where they were born, the people in the South Georgia Parkinson Disease Support Group had more field crops and fruit trees. The North Dakota Parkinson Disease Support Group had more grain crops. The South Georgia Control Group also had more field crops and the North Dakota Control Group had more grain crops. Few could remember what kind of pesticides or herbicides were used on their farms. Only one person in the South Georgia Parkinson Support Group could remember using Paraquat. In all four groups well water for drinking was greater than all of the other water sources.

In both the South Georgia Parkinson Support Group and the North Dakota Parkinson Support Group, the unusual numbers were the amount of parents and grandparents who were farmers, almost twice as many as all the other occupations. In the control groups there were only a few parents who were farmers and more grandparents that were farmers than any of the other occupation. Many in the two Parkinson's disease Support Groups were exposed to chemicals, chemical odors, pesticides, petroleum and

petroleum products, gasoline, oil, asphalt and paints, a few in the control groups were also exposed to these things in their occupations or the military.

Inferential Statistics

Given the disparity in the numbers of responses of Parkinson's Disease patients and the numbers of controls in the two populations, in order to obtain the truest configuration of factors, statistical analysis was performed on SPSS software using Chi-square analysis and descriptive statistics. Chi-square was chosen as appropriate since

Research Questions

Research Question Number One

What are the demographic characteristics of sufferers versus non-sufferers of Parkinson's disease in each of two United States communities?

Findings related to demographic factors. Of the total number of study participants, 82 (84%) had Parkinson's disease and 15 (16%) did not have Parkinson's disease. Study participant's ages ranged from a minimum of 20 years of age to a maximum of 92 years of age. A mean age of 71 and median age of 69 was reported by participants. Forty-eight percent of the study participants were 70 years of age or less. Most study respondents (92, 95%) were white, with 3(3%) African American, and 2 (2%) not listed. Sixty-one (63%) were male and 36 (37%) were female. Eleven (14.3%) study participants, who were sufferers of Parkinson's disease were younger than 50 years of age, 45 (59%) were 50 to 74 years of age, and 21 (37.3%) were 75 years of age or older.

Research Question Number Two

2. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when environmental factors such as exposure to crop pesticides, home water supply,

length of time living at a rural residence, use of lawn pesticides, and exposure to chemicals are examined?

Findings related to environmental factors. Environmental factors examined included participant exposure to crop pesticides, home water supply, length of time living at a rural residence, and the reported use of pesticides on participant's lawns. Forty participants (41%) reported that they were exposed to crop pesticides (see Table 1). When asked about the source of their household water, 40 (42%) reported well water, 21 (22%) aquifer water, 7 (7%) reported they received their water from lakes, 7 (7%) received their water from rivers, and 12 (12%) received their household water from other sources. Nine (9%) did not report their source of household water (see Table 2). Forty-seven (49%) of study participants reported they used herbicides on their lawn (see Table 3). Twenty-nine participants who lived in rural areas (see Table 4), reported the length of time that they lived in their present setting (see Table 5).

Several environmental variables were found to be statistical significance to study participants including sources of family water supply $\chi^2(5, \underline{N} = 88) = 347.698, p = 0.000$, number of years living in a rural area $\chi^2(1, \underline{N} = 87) = 114.438, p = 0.000$, being born on a farm $\chi^2(1, \underline{N} = 90) = 3.200, p = 0.074$, and being exposed to chemicals $\chi^2(1, \underline{N} = 96) = 6.750, p = 0.009$. Other environmental variables found to be statistically insignificant include the use of crop pesticides $\chi^2(1, \underline{N} = 97) = 2.727, p = 0.099$ and the use of lawn pesticides $\chi^2(1, \underline{N} = 94) = 11.750, p = 0.001$.

Research Question Number Three

Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when occupational factors such as participant's occupation and their parent's occupation are explored?

Findings related to participant's occupational history. For data presentation, occupational history included the major occupation of their parents and themselves. Participants reported that 34 (35%) worked in agriculture and 55 (57%) worked with chemicals. Eight (8%) reported occupations not involving exposure to agriculture pesticides (see Table 6) or chemicals (see Table 7) and 38 (39%) reported they were born on farms (see Table 8).

Occupational variables found to be statistical significance included the occupation of their parents $\chi^2(1, N = 90) = 114.438, p = 0.000$ and the occupational history of themselves $\chi^2(2, N = 76) = 7.997, p = 0.018$.

Research Question Number Four

Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when the study participant's medical histories such as family history of Parkinson's disease and a history of head trauma are examined?

Medical history. The majority of study participants (82, 84%) indicated they had Parkinson's disease and 15 (16%) indicated that they did not have Parkinson's disease. Medical variables that were found to be statistical significance included a history of head trauma $\chi^2(1, N = 96) = 9.188, p = 0.002$ (see Table 9) and a history of having the flu shortly prior to symptom manifestation development $\chi^2(1, N = 86) = 18.233, p = 0.000$ (see Table 10). No statistical significant relationship was found to exist between

participants with Parkinson's disease and family history of Parkinson's disease $\chi^2(1, N = 97) = 0.253, p = 0.615$ (see Table 11). Forty-five (59%) of the study participants who were sufferers of Parkinson's disease were 50 to 74 years of age. Eleven (14.3%) of the study participants who were sufferers of Parkinson's disease were younger than 50 years of age. Twenty-one (37.3%) of study participants were 75 years of age or more (see Table 12).

Summary of Results

The chapter opened with a review of the demographic statistics that were gathered in this study. Survey instruments were received from 97 study participants. The South Georgia Parkinson Disease Support Group reported the majority of participants were over 60 years of age and this was also found in the North Dakota study sample. Many of the study participants were born or raised on farms and had exposure to farm pesticides, lawn herbicides or industrial chemicals. Occupations reported large numbers of affected study participants had occupations that exposed them to agricultural or industrial chemicals as opposed to the control sample groups. The final chapter will present the summary, conclusions and implications of the study.

CHAPTER 5

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary

Research regarding the causes of Parkinson's disease seems to suggest that genetics, exposure to industrial and agricultural chemicals and hydrocarbons, trauma, severe blows to the head, age and oxidative stress are all involved in this illness of Parkinson's disease. The intent of this study was to see if any of these causes were involved and present in the lives of the Parkinson's disease patients in the South Georgia Parkinson Disease Support Group and the North Dakota Parkinson Disease Support Group.

Discussion of Research Findings

Research Question Number One

1. What are the demographic characteristics of sufferers versus non-sufferers of Parkinson's disease in each of two United States communities?

The demographic characteristics of the populations in this study, showing a mean age of 71 and a median age of 69 in Parkinson's disease sufferers, is consistent with the results found in several scientific studies that Parkinson's Disease increases as a person gets older. Bennett et al. (1996) found in Boston, Massachusetts, that a prevalence of signs of Parkinson's disease increases markedly with age, affecting up to 52% of people over 85. Morgante et al. (1992) studying Parkinson's disease in three Sicilian municipalities found that Parkinson's disease increased steeply with age. Also Semchuck et al. (1992) found the mean age of Parkinson's disease patients in their study to be 68.5 years of age. A further study by Bower et al. (1999) in southeastern Minnesota found the

average incidence rate for Parkinson's Disease was 139.4 in those patients 65 to 99 years old and 272.6 in those patients aged 85 to 99 years old. Their study showed that the incidence rate increased sharply with age going from 26.5 in the 50 to 59 age group to 304.8 in the 80 to 99 age group (a twelve-fold increase). According to their study the risk of developing Parkinson's disease was 0.7% to age 60, 2.1% to age 70, 5.1% to age 80 and 7.5% to age 90 years.

This increased incidence of Parkinson's disease with increased age may also be due to the fact that brain cells die, as a person gets older. Also individuals who live longer lives are exposed to more environmental toxins than those who live shorter lives.

Research Question Number Two

2. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when environmental factors such as exposure to crop pesticides, home water supply, length of time living at a rural residence, use of lawn pesticides, and exposure to chemicals are examined?

Study findings suggested that family water supply and years of rural living were risk factors for Parkinson's disease in both Parkinson's groups. This significance supports the findings of many scientific studies such as Koller et al. (1990) which found that drinking well water in childhood and early adulthood increased the risk of Parkinson's disease. Also Taylor et al. (1999) who concluded that rural living and well water are considered risk factors for Parkinson's disease. A study by Ho, Woo and Lee, (1989) in Hong Kong found that subjects with over 40 years of living in rural areas or over 20 years of farming had an increased risk of about 5 as compared to those who had never lived in rural areas.

A further study by Marjama-Lyons (2002) of a cluster of Navajo Indians in New Mexico with Parkinson's disease found all were born and raised in a rural environment and all drank well water or natural water from birth. Gorell et al. (1998) studied a group of Parkinson's disease patients in Detroit and found that these patients previously lived in a rural or farm setting and were exposed to well water from birth until 20 years of age.

Being exposed to chemicals was also a significant risk factor in this study. This supports previous studies such as that done by Ritz and Yu (2000) in California. These scientists found Parkinson's disease mortality rates higher in agricultural pesticide use counties than in non-pesticide use counties. In another study Ascherio et al. (2006) found that individuals exposed to agricultural pesticides had a 70% higher incidence of Parkinson's disease than those who were not exposed. Ho et al. (1989) concluded that subjects with direct or indirect exposure to toxic substances contained in herbicides and insecticide have a high risk of developing Parkinson's disease and Butterfield et al. (1993) found that a significant relationship exists between certain pesticide exposures and Parkinson's disease.

The fact that MPTP caused a Parkinson Disease like syndrome in a group of drug addicts and that MPTP is an active ingredient of Cyperquat and Paraquat that are frequently used in agricultural settings, strengthens the hypothesis that chemical exposure is a risk factor for Parkinson's disease (Ballard et al. 1985).

Much more research is important and necessary to find the relationship of the chemicals on farms that are causing the risk for Parkinson's disease.

Research Question Number Three

3. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when occupational factors such as participant's occupation and their parent's occupation are explored?

The statistical significance in this study of the occupational history of the participants as well their parents is also consistent with much of the published scientific research. It is noted that 25% of the North Dakota Parkinson's Disease subjects were farmers or in agricultural occupations, 50% of their parents and 62% of their grandparents were farmers or in agricultural occupations. None of the South Georgia Parkinson's disease subjects were farmers but 24% of their parents and 48% of their grandparents were farmers or were in an agricultural occupation.

In a study examining specific neurodegenerative diseases and occupational occurrences in twenty-seven states from 1982 to 1991, Schulte et al. (1996) found occupational clustering for Parkinson's disease exhibited in specific occupational categories such as agricultural workers. Kirkey et al. (2001) in Detroit, examined the possible association between Parkinson's disease and a spectrum of occupations and industrial categories. He found an increased risk for Parkinson's disease with ever working in the agricultural, fishery or forestry occupational group and corresponding industrial categories. Working in a service occupation showed a negative association with Parkinson's Disease.

Semchuck et al. (1992) in a study in Canada, found an increased odds ratio for agricultural work. Also Petrovitch et al. (2003) studying plantation work in Hawaii found that the incidence of Parkinson's disease increased significantly with increasing years of

plantation work. The risk of Parkinson's disease doubled in those who worked on a plantation for more than 20 years compared to those who never worked on a plantation.

In another study by Liou et al. (1997) in Taiwan only the occupational use of herbicides, pesticides and paraquat were significant risk factors for Parkinson's disease. Results in a study by Semchuck et al. (1992) suggested that individuals with a history of agricultural work (field crop farming or grain farming), or the occupational use of pesticide chemicals (herbicides or insecticides) showed an increased risk for Parkinson's disease.

Further an increased risk for Parkinson's disease was associated with occupational or residential exposure to industrial chemicals in a study by Tanner et al. (1989). Also in this same study an increased risk for Parkinson's disease was associated with residential or occupational exposure to quarries.

Research Question Number Four

4. Does a relationship exist between sufferers and non-sufferers of Parkinson's disease when the study participant's medical histories such as family history of Parkinson's disease and a history of head trauma are examined?

This study found a significance of history of head trauma as a risk factor for Parkinson's disease which is consistent with many of the findings from past studies that have been done. Several scientific studies have reported a significant association between head trauma and later occurrence of Parkinson's disease. One such study is that by Bower et al. (2003) which found an association between head trauma and a later development of Parkinson's disease that varies with severity of the trauma. These scientists concluded however that although their study suggested a strong association

between head trauma and Parkinson's Disease, the proportion of incident cases of Parkinson's Disease in the general population that are possibly related to head trauma is relatively small and a rare event.

Another study by Stern et al. (1991) studying both young-onset and older on-set Parkinson's disease patients concluded that the most significant finding in their study was the high incidence of head trauma prior to the onset of Parkinson's disease. The average number of years between the most recent head injury and age of onset of the Parkinson's disease was 19.8 years.

Taylor et al. (1999) also found that head injury was associated with increased risk of Parkinson's disease. The average age in their study at which the first head injury occurred was 16 years and the average years passed between the time of head injury and the age of Parkinson's disease onset was 36.5 years. Although this study feels that the possibility of recall bias must be considered since Parkinson's disease patients may attribute greater significance to past events such as head trauma when questioned than will control subjects.

In addition to head trauma this study found the incidence of flu prior to diagnosis of Parkinson's disease also a significant risk factor for Parkinson's disease. Viruses have been considered a risk factor for Parkinson's disease since the outbreak of a flu-like virus encephalitis lethargica in the early 1900's. Dickman (2001), in an article in Archives of Neurology, concludes that despite modern virology, failure to isolate causative agents of any presumed cases of encephalitis casts a strong shadow of doubt on all reported cases and their relationship to Parkinson's disease.

Summary and Recommendations

Study findings support that the presence of Parkinson's disease is associated with environmental toxins exposure. Since Parkinson's disease develops in aging clients the interaction of the normal aging process and environmental and genetic risk factors, the occurrence of Parkinson's disease seems to increase as the patient ages. Since the elderly population is increasing it follows that the cases of Parkinson's disease will also increase. It is important that further study be done to find, if possible the environmental risk factors that might contribute to Parkinson's disease. A further study should especially be done of agricultural chemicals or natural chemicals that are present in the soil of agricultural settings. The researcher also recommends that an educational intervention be developed to target populations who are exposed to the known risk factors for Parkinson's disease.

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APPENDICES

APPENDIX A

TABLES

Table 1

Sufferers of Parkinson's Disease by Use of Crop Pesticides

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Use of crop pesticides			
Number	34	6	40
Percent			
No use of crop pesticides			
Number	48	9	57
Percent			
	82	15	97

$$\chi^2(1, N = 97) = 2.727, p = 0.099$$

Table 2

Sufferers of Parkinson's Disease by Family Water Source

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Well water			
Number	35	6	41
Percent			
Aquifer water			
Number	20	1	21
Percent			
Lake water			
Number	5	2	7
Percent			
River water			
Number	6	1	7
Percent			
Reservoir and other sources			
Number	8	3	11
Percent			
	74	13	87

$\chi^2(5, N = 88) = 347.698, p = 0.000$

Table 3

Sufferers of Parkinson's Disease by Use of Lawn Herbicides

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Used lawn herbicides			
Number	41	6	47
Percent			
Does not use lawn herbicides			
Number	38	9	47
Percent			
	79	15	94

$$\chi^2(1, N = 94) = 11.750, p = 0.001$$

Table 4

Sufferers of Parkinson's Disease by Years Living in Rural Area Versus Urban Area

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Years in rural area			
Number	33	5	38
Percent			
Years in urban area			
Number	46	10	53
Percent			
	76	15	91

$\chi^2(1, N = 87) = 114.438, p = 0.000$

Table 5

Length of Time Sufferers of Parkinson's Disease Lived at Same Residence

Range of Years	Frequency	Percent
One to 10 years	37	42.5%
Eleven to 20 years	23	26.5%
Twenty-one to 30 years	8	9.2%
Thirty-one to 40 years	11	12.6%
Forty-one to 50 years	3	3.5%
Fifty-one to 60 years	3	3.5%
Sixty-one to 70 years	1	1.1%
Seventy-one to 80 years	1	1.1%
	87	100%

N = 87

Table 6

Sufferers of Parkinson's Disease by Occupation of Self

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Occupation related to agriculture			
Number	32	2	34
Percent			
Occupation related to chemical exposure			
Number	44	11	55
Percent			
No exposure to agriculture chemicals or other chemicals			
Number	1	0	1
Percent			
	77	13	90

$$\chi^2(2, N = 90) = 7.997, p = 0.018$$

Table 7

Sufferers of Parkinson's Disease by Exposure to Chemicals

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Years in rural area			
Number	38	6	44
Percent			
Years in urban area			
Number	43	9	52
Percent			
	81	15	96

$\chi^2(1, N = 96) = 6.750, p = 0.009$

Table 8

Sufferers of Parkinson's Disease by Being Born on a Farm

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Born on a farm			
Number	32	6	38
Percent			
Not born on a farm			
Number	43	9	52
Percent			
	75	15	90

$$\chi^2(1, N = 90) = 3.200, p = 0.074$$

Table 9

Sufferers of Parkinson's Disease by Incidence of Head Trauma

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
History of head trauma			
Number	17	1	18
Percent			
No history of head trauma			
Number	64	14	78
Percent			
	81	15	96

$\chi^2(1, N = 96) = 9.188, p = 0.002$

Table 10

Sufferers of Parkinson's Disease by Experiencing the Flu Prior to Parkinson's Disease

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Flu symptoms prior to Parkinson's disease			
Number	10	0	10
Percent			
Years in urban area			
Number	61	15	76
Percent			
	71	15	86

$\chi^2(1, N = 86) = 18.233, p = 0.000$

Table 11

Sufferers of Parkinson's Disease by Family History of Parkinson's Disease

	Presence of Parkinson's disease		
	Parkinson's	No Parkinson's	Total
Family history of Parkinson's disease			
Number	27	3	30
Percent			
No family history of Parkinson's disease			
Number	55	12	67
Percent			
	82	15	97

$$\chi^2(1, N = 97) = 0.253, p = 0.615$$

Table 12

Age of Sufferers of Parkinson's Disease at Time of Onset of Symptoms

Range of Years	Frequency	Percent
Twenty to 25 years of age	1	1.3%
Twenty-six to 30 years of age	0	0%
Thirty to 35 years of age	0	0%
Thirty-six to 40 years of age	2	2.6%
Forty-one to 45 years of age	2	2.6%
Forty-six to 50 years of age	4	5.2%
Fifty-one to 55 years of age	2	2.6%
Fifty-six to 60 years of age	9	11.7%
Sixty-one to 65 years of age	8	10.4%
Sixty-six to 70 years of age	13	16.9%
Seventy-one to 75 years of age	15	19.5%
Seventy-six to 80 years of age	12	15.6%
Eighty-one to 85 years of age	8	10.4%
Eighty-six to 90 years of age	1	1.3%
	77	100%

N = 77

APPENDIX B
INSTITUTION REVIEW BOARD APPROVAL
AND CONSENT LETTER

Georgia Southern University
Office of Research Services & Sponsored Programs

Institutional Review Board (IRB)

Phone: 912-681-5465
Fax: 912-681-0719

Ovrsight@gasou.edu

4 College Plaza, P.O. Box 8005
Statesboro, GA 30460-8005

To: Ms. Alice P. Gerber
LTHD

Cc: Dr. Mia Alexander Snow
LTHD

From: Office of Research Services and Sponsored Programs
Administrative Support Office for Research Oversight Committees (IACUC/IBC/IRB)

Date: April 13, 2003

Subject: Status of Application for Approval to Utilize Human Subjects in Research

After an expedited review of your proposed research project titled "Are There Commonalities Among the Parkinson's Disease Patients in Savannah/Chatham County From Which Implications of Possible Causes Can Be Drawn," it appears that (1) the research subjects are at minimal risk, (2) appropriate safeguards are planned, and (3) the research activities involve only procedures which are allowable under the following research category:

Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Therefore, as authorized in the Federal Policy for the Protection of Human Subjects (45 CFR §46.101), I am pleased to notify you that the Institutional Review Board has approved your proposed research.

This IRB approval is in effect for one year from the date of this letter. If at the end of that time, there have been no changes to the expedited research protocol, you may request an extension of the approval period for an additional year. In the interim, please provide the IRB with any information concerning any significant adverse event, whether or not it is believed to be related to the study, within five working days of the event. In addition, if a change or modification of the approved methodology becomes necessary, you must notify the IRB Coordinator prior to initiating any such changes or modifications. At that time, an amended application for IRB approval may be submitted. Upon completion of your data collection, please notify the IRB Coordinator so that your file may be closed.

C: Dr. Tom Case, IRB Chairperson
Dr. Bryan Riemann, IRB Associate Chairperson
Ms. Melanie Reddick, IRB Administrative Assistant

Application for Approval to Utilize Human Subjects in Research



Instructions: Complete all sections of these forms (indicate any sections that do not apply with "N/A") and submit completed materials, including all data collection instruments, informed consent forms, and other relevant materials, to the address below. Please type or print.



Application Review: All applications are reviewed on a first come - first served basis, and as quickly as possible. Depending upon the type of review necessary, turn-around time can range from less than a week (for certain types of exempt research protocols) to 6-8 weeks for a full Committee review. *Failure to follow instructions will delay the review process.*

Research Oversight Coordinator Institutional Review Board (IRB) Office of Research Services P.O. Box 8005 Statesboro, GA 30460-8005	Submit Completed Application to:	Phone: 912-681-5465 Fax: 912-681-0719 E-Mail: ovr@ga.edu http://www2.gasou.edu/research/Resources/
---	-------------------------------------	---



Research Title: Are there commonalities among the Parkinson's Disease patients in Savannah/Chatham County from which implications of a possible cause can be drawn?

Principal Investigator: Alice P. Gerber **Title:** _____

Department: _____



Mailing Address: P.O. Box 13602 **Phone:** 912-355-6347

Savannah, Ga 31416 **E-Mail:** Goag1543@aol.com

Approval Signatures: _____

Alice P. Gerber **Principal Investigator** 12/4/02 **Date:**

Mia AS **Faculty Advisor (if student researcher)**

Cathy A. ... **Department Chair**

Print Name of Faculty Advisor

Do Not Write Below This Line - For Internal IRB Use Only

DETERMINATION OF INSTITUTIONAL REVIEW BOARD (IRB)

Human Subjects:	<input type="checkbox"/> At Risk	<input type="checkbox"/> Not At Risk	
Action:	<input type="checkbox"/> Approved	<input type="checkbox"/> Conditional †	
	<input type="checkbox"/> Returned for Revisions/Not Approved	<input type="checkbox"/> Extension of Approval Period	

† Attach Conditions of Approval

Indicate Section of Federal Code that Applies _____

Signed: _____ **Date:** _____
 Chair, Institutional Review Board



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CONSENT FORM
For Participation in Interviews/Observations

ADULT EDUCATION
 COUNSELOR EDUCATION
 EDUCATIONAL LEADERSHIP
 HIGHER EDUCATION STUDENT SERVICES
 INSTRUCTIONAL TECHNOLOGY
 SCHOOL PSYCHOLOGY
 SPECIAL EDUCATION

Your rights as a volunteer:

You are being asked to participate in this research about the commonalities among the members of the Savannah Parkinson's Disease Support Group. **Should you agree to participate in this study, you are free to withdraw at any time.**

By agreeing to participate in this study, you are agreeing to person to person or telephone interviews. In addition you are consenting to fill out a questionnaire about your life and your illness. This study will take place on an on-going basis with an expected culmination date of 2004.

Your rights and privacy will be maintain in the following manner. All information about you during the study will be kept confidential as legally as possible and only will be accessible to the investigator. All data collected from this study will be kept in a locked file in the investigator's home in which she and her dissertation committee will be the only individuals to have access. If and when the data is no longer useful or should you decide to no longer participate in the study, all collected data for the study or relating to you will be incinerated. Should the results of the study be published, neither your name nor any information from which you may be identified will be included.

If you have general questions about giving consent or your rights as a participant in this study, you can call the Georgia Southern University Institutional Review Board at (912)681-5218 or the investigator at (912)355-6347. The investigator also may be contacted by e-mail Goag1543@aol.com or in writing at P.O. Box 13602, Savannah, Ga. 31416.

STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY

- I have read this consent from. All my questions have been answered, and I am freely and voluntarily choosing to participate. I understand that I may withdraw at any time.
- The material in this consent form has been explained to my verbally. All my questions have been answered, and I freely and voluntarily choose to participate. I understand that I may withdraw at any time.

Date	Signature of participant
Date	Signature of participant or legal representative on behalf of participant
Date	Other signature(s) Relationship to volunteer when applicable

APPENDIX C
SURVEY INSTRUMENT

QUESTIONNAIRE:

AGE _____ RACE/ETHNICITY _____ SEX _____

1. WHERE WERE YOU BORN? _____

URBAN AREA _____ RURAL AREA _____

2. WERE YOU BORN OR RAISED ON OR NEAR A FARM? YES ___ NO ___

IF SO WHAT CROPS WERE GROWING IN THAT AREA?

FIELD CROPS

COTTON _____ PEANUTS _____ TOBACCO _____
POTATOES _____ TOMATOES _____ LETTUCE _____ SOYBEANS _____
OTHER VEGETABLES _____

GRAIN CROPS

WHEAT _____ CORN _____ RICE _____ OTHER GRAINS _____

FRUIT TREES

PEACHES _____ CHERRIES _____ APPLES _____
PLUMS _____ PEARS _____ NECTARINES _____ ORANGES _____
GRAPEFRUITS _____ LIMES _____ LEMONS _____
OTHER _____

NUTS

PECANS _____ ALMONDS _____ WALNUTS _____
ANY OTHER NUTS _____

**3. DO YOU KNOW WHAT CHEMICALS-INSECTICIDES-HERBICIDES-
PESTICIDES-FUNGICIDES WERE USED ON THOSE CROPS? ___ YES ___ NO**

PARAQUAT _____ MANEB _____ ROTENONE _____
OTHER _____

4. AS A CHILD WHAT WAS THE SOURCE OF THE WATER YOU DRANK?

WELL WATER _____ UNDERGROUND AQUIFER _____ LAKES _____
RIVERS _____ OTHER _____

**5. WHAT KIND OF COOKING UTENSILS WERE USED IN YOUR
CHILDHOOD HOME?**

ALUMINUM _____ IRON _____ STAINLESS STEEL _____
COPPER _____ OTHER _____

**6. HOW MANY YEARS SINCE YOU WERE DIAGNOSED WITH PARKINSON'S
DISEASE?** _____

7. WHAT CHILDHOOD DISEASES DID YOU HAVE? (CHECK ALL THAT APPLY AND INCLUDE AGE.

MEASLES _____ MUMPS _____ CHICKEN POX _____
DIPHTHERIA _____ SCARLET FEVER _____ WHOOPING COUGH _____
PNEUMONIA _____ RHEUMATIC FEVER _____ EAR PROBLEMS _____
EYE PROBLEMS _____ ASTHMA _____ HAY FEVER _____
NONE OF THE ABOVE _____ OTHER _____

8. AS A CHILD, DID YOU HAVE ANY LEARNING DISABILITIES? YES NO

DIFFICULTY READING _____ DIFFICULTY WRITING _____
DIFFICULTY LEARNING _____

9. IN YOUR FAMILY (AS MANY GENERATIONS AS YOU CAN GO BACK) ARE THERE ANY OTHER MEMBERS THAT HAVE OR HAVE HAD PARKINSON'S? INCLUDE THE RELATIONSHIP OF EACH FAMILY MEMBER TO YOU.

10. DID ANY FAMILY MEMBERS HAVE AN UNUSUAL ILLNESS THAT WAS NEVER REALLY DIAGNOSED, JUST HYPOTHESIZED? (DESCRIBE)

11. DID ANY FAMILY MEMBER HAVE ANY ADDICTIONS? (DESCRIBE) AND INCLUDE THEIR RELATIONSHIP TO YOU.

12. WHAT OTHER ILLNESS HAVE YOU HAD AS AN ADULT? INCLUDE AGE.

HEART PROBLEMS _____ CATARACTS _____
ARTHRITIS _____ HEARING PROBLEMS _____
CANCER _____ KIDNEY PROBLEMS _____
LIVER PROBLEMS _____ NONE LISTED ABOVE _____
ANY OTHER PROBLEMS _____

13. HAVE YOU HAD ANY TRAUMATIC INJURIES TO YOUR HEAD? YES NO (DESCRIBE)

14. DID YOU HAVE THE FLU WITHIN 1 OR 2 YEARS PRIOR TO YOUR PARKINSON'S DIAGNOSIS? _____

15. LIST ALL MEDICINES THAT YOU ARE CURRENTLY TAKING AND/OR HAVE TAKEN? _____

16. LIST ANY MEDICATIONS TO WHICH YOU ARE ALLERGIC. _____

17. HOW LONG HAVE YOU LIVED AT YOUR PRESENT ADDRESS? _____

DO YOU LIVE ON OR NEAR THE WATER? _____

DO YOU HAVE YOUR HOUSE EXTERMINATED EVERY MONTH? _____

DO YOU DO A LOT OF YARD WORK? YES NO HOW MUCH? _____

DO YOU DO A LOT OF GARDENING? YES NO _____

WHAT DO YOU GROW? _____

18. WHAT ARE YOUR HOBBIES? (INCLUDE AVERAGE TIME SPENT DOING EACH HOBBY?)

WOODWORKING _____ SCULPTURE _____

PAINTING _____ GOLF _____ FISHING _____

SEWING _____ READING _____ SWIMMING _____

GARDENING _____ VOLUNTEER WORK(WHERE) _____

ATHLETICS _____ BOATING _____ FLYING _____

OTHERS _____

19. HOW MUCH DO YOU WEIGH NOW? _____

20. AS A CHILD, WERE YOU:

UNDERWEIGHT _____ OVERWEIGHT _____

SLIM _____ HEAVY _____ OBESE _____

21. WHAT WERE THE OCCUPATIONS OF YOUR PARENTS? (DESCRIBE) _____

22. WHAT WERE THE OCCUPATIONS OF GRANDPARENTS? (DESCRIBE) _____

23. ARE YOU CURRENTLY WORKING? YES NO. IF WORKING:
WHAT IS YOUR OCCUPATION? _____

24. ARE YOU RETIRED? YES NO IF RETIRED:
HOW LONG SINCE YOU RETIRED? _____
WHAT WAS YOUR OCCUPATION? _____

DESCRIBE THE KIND OF WORK YOU DID _____

DID YOU WORK AROUND OR NEAR ANY (INCLUDE TYPE IF KNOWN):

CHEMICALS _____ CHEMICAL ODORS _____
DYES _____ FABRICS _____ PAINTS _____
PESTICIDES _____ HERBICIDES _____
WELDING OR WELDING MATERIALS _____
PETROLEUM PRODUCTS _____
GASOLINE _____ OIL _____ TAR _____
RUBBER _____ PITCH _____ ASPHALT _____
STONE QUARRIES _____ ANY OTHER UNUSUAL ELEMENTS _____

25. DID YOU WORK IN AN ENCLOSED BUILDING? YES NO

HOW OLD WAS THE BUILDING? _____

26. WERE YOU IN THE SERVICE? YES NO

WHICH BRANCH? _____

WHERE WERE YOU STATIONED? _____

WHAT KIND OF WORK DID YOU DO IN THE SERVICE? _____

27. DID ANY TRAUMATIC EVENTS OCCUR IN YOUR LIFE PRIOR TO THE PARKINSON'S DISEASE DIAGNOSIS? _____

SERIOUS ACCIDENT _____
SERIOUS SURGICAL PROCEDURE _____
SEVERE ILLNESS _____
OTHER _____

28. HAVE YOU EVER SMOKED? ___ YES ___ NO AT WHAT AGE? _____

DO YOU SMOKE NOW? ___ YES ___ NO HOW MUCH? _____

29. DO YOU DRINK ALCOHOL? ___ YES ___ NO HOW OFTEN? _____

30. WHAT DO YOU THINK WAS THE CAUSE OF YOUR PARKINSON'S DISEASE?

WOULD YOU LIKE TO BE INTERVIEWED? _____ YES _____ NO

CONTACT INFORMATION:

NAME: _____

ADDRESS _____

TELEPHONE _____ E-MAIL _____
