Descriptive Epidemiology of Parkinson's Disease in South Carolina

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Abstract

Parkinson's disease (PD) is a chronic, progressive neurological disorder that affects an estimated one per 100 people in the US over the age of 60. Surveillance for PD is difficult, due to many factors. In South Carolina (SC), a unique resource exists which can be used as ersatz disease surveillance in the Office of Research and Statistics in the State Budget and Control Board. We queried this database to find hospital and emergency room visits with a diagnosis of PD. From this we computed rates per 10,000 per county. Other environmental factors, such as potential contaminated groundwater and toxic release inventory are examined concurrently.

Background

Parkinson's disease (PD) is a chronic neurological condition named after Dr. James Parkinson, a London physician who was the first to describe the syndrome in 1817.

PD is a slowly progressive disease that affects a small area of cells in the mid brain known as the substantia nigra. Gradual degeneration of these cells causes a reduction in a vital chemical known as dopamine. This decrease in dopamine can produce one or more of the classic signs of Parkinson's disease: resting tremor on one side of the body; generalized slowness of movement (bradykinesia); and stiffness of limbs and gait or balance problems. (1)

While the cause of PD remains unknown, recent evidence suggest certain environmental factors, such as well water drinking, herbicides and pesticides exposure, and neurotoxins, may trigger the chain of oxidative reactions culminating in the death of dopaminergic neurons in the substantia nigra to cause Parkinsonism. (2)

It is estimated that up to 1.5 million Americans have PD. Approximately 15% of patients are diagnosed before age 50, although PD is generally considered a disease which targets older adults. Generally, PD affects one of every 100 persons over the age of 60. As the population of the US continues to age, PD will become an increasing public health burden.

Thanks to public health strides and healthier lifestyle choices, many people now live well into their eighties, adding to the impression that the incidence of Parkinson's disease is increasing. While there is, as yet no cure for this condition, progressive treatments allow many patients to maintain a high level of function throughout their lifetimes. (1)

Surveillance for PD is difficult. Onset is gradual, and it can be some time before the symptoms are realized. There is also no mechanism for PD surveillance as exists for cancer. Reliable estimates are therefore difficult to determine.

We set out to quantify PD in SC, to conduct the first steps in rigorous epidemiology and describe the distribution of the disease using ArcGIS.

Methods

PD data was obtained from the SC Budget and Control Board's Office of Research and Statistics. Their system is a unique resource for epidemiological investigation. Named the Integrated Data System, ORS collects public health and health care payer databases and more for the purposes of research. One is able to identify a patient in one database, and follow him in another; it is therefore possible to conduct epidemiological research of complicated designs with minimal cost. For this project, the Integrated Data System was queried for all hospital discharges and emergency room visits with a diagnosis of PD, based upon ICD-0 codes for the years of 1996-2000. Rates of disease were calculated using the 2000 Census. Other variables requested were county of residence and race. Data were screened for duplications and each case was found to be separate. After conversion to a personal geodatabase, the data were brought into ArcGIS for map creation.

Two other shapefiles were available at the State Department of Health and Environmental Control's GIS clearinghouse. These were potential groundwater contamination sites and toxic release inventory shapefiles. Other more comprehensive datasets of measurements in groundwater and soil were requested, but not available in time for publication.

Results

Rates were calculated for residents over age 60 per county. The overall rate of PD in SC based upon this surveillance was 20.22 per 10,000. For whites, the overall rate was 25.35 per 10,000, and for blacks was 10.04. The rate for races classified as 'other' was 6.63 per 10,000.

The rates were then analyzed spatially, using ArcGIS, and patterns of disease were evaluated. For overall rates, the distribution of PD per county was interesting. The counties of Oconee (29.45), Anderson (27.21) Spartanburg (26.91) Union (41.46) Chester (26.12) and Newberry (29.08) in the upstate were in the highest quartile. There were also two groups of adjacent counties that were in the highest quartile: Dillon (36.46), Marion (27.63) and Georgetown (31.36) around the Pee Dee region and Allendale (25.87) Hampton (26.19) along the lower Savannah river. Most troubling is the rate for Union county, which adjoins three other highest-quartile counties. Interestingly, the contiguous counties of Abbeville (14.52), McCormick (13.05) Edgefield (11.79) and Aiken (17.05), in which the Savannah River Site resides, were in the lowest quartile.

For whites, the distribution was similar to the overall map. Union (56.76), Chester

(37.23) Newberry (38.07) and Fairfield (35.55) in the upstate were again in the highest quartile. There was a similar distribution in the Pee Dee region as well: Dillon (52.32) Marion (47.34), Florence (35.79) Lee (35.47 and Georgetown (45.34) were in the highest quartile. Orangeburg (40.24) and Barnwell (36.28) were also in the highest quartile. Again, Abbeville (18.46), McCormick (15.70), Edgefield (15.76) Lexington (20.07) and Aiken (20.54) were in the lowest quartile.

For blacks, the distribution was markedly different. Oconee (14.41) and Laurens (14.8) counties were in the highest quartile in the upstate. Darlington (18.18), Dillon (21.53) and Marion counties in the Pee Dee were also in the highest quartile. Six contiguous counties across the lower plain of the state were high as well. Clarendon (17.37), Orangeburg (13.46), Bamberg (18.25) Allendale (28.89) Hampton (22.68) and Colleton (14.87) stretch form the midlands to the coast and the Savannah River in the highest quartile. Similarly to the distribution in whites, Abbeville (6.31) Greenwood (4.28) Saluda (1.74) Edgefield (5.88) Lexington (6.6) and Aiken (8.51) were in the lowest quartile.

Discussion

Fascinating patterns of disease were observed. Berkeley and Dorchester counties were consistently low in both whites and blacks, as were counties on the Savannah River around Aiken. Rural Jasper county was also low for both whites and blacks. Two areas of concern were found for whites: the upstate and the Pee Dee. In these areas, rates were much higher than the average rate per 10,000. For blacks, Allendale county had the highest rate at almost triple the average. For whites, Allendale county was in the lowest quartile. The highest counties for blacks tended to be in the lower plain of the state, which was often similar to the state rate for whites.

Groundwater contamination and toxic release data were not examined intensely, as the data had little specificity as to the amount of contamination. In general, these sites were in the urban areas, which tended to be around the state overall rates.

More research should be conducted in the descriptive epidemiology of PD in SC. Our preliminary work has shown clusters of counties which are both much higher and lower than the overall race specific rates. More specific environmental data is necessary to investigate in more depth.

Our project has certain limitations. While the data from ORS are the best available, it is not an active surveillance system like a cancer registry. It is possible that we missed a number of PD cases. It is possible that a PD patient would not visit an ER or hospital in our four years data frame. As stated earlier, the environmental data were of limited benefit. Our research cannot account for PD patients who are treated outside South Carolina. This phenomenon may contribute to the low rates seen near the Georgia border, for example.

This is only our first step in our research. We have a pending request for measurements of specific contaminates in water and soil, which will add the kind of data to begin to

investigate environmental hypotheses of associations. We also plan to request data from 2000 to present, and examine rates for changes over time.

Reference and Credit:

(1) The National Parkinson Foundation, Inc.; *http://www.parkinson.org/pdedu.htm*
(2) Tsai, Lo, See, Chen, Weng, Chang, Lu; *Environmental risk factors of young onset Parkinson's disease: a case-control study.* Clinical Neurology & Neurosurgery. 104(4):328-33, 2002 Sep