

# Chronic Pesticide Exposure: A Study of Autoimmune Disease Prevalence in a Rural Illinois County

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## Introduction

Autoimmune disease prevalence is estimated to be at 8% of the U.S. population. It is currently unknown what leads to the development of autoimmune disease, but different environmental risk factors are quickly becoming popular in literature as primary causes (1). One such environmental factor, pesticide exposure, has come to the forefront of environmental exposures increasing the risk for autoimmune disease development. Over the past several decades, controversy surrounding the use of pesticides for agriculture and their associated effect on the environment, acute human toxicity, and human disease progression has been elevated to unprecedented levels. One particular area that has very little data available is the assessment of geographically chronic disease states in heavy areas of pesticide exposure. Pesticides ability to alter hormones has been particularly interesting as research is uncovering that endocrine disrupting properties of pesticides in animal and human cells have interfered with the production of cytokines, immunoglobulin, mediators of inflammation, and alteration in the activation and survival of immune cells (2). These changes have been hypothesized to cause the immune system to enter into a hyper reactive state, potentially leading to autoimmune diseases.

The Midwest is one area of the country that has a substantial amount of pesticide use, especially Illinois. Illinois is one of the top 5 states in cash income and total value of real estate that is directly related to agriculture in the country (3). Illinois is one of 4 states with the highest annual agricultural pesticide use measured in pounds per square inch in the country (4). Individual communities surrounded by rural agricultural farm land could possibly have increased risk of pesticide exposure for all members of that particular community, potentially resulting in a higher prevalence of autoimmune disease.

## Methods

The prevalence of 10 of the most universally common autoimmune diseases was studied in Fulton County, IL. Fulton County is unique in that it has one predominant medical group, Graham Medical, using one EMR across 4 distinct sites in the county, representing a patient population of roughly 45,000. Fulton County is a heavy agricultural area with almost 1,000 farms over 355,000 farming acres (5). This county is predominantly rural with its largest city, Canton, having an estimated population of only 14,307 (6). Fulton County represents an opportunity to easily assess the prevalence of autoimmune diseases using EMR data in a geographically heavy agriculturally rural Illinois county that would have as high of a risk of chronic pesticide exposure as any other county in Illinois.

Graham Medical Group uses eClinical Works v.10 as their electronic medical record across four different sites in Fulton County (Canton, Farmington, Lewistown, and Cuba). A report was generated representing all sites with both ICD-10 and ICD-9 codes of specific autoimmune diseases due to mid-migration to ICD-10. With a filter active, the report only displayed age and gender for each patient associated with each particular ICD code. These reports were exported to Excel to be analyzed. There were no patient identifiers present and the individual creating the reports did so in a way so they did not see patient identifiers, only ICD code, age, and gender.

Data was analyzed to calculate prevalence in Fulton County of each autoimmune disease. Further analyses were done based on age groups and gender. Comparisons were made to the most current epidemiological data in the United States.

Figure 1 – Hashimoto's Disease

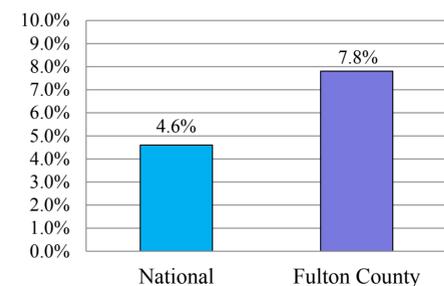


Figure 2 – Rheumatoid Arthritis

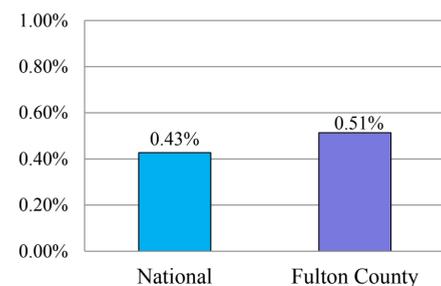


Figure 3 – SLE

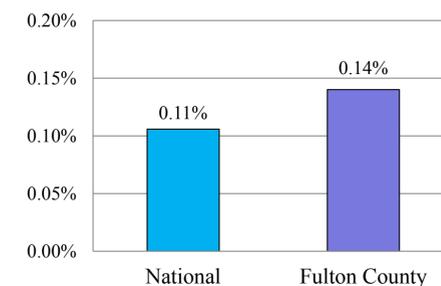


Figure 4 – Multiple Sclerosis

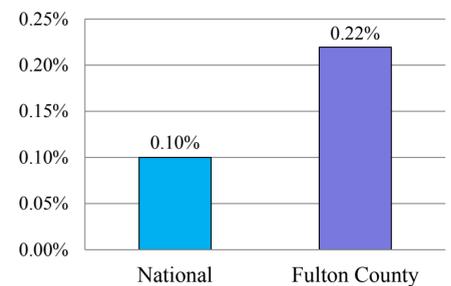


Figure 5 – Crohn's Disease

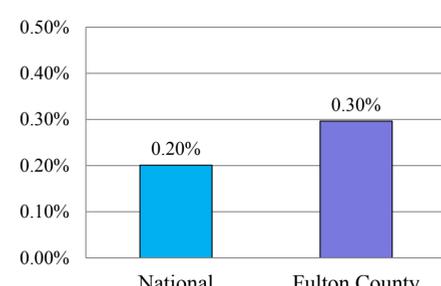


Figure 6 – Myasthenia Gravis

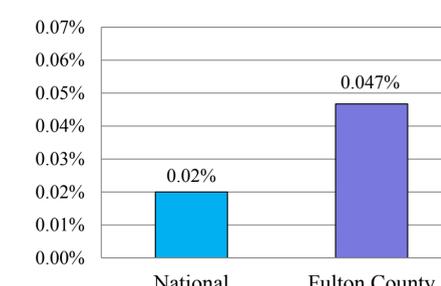


Figure 7 – Pernicious Anemia

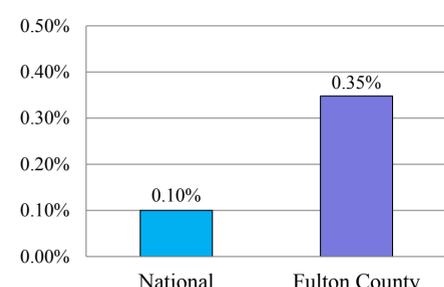


Figure 8 – Gender Distribution

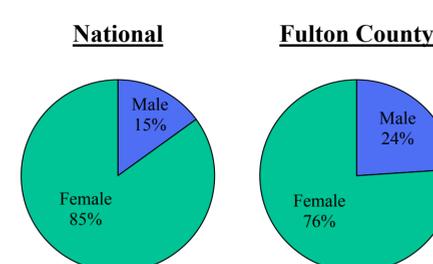
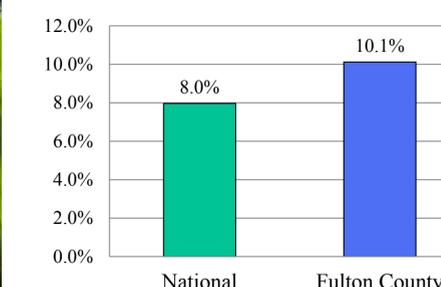


Figure 9 – Overall Prevalence



## Conclusion

This data shows a higher prevalence of almost all of the autoimmune diseases studied in addition to a higher prevalence overall compared to most recent national data. Several studies support these results; one of the earliest studies found a statistically significant relationship between long term mixing of pesticides and the prevalence of systemic lupus erythematosus within this population of workers (7). Over half a decade later, in a landmark study, long term application of insecticides were linked to increased risk of both rheumatoid arthritis and systemic lupus erythematosus in postmenopausal women (8). Lastly, one study evaluated hypothyroidism in workers who apply pesticides and found a significant increased risk of developing this autoimmune disease (9). Disturbingly, another recent study has shown the occupation of farming is associated with increased risk of death from autoimmune disease in addition to increased risk of exposure to pesticides (10).

One literature review found several studies supporting significantly greater pesticide presence in residential dust at farm homes compared to non-farm homes (11). Another study assessing agricultural pesticide drift showed significant increases in pesticides present within 200 ft of farm crop with the frequency of detection increasing by 6% for every 10 acre increase of crop (12). This data lends support that agricultural communities are at much greater risk for pesticide exposure and furthermore, potentially increased risk for autoimmune disease. In fact, of all the pesticides used agriculturally in Illinois, atrazine is one of the most commonly applied pesticides having the highest state usage across the country (13). This is particularly of concern due to growing evidence that atrazine has endocrine disrupting features following exposure to a variety of species (14). As discussed, endocrine disruption is thought to be a precursor to autoimmune disease. In addition, another study linked atrazine exposure in mice to immunomodulatory effects suitable for hypersensitivity states and autoimmune function (15). In 2010 the Natural Resources Defense Council published results evaluating treated drinking water in the Midwest and identified 67 sites that exceeded the minimum concentration set forth by the EPA, with Illinois being one of two states with the most prevalent sources (14). Considering the widespread use of atrazine and its continued presence in drinking water, the agriculturally heavy state of Illinois could place rural communities at a potentially increased prevalence of autoimmune disease.

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