Global Pesticide Use and Parkinson's Disease Incidence: Using Data Science to Optimize Pesticide Regulations and Linking Glyphosate Exposure to Neural Inflammation

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In this study, I use data science principles to analyze pesticide use and Parkinson's Disease (PD) incidence, internationally. Countries were clustered using DBSCANs, the k-means method, and by development using the Human Development Index reported by the World Health Organization. Dataframe compiling, clustering methods, statistical testing, and figures were coded in Python in Google CoLab and Jupyter Labs using the Bridges2 supercomputer and the statistical analysis software PRISM. The relationship between pesticide use per area cropland and the age-standardized incidence rate of Parkinson's Disease was further investigated for the cluster of highly developed countries. Agricultural policy and pesticide regulations were examined in highly developed countries using country-specific reports. Feasible regulations were outlined for countries with high PD incidence to protect populations from toxic agrochemical exposure. Focus was directed to glyphosate, a widely used pesticide in agriculture, of which millions of pounds are applied to principal US crops. I found that there exists a strong direct relationship between Parkinson’s Disease incidence and the amount countries pay for glyphosate-applied US bulk grains. A novel understanding of PD risk was reached. To validate the findings of this study, previous data was investigated. This showed considerable potential for glyphosate to exacerbate neuroinflammation, a widely experienced symptom in Parkinson's patients. Glyphosate-induced cytokine release and increases in protein amyloid-beta levels may polarize immunoregulatory nerve cells called microglia in the hyperactive neurotoxic state and internally stress nerve cells. This retrospective analysis inspires future direct and actionable changes to pesticide regulations.

Awards Won:

Third Award of $1,000

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