STAT 5243 Project 3: Autism and Allergies in Children

Lilly Enekes

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Abstract

This paper finds that there could be a bidirectional relationship between autism and allergies in children: meaning that children with autism are more likely to also have allergies and vice versa. By using clusters to analyze the data collected from the 2021 National Health Interview Survey (NHIS), PCA shows the variability between children who do and do not have autism.

Introduction

There has been some research done on the relationship that Autism Spectrum Disorder (ASD) and allergies share in children. In Estrella et al.'s "Food Allergies and Autism Spectrum Disorder: A comparative Study of Sensitization in Children," a statistically significant relationship between having a history of autism and a positive Skin Prick Test (SPT) result for food allergens (p=¡.001) was found. It was found that more than 80 percent (n=33) of the ASD group had a positive SPT result for food allergens, compared to 42 percent (n=16) in the control group. Directionally, this would suggest that children with ASD are more likely to have food allergies than children without ASD.

In Xu et al.'s "Association of Food Allergy and Other Allergic Conditions With Autism Spectrum Disorder in Children" which used a cross-sectional study, results showed that the weighted prevalence of reported food, respiratory, and skin allergies was higher in children with ASD compared with children without ASD. These results stayed significant when analyses was adjusted for other factors (age, sex, race/ethnicity, family highest education level, family income level, geographical region, and mutual adjustment for other allergic conditions. The odds ratio of ASD increased in association with food allergy, respiratory allergy, and skin allergy when comparing children with these conditions and those without.

Using this research, we can continue to study these relationships and find more updated information and correlations. Do these correlations become more significant with recent generations and more diagnoses?

Methods

Using the 2021 National Health Interview Survey results, analysis could be done on the collected data. This meant creating a database/spreadsheet that includes all four of the variables needed for further analysis.

These variables answer the following questions:
(1) Has a doctor or other health professional ever told you that (NAME) had Autism, Asperger's disorder, pervasive developmental disorder, or autism spectrum disorder? [Autism variable]
(2) Does (NAME) get symptoms such as sneezing, runny nose, or itchy or watery eyes due to hay fever, seasonal or year-round allergies? [Respiratory Allergies variable]
(3) The next question is about food allergies. People with food allergies have reactions such as hives, vomiting, trouble breathing, or throat tightening that occur within two hours of eating a specific food. Does (NAME) have an allergy to one or more foods? [Food Allergies variable]
(4) The next question is about an allergic skin condition. Does (NAME) get an itchy rash due to eczema or atopic dermatitis? [Skin Allergies variable]

With these variables, we can create multiple different PCA clusterings to see the interactions and relationships of the different variables. Since we are interested in the relationship that autism has to allergies, a PCA clustering is plotted for all of the different allergies with autism. This leads to a total of three PCA plots.

Code Availability

Here is a link to the public Github account where the code is available: `https://github.com/le2363/STAT5243`.

Results

The below figures are the PCA plots of the clusters for food, respiratory, and skin allergies with autism.

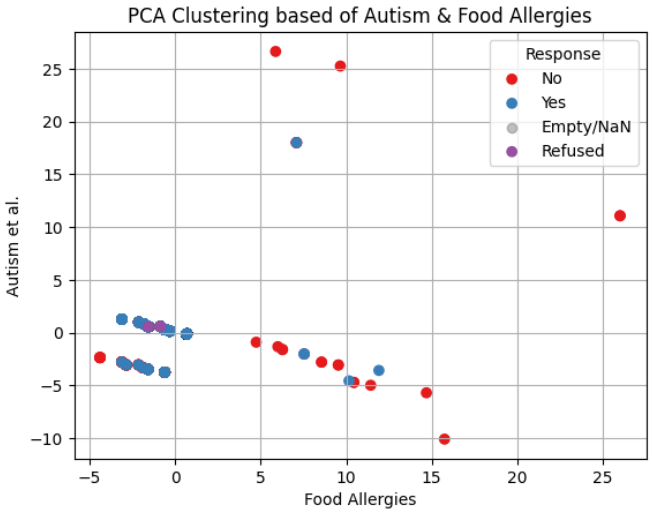

Figure 1: PCA Plots of Autism with Food Allergies

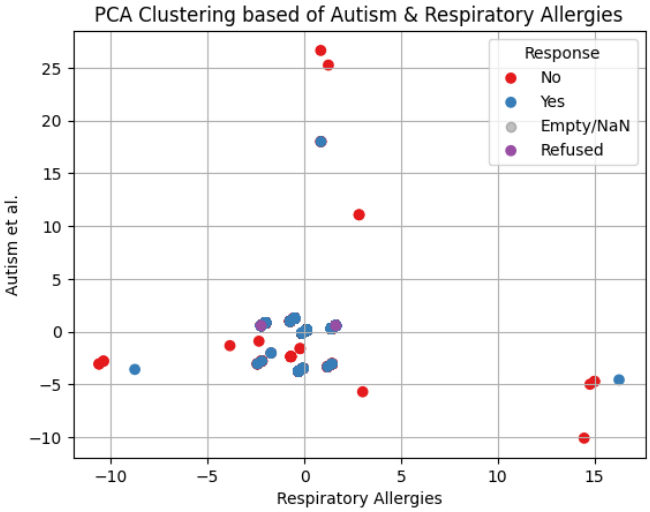

Figure 2: PCA Plots of Autism with Respiratory Allergies

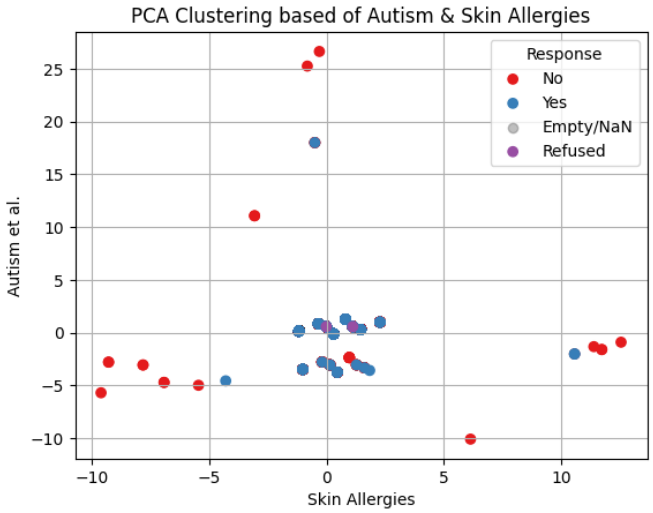

Figure 3: PCA Plots of Autism with Skin Allergies

As you can see with the PCA plots, the cluster of blue ("Yes") data points are all close to the origin or (0,0) location. This indicates that there is not much variability between the two components of autism and allergies. This further supports the claim that a child who has either autism or allergies, is more likely to have the other than if the child had neither, which has much greater variability shown with the red ("No") data points.

Conclusion

With the data provided by the NHIS, a relationship between allergies and autism can be seen. Using the location of the autism children's clusters, their relationship to allergies is presented.