

# Investigation of RNA concentration in three layered or surgical masks among those with and without asthma

## Intro

Asthma is the most common chronic illness for children (Zahran). It has been recorded that within one year, a child with asthma will have at least one or more asthma attacks (Zahran). Yet, in recent times, with the COVID-19 pandemic, there has been a decrease in the hospitalization of children due to asthma attacks (Kenyon, Zhang, Krivec). This change is believed to be explained by the use of masks as a protectant against COVID-19 which in turn protects against harmful pathogens or other air pollutants that exacerbate asthma attacks (Zhang, Saraya, Chatkin). Furthermore, it has been found that people with asthma are more likely to hold pathogens within the microbiome of their airways that can exacerbate asthma (Hilty, Kim). Therefore when looking at masks it would be expected to find a difference in the concentration of RNA within each mask layer. However, we only have studied the concentration of RNA on the outside layer of the surgical masks (Chughtai). So, there is a lack of understanding on where in the three layered or surgical masks, holds the most and least concentration of RNA.

## Objective

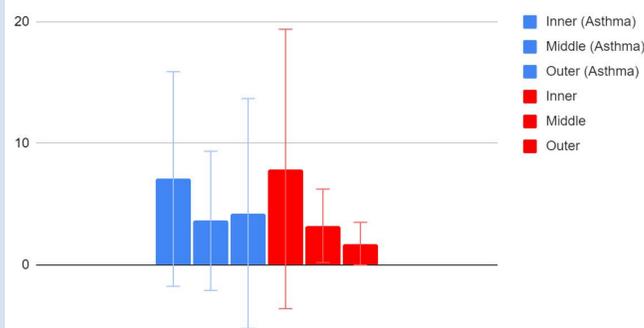
This study aims to take a look at the nucleic acid concentration within the inner, middle, and outside layers of masks. The study will analyze the concentrations of nucleic acid from masks worn by children with and without asthma. For the reasons stated above it would be accepted that

## Limitations

Since this research is new there was no way to find a power. Also, as described why later, using non-parametric testing is not as strong in its conclusion. Therefore it is clear that more research needs to be done

## Procedure

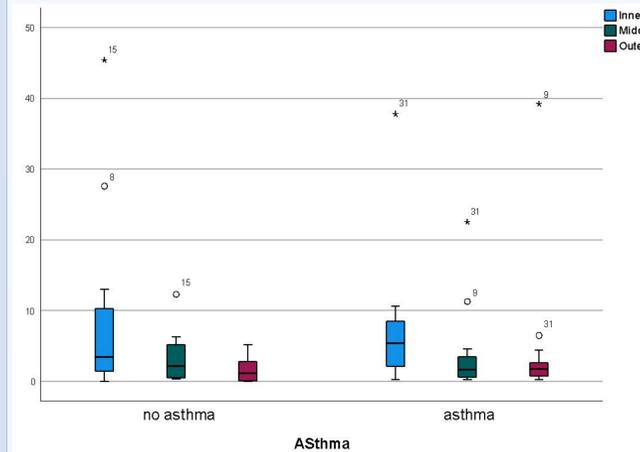
1. Used masks were taken from children at Hartford public school. The masks were taken from children with and without asthma. (The obtaining of masks was done by Dr. Jessica Hollenbach).
2. Dr. Hollenbach's lab assistant used DNA/RNA extraction by soaking the layers in PBS, amplifying using PCR, and quantifying using Qiagen. Then they used photometry (UV-Vis) quantification on the separated layers of masks.



3. Then I organized the data simply to look at trends. But, it was decided that the data didn't fit a normal bell curve, and more data analysis was needed. Below is the initial analysis of asthma v.s. non-asthma. The Blue is with asthma and red without. From left to right it goes, inner middle outer.

4. So non-parametric testing was clearly needed. With the guidance of Dr. Hollenbach, non-parametric testing was completed. Kruskal-Wallis Test was used to distinguish between the three layers for both asthma and non-asthma data and the Mann-Whitney U test was used to distinguish between asthma and non-asthma data sets.

## Results

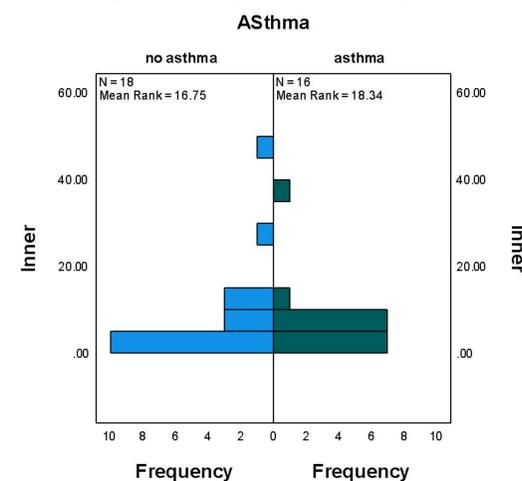


Pictured above is both the distribution of asthma and non-asthma. To complete the Kruskal-Wallis test the layers were grouped and the means were ranked. Using that, it was found that in both asthma and non-asthma there was a difference between the layers. Below is the P-value determination.

## Test

Method	DF	H-Value	P-Value
Not adjusted for ties	2	6.19	0.045
Adjusted for ties	2	6.21	0.045

## Independent-Samples Mann-Whitney U Test



## Results (cont.)

Pictured below the test, is the graph for the Mann-Whitney U test. It was determined that there is not a statistical difference between asthma and non-asthma.

## Conclusion

So, in short, it was found that there is a statistical difference of nucleic acid between each layer in both cases, but there was not a statistical difference across asthma and non-asthma masks. Still, this study provides crucial knowledge about masks. Based on the data, it was found that most nucleic acid resides in the inner layer of the mask. This could suggest a redesign of the mask but, in general, more research on masks should be done. Lastly, since there is no difference in the distribution of nucleic acid for those with asthma it suggests that masks are equally protective and safe for children with asthma.

## Sources

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