Wet Zones and Wheezing
Analysis of the Relationship between Flooding and Asthma in Maryland
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Introduction
Flooding produced by major storms has caused extreme damage to communities throughout the United States. The indirect health effects of floods, such as the exacerbation of existing chronic conditions, are not typically addressed by emergency aid relief, especially in smaller urban communities (Paterson, Wright & Harris, 2018). The University Of Maryland School Of Public Health noted a swiftly increasing rate emergency asthma hospitalizations during periods of extreme weather. Hospitalization rates for asthma in Baltimore have been projected to double by 2040 (Wells, 2016). This analysis investigates hospitalizations in the context of health access and placement along the Maryland floodplain as factors in an assessment of areas that would benefit from increased flood healthcare planning.

Data
Floodplain vector data was used to look the statistical risk of flooding in areas throughout the state. High-water event tabular data from USGS was used to analyze significant flooding during hurricane Irene in 2011 and hurricane Joaquin in 2015. Asthma prevalence was assessed using tabular data from Data.gov which showed the number of emergency department hospitalizations per 10,000. Healthcare accessibility was considered using hospital location point data, major roadways vector data, and tabular income data accessed through the Maryland iMap.

Methods
The high water elevation tables for hurricane Irene and Joaquin were added to the map using a spatial join of the County Boundary layer using the three-digit county FIPs codes which were manually added to the High Water. Water elevation level in feet was represented using graduated symbols with equal interval categorization. The 100 year floodplain layer accompanying this data was created by using select by attribute from the Maryland FEMA floodplain layer where the floodplain description was ‘100 years’.

Results
The analysis of the association between storm water flooding and asthma prevalence showed an average increase in emergency hospitalizations for asthma in counties where major flooding had occurred. We found that counties that had experienced severe flooding in 2010 had a 2.89% greater average increase in asthma hospitalizations from 2010-2011. Counties that had experienced severe flooding in 2014 had a 2.86% greater average increase in asthma hospitalizations from 2014-2015. During hurricane Irene, which occurred September 2010, Talbot, Queen Anne’s, Caroline, and Kent County experienced severe flooding. Of this county group, Kent and Caroline are both target areas with at least 70% of the households in the county having an income less than 80% of the state median. During hurricane Joaquin, which occurred in 2014, St. Mary’s and Charles County experienced significant flooding. All counties that experienced significant flooding showed an increase in the rate of emergency hospitalizations for asthma, and are located in areas with fewer hospitals.

Conclusions & Discussion
Ultimately, through this analysis an association between was found between asthma emergency hospitalizations and flooding in the periods from 2010-2011 and 2014-2015. These coastal areas tended to be away from the healthcare epicenter of Maryland. There was also decreased access to major roads from these points. This analysis is restricted by limited data available for both asthma prevalence and flood water elevation. Also, the hospitalization data may be underreported in counties near the border of the state where patients could seek healthcare outside of Maryland.

References and Map Information
Project: NAD_1983_Virginia_Lambert
Data Sources: USGS, FEMA, Maryland iMap, Data.gov