Geospatial analysis of pharmacy functionality during the 2018 Hurricane Florence disaster
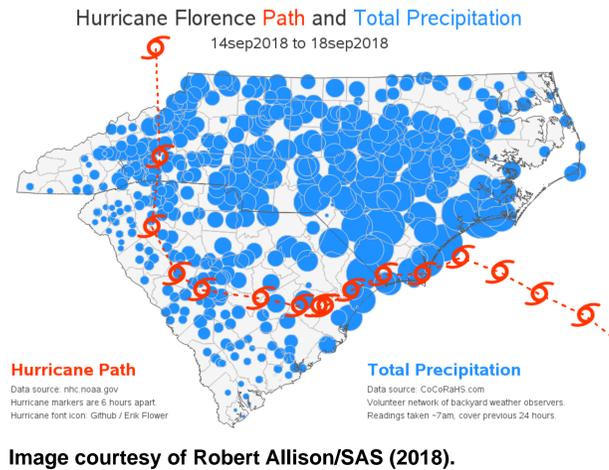
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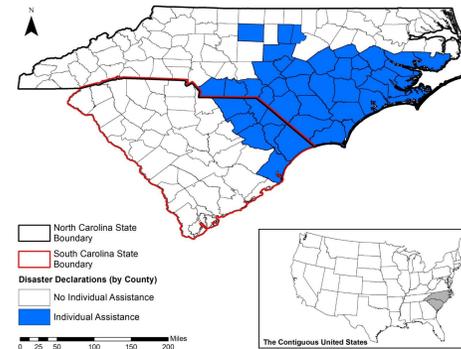
BACKGROUND

➤ Hurricane Florence made landfall as a Category 1 storm near Wilmington, North Carolina on September 14, 2018
➤ Hurricane Florence caused significant damage in North and South Carolina
  ▪ Rainfall totaled near 36 inches and damages totaled ~$22 billion in NC
  ▪ Rainfall totaled near 24 inches and damages totaled ~$1.2 billion in SC
➤ During Hurricane Florence, community pharmacies were rendered nonfunctional
➤ **To better understand the extent to which pharmacies were affected by Hurricane Florence, we examined the distribution of operational pharmacies before, during, and after the disaster**

Hurricane Florence Path and Total Precipitation
14sep2018 to 18sep2018

Hurricane Path
Data source: nhc.noaa.gov
Hurricane markers are 6 hours apart.
Hurricane font icon: Github / Erik Flower

Total Precipitation
Data source: CoCoRaHS.com
Volunteer network of backyard weather observers
Readings taken ~7am, cover previous 24 hours.

Image courtesy of Robert Allison/SAS (2018).

METHODS

➤ **Study area:** counties eligible for individual assistance under FEMA declarations DR-4393 and DR-4394
➤ **Data source**: Healthcare Ready
➤ **Duration:** September 12-20, 2018
  ▪ Preparedness: Sept. 12-13
  ▪ Response: Sept. 14-17
  ▪ Recovery: Sept. 18-20
➤ **Analysis:** Operating pharmacy capacity (OPC) was computed, and GeoDa was utilized to calculate Getis-Ord Gi*(d) statistics

North Carolina State Boundary
South Carolina State Boundary
Disaster Declarations (by County)
No Individual Assistance
Individual Assistance
The Contiguous United States

$$OPC_i = \left[\frac{\sum open\ pharmacies_i}{\sum open\ pharmacies_i + \sum nonresponsive\ pharmacies_i + \sum closed\ pharmacies_i} \right] \times 100$$
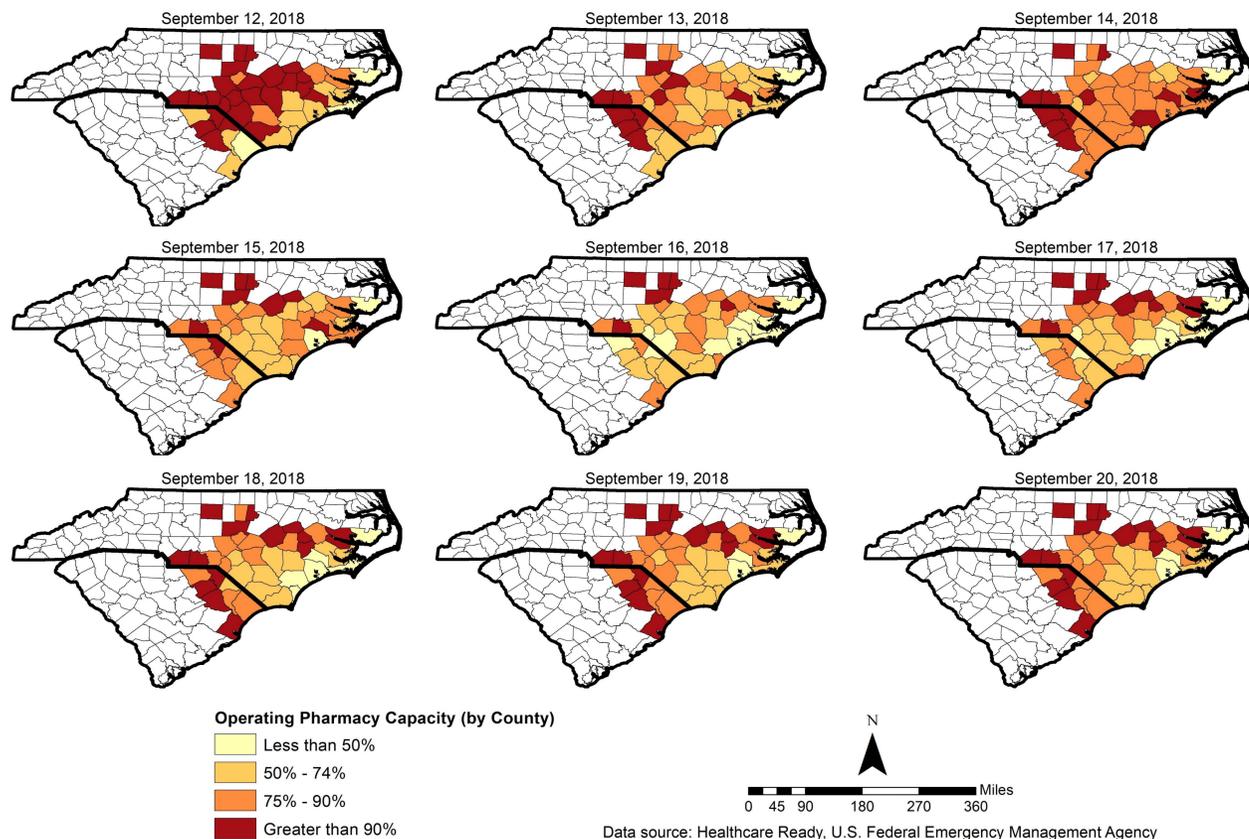
Equation for the operating pharmacy capacity (OPC).

CONCLUSIONS

➤ Spatially, coastal counties in the Hurricane Florence-impacted area had the worst operating pharmacy capacity
➤ Temporally, disaster preparedness and recovery efforts of pharmacies in North Carolina and South Carolina were adequate, yet disaster response efforts were suboptimal
  ▪ 71% of North Carolina counties (n = 24) and 88% of South Carolina counties (n = 7) increased operating pharmacy capacity or maintained high capacity of 90% or higher between September 13 and 14 in preparation for the landfall of Hurricane Florence
  ▪ Operating pharmacy capacity was lowest during the disaster response period on September 16 at 71% for North Carolina and 62% for South Carolina
  ▪ Operating pharmacy capacity recovered one week after landfall during the disaster recovery period at 80% for North Carolina and 88% for South Carolina

RESULTS

Operating Pharmacy Capacity Before, During, and After Hurricane Florence in North Carolina and South Carolina Counties Eligible for Individual Assistance, September 12, 2018 – September 20, 2018

Operating Pharmacy Capacity (by County)
Less than 50%
50% - 74%
75% - 90%
Greater than 90%

Data source: Healthcare Ready, U.S. Federal Emergency Management Agency

Clusters of Operating Pharmacy Capacity Before, During, and After Hurricane Florence in North Carolina and South Carolina Counties Eligible for Individual Assistance, September 12, 2018 – September 20, 2018

Clustering of Operating Pharmacy Capacity (by County)
Not Significant
High Cluster
Low Cluster

Data source: Healthcare Ready, U.S. Federal Emergency Management Agency

Centers for Disease Control and Prevention
Agency for Toxic Substances and Disease Registry

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NOTE: The findings and conclusions have not been formally disseminated by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry and do not necessarily represent the official position of any agency, determination, or policy.