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## Examining the Impacts of Flooding on Public Health

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# **Examining the Impacts of Flooding on Public Health**

By

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Public Health

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## **Abstract**

Over the past 10 years, South Carolina has experienced over five major weather events that have led to extreme flooding along the coast. These types of repeated major events have the potential to significantly impact people's lives and livelihoods. When looking at the issue from a public health perspective, it is known that natural disasters such as flooding can negatively affect community health. However, little research has been done to analyze the impacts on individual health from flooding. This issue inspired a more in-depth research analysis to examine those health impacts from local Horry County residents. This research aims to gain a better understanding of how survivors of flooding are impacted and to highlight those issues to the public. This thesis is based on qualitative analysis of interviews conducted by students from Coastal Carolina University as part of the Flooded Afterlives project. The analysis focused on three main research questions that related to information pertaining to the health of flood survivors, what they wish their community knew, and what changes they would like to see in the future. Collecting and disseminating this information from survivors will allow their voices to be finally heard and create changes to prevent further disasters to communities.

## **Introduction**

As I began my research and wanted to know more about how flooding affects people's health and wellbeing, I wanted to go straight to the source to get information. While working with my research advisor we had the idea to interview victims that had been recently impacted by flooding. I began this search by reaching out to local organizations that advocate on the behalf of victims. My quest came up very few and far between, making the task of finding participants quite difficult. Because of this lack of participants, our research had to take on a different perspective. Using interviews from a similar project, we were still able to learn more about the health impacts of flooding.

To completely understand how people are being impacted by flooding, we must first understand the history of natural disasters in this area. South Carolina's coast has always been susceptible to hurricanes and flooding. One of the most memorable being Hurricane Hugo that reached shore in 1989. At the time that this storm hit, it was said to be the costliest hurricane in US history, and nearly 80,000 homes were damaged or destroyed (Arnold 2019). Since Hurricane Hugo, the Horry County area has continued to be hit by similar devastating storms. In October of 2015, Hurricane Joaquin ushered in thousands of gallons of water into the Horry County area. This devastating storm impacted nearly 100,000 residents across the county and caused millions of dollars of damage to property and businesses (Arnold 2019). At the time, the flooding was considered a "500-year flood" and had been the most destructive storm since Hugo in 1989. However, this would certainly not be the last major flooding event for South Carolina residents. A year later, Hurricane Matthew again flooded the Horry County area crippling already struggling victims that had been impacted in 2015. This

pattern continued with multiple heavy rain events and a category four hurricane occurring in the following years.

A major possible factor contributing to the pattern of major weather events affecting South Carolina's coast is climate change. Over the last couple of decades, the topic of climate change has become a major discussion among scientists. Though many may discuss how climate change may impact our world in the future, it is fair to say this issue is impacting our coast more and more every year. While climate change does not directly induce flooding along the coast, it can lead to issues such as sea level rise and other factors that may exacerbate already existing issues with flooding. One of the biggest elements that cause flooding along our coast are hurricanes. It is thought that in the near future there will be an increase in the frequency of strong storms, with a nearly 80% increase of category 4 and 5 hurricanes in the Atlantic basin (Denchak, 2019). These types of storms cause major damage from substantial amounts of rainfall and flooding local rivers and creeks. According to the National Resource Defense Council (2019), over the last decade coastal flooding events have doubled and heavy precipitation events are projected to greatly increase. This type of statistic is very alarming for communities along our coast that are already seeing the human costs of these severe weather events. It is important when looking at how our communities are being affected by severe flooding, we look at the environment around us. Climate change is here and it's impacting the lives of people and communities along our coast.

When looking at the issue of flooding as a Public Health concern, it is important to look at how both community and individual health are being affected. Little research has been done on the topic of flooding in the Public Health field, especially research that investigates aspects of mental and emotional health of victims. Much of the current research looks at environmental

health aspects of the aftermath of flooding and how that can impact communities (Azuma et al., 2013; The Lancet, 2017). The water itself can pose a great danger to the environment, people, and animals. One of the greatest concerns within public health with flooding is the contamination of the water. Flood water is often contaminated with bacteria, debris, and harmful chemicals that could pose a threat to humans. This toxic concoction is then filling people's homes to near waist deep and bringing mold and moisture to everything it touches. Encountering contaminated items can be dangerous and consuming anything that has come in contact to floodwater can lead to serious illness such as Cholera or other water-borne diseases (Rastogi, 2018). When looking past the immediate environmental health concerns, there may also be an aspect of flooding that impacts the emotional and mental health of individuals. Dealing with any type of natural disaster can be very stressful and is sure to take a toll on the emotional health of its survivors. For example, Tong's (2017) research on the mental health impacts of being displaced due to flooding found a significant association between flood related displacement and the odds of reporting symptoms of a mental health disorder. Tong (2019) also discussed how poorly understood the long-term mental health impacts of being displaced by flooding can affect people. It is essential that more research be conducted to gain a better understanding of the true toll that flooding has on individuals.

## **Methods**

This research analyzes eight interviews conducted through the Flooded Afterlives Project. The Flooded Afterlives Project aims to have a better understanding of how people's lives are being impacted after major flooding events in the Horry County area. The project came about after the Horry County area experienced an influx of historic rain events and hurricanes over the

past couple of years. Each individual that participated in the project had experienced flooding in the last five years in their homes or primary place of residence. Participants were recruited through an already existing relationship between the Socastee and Rosewood communities and the University. Local community leaders also helped reach community members. Snowball sampling was used during interviews with residents to identify other key community members that could offer valuable information. People that took part in the interviews were given a ten-dollar gift card for their participation in the study.

In the spring of 2021, as a part of the Water and Women course conducted by my research advisor, Dr. Jennifer Mokos, undergraduate students conducted semi-structured interviews via the Zoom platform. Each interview was conducted by one or two students that had previously undergone training for qualitative and community-based research methods during the class. In the approximately hour-long interviews, residents gave their own personal stories of how their families and communities have been impacted by past and recent flooding events in their area. Students were given an interview guide with questions that pertained to residents' personal experiences, the impact on the community, and their visions for the future. Their entire interview was recorded live and then later transcribed by students. The responses were then digitally archived at Coastal Carolina University and used in part to help build a storehouse of information on the impacts of flooding in the Horry and Georgetown County area.

In order to thoroughly analyze each interview, the process of coding the transcript was conducted. To begin, the first step was to read through each interview transcript and highlight information that could possibly pertain to each specific research question and take notes on important examples that should be included in the results. This process was quite tedious and time consuming but was very useful to truly understand each individual's story. In total, eight

interviews were analyzed and coded. The coding process began with printing the transcript of each interview and highlighting information in different colors based on the research question. This allowed for the process of separating the information to be easier when writing up the results. That data was then placed on a spreadsheet and categorized based on the already existing research questions. Once all the data that had been collected through the secondary analysis had been organized, those results were used to examine the impacts of flooding on Public Health.

## **Results**

### *How has flooding affected your health?*

When analyzing the interviews conducted with flood victims, our main priority was to understand how the victim's health had been impacted. The word “health” itself can have many different connotations. The World Health Organizations defines health as, “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (2021). Many times, when people think of health, there is only a focus on the physical aspect of what makes someone healthy. However, it is important that we look at all the different elements that affect a person’s wellbeing.

Many of the interview participants reported that mental and emotional health was the biggest burden of their homes being flooded. After dealing with such a tragedy such as losing your home, experiencing large amounts of stress is inevitable. It is known that large amounts of stress over a period of time can greatly impact people’s mental health. Long term stress is especially dangerous and can lead to a plethora of health conditions and exacerbate already existing mental health issues. According to an article written by the Mental Health Research

Foundation, the emotional symptoms of stress can often overlap with the same symptoms of mental health conditions such as anxiety and depression (Doughty, 2018). Nearly every interview participant reported experiencing high amounts of stress and anxiety after seeing their homes flooded. The experience alone of seeing your home be devastated by flood waters is very devastating. In the interview with Mr. Johnson,<sup>1</sup> as a Socastee resident who has lived in the Horry County area for over twenty years, he recounts his wife's reaction to their home flooding the first time. In 2016, after the landfall of Hurricane Matthew, the Johnson's home was filled waist deep with flood water. Unlike any of the other storms that came close to flooding their homes, Hurricane Matthew was unlike any other. Their homes initially flooded with an inch of water covering their floors and baseboards. However, within the next week their home was filled with 18 more inches that saturated nearly all their belongings. When he described their experience evacuating their flooding home, waist deep in hip waders pulling his wife out of their home in a small aluminum boat, she began having a panic attack and wasn't even able to look up as they floated farther to safety. Since the first incident of flooding in 2016, their home has flooded three more times. Even years later, that memory of them being forced to leave their home for the first time has stayed with them. Unfortunately, the Johnson's experience is not uncommon and there are many stories of residents dealing with long term trauma after the incidents. In another instance, Ms. Williams, another fellow Rosewood resident, shared her experience of having nightmares from the flooding. She first experienced her home flooding in 2016 after Hurricane Matthew, and then again in 2018. After taking the time to completely renovate her home that had been devastated by water, she continued to have dreams of her drowning from flood water. After repeatedly experiencing these dreams, she eventually had to move out of the Socastee area and passed her home off to her son's care. It is stories like these

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<sup>1</sup> Pseudonyms are used to protect the confidentiality of participants.

that truly show the emotional costs that living through repeated flooding can have. Experiencing this degree of trauma will continue to impact these victims for the rest of their lives.

Flood waters also play a part in disrupting people's physical health. It is known that flood water tends to be some of the most polluted and dirty water filled with debris. It is always advised by public health professionals that people avoid contact with flood water, which can be a difficult task when your home is filled with several inches of water. According to the CDC, coming into direct contact with flood water can cause serious health risks such as wound infections, gastrointestinal illness, and tetanus (2019). This is due to much of the water coming into contact with all different types of sewage and debris, making it a breeding ground for harmful bacteria and chemicals. In many of the interviews conducted with Rosewood residents, people reported a strong odor coming from the floodwater that stayed around the area for weeks after the water subsided and debris scattered around the neighborhood. One of the most alarming claims from interviewees about flooding was the discussion of pig parts and feces possibly contaminating the flood water. Because much of the water Horry County receives after hurricanes and other heavy rainstorms comes from North Carolina, it is a big concern that pig farms located in the state could cause serious environmental concerns for area residents. North Carolina is one of the leading states in hog farming and boasts nearly 2,000 farms with over 10 million hogs across the state (Helmer, 2018). Each of these farms contains hog lagoons, which are large pools that contain diluted hog waste. On these farms, the hog waste is then used as fertilizer to spray their crops. The issue with these lagoons is the potential for them to flood and further contaminate the water that flows in South Carolina. This idea is not far from reality considering that many North Carolina farmers in 1999 were forced to change regulations due to Hurricane Floyd. At that time over 40 hog operations spilled the contents of these lagoons, which

soaked into the soil and flowed into local rivers. In 2000 legislation was put in place to find safer alternatives and many operations were downsized or closed. However, a decade after these incidents researchers still found high concentrations of fecal bacteria in the surrounding surface waters (Helmer, 2018). If these claims are true, it could mean potential health risks every time the water flows south.

*What do you wish your community knew about flood victims?*

Another important question that we asked when analyzing previous interviews is what each resident wishes their community knew about flood victims. This question is extremely important when it comes to future advocacy and policy changes for flood victims in the future. One of the most common sentiments shared by all local flood victims was a need for more understanding about the economic burden that comes with your home being flooded multiple times. When your home and all of your personal items become soaked in dirty flood water, nearly everything must be disposed of and replaced. Even after the water subsides from their homes, it leaves behind mold and mildew that ruins everything it touches. Days after each major rainstorm or hurricane, large piles of trash filled the driveways of Rosewood residents. In these piles of trash are everything from flooring, dry wall, and home appliances. All of these things had been ruined by water or mold and needed to be thrown away and replaced. When natural disasters or emergencies like this occur, residents with home or flood insurance shouldn't have to worry about coming up with the money to rebuild their homes. However the truth is, in many cases resident's insurance policies failed to cover the full costs of replacing and rebuilding their homes, or completely refused to cover anything at all. Before the cycle of flooding began, some Rosewood homeowners didn't even have flood insurance due to their homes not being marked as

a flood zone. Previously, flooding had never been much of a concern for residents until recently and many felt no need for flood insurance. This combination of factors led to many facing devastating financial consequences in the aftermath. An insightful example of this is the case of Ms. Anderson, a former Rosewood resident, who has been previously displaced due her home flooding. In her interview, Ms. Anderson describes her frustration when finding that her flood insurance would not cover the cost of rebuilding due to it being deemed “standing water.”

Because much of the water that flows into this area comes from storms and potential dam issues in North Carolina, the water isn’t considered to be flash flooding, and therefore is not covered under their flood insurance. Of course, when choosing to get flood insurance she was unaware of this loophole that would prevent her from getting her insured amount. Residents that did have flood insurance found the process to be extremely complicated and difficult to manage while also coping with losing their homes to the floods. In order to receive reimbursement for the items they lost in the homes, each item must be written down individually and sent to the insurance companies. When trying to sort through your entire home, it can be a time consuming and daunting task. When insurance cannot cover expenses the government agency, FEMA, is designed to support people who have been impacted by natural disasters. However, this agency is a big source of contention among flood victims. When natural disasters occur, FEMA will offer some financial assistance to victims to help with replacing and rebuilding. The amount of money that people receive in payouts is supposed to depend upon the amount of loss and potential cost of being displaced from your home. However, much of this assistance even when combined with insurance payouts do not cover the full cost of starting your life all over. There are many unseen costs when rebuilding your home after a disaster such as paying for moving trucks, renting equipment, and even hotel or rental costs for those who have been displaced. For the average

middle-class family, these costs add up quickly and could mean having to take out thousands in debt. To further cover these types of extra expenses, FEMA offers homeowners low interest small business association (SBA) loans to cover some of the extra costs. While these loans can be extremely helpful for victims looking to rebuild their homes again, it can be difficult to repay your debt when facing a repeated cycle of flooding. Ms. Anderson, the homeowner who faced difficulties getting assistance from her insurance, also dealt with this cycle of taking out loans just to have to rebuild again. What is the point in continuing to take out these loans to fix their homes when you know the water is coming again, many residents asked. This leads to families having to make the big financial decision of whether they can afford to stay in their homes or move to higher ground.

Another aspect that victims thought was being overlooked in their community was the emotional toll of losing your home to the flood water. Like previously discussed, flood victims' emotional and mental health can be greatly impacted when dealing with the loss of their homes and communities. Many people's homes have been destroyed along with their most valuable and sentimental items. Things such as old family pictures or heirlooms are items that can truly never be replaced with any amount of payout. In the interview with Ms. Williams recounts how her sister who had also been impacted by flooding in the area lost all her family pictures. She no longer has any of her wedding pictures or old memories of her kids as children due to the flooding in her home. While losing some old pictures may not seem like a big deal, these things are gone forever. The same is felt for those Rosewood residents and others around the county who do not want to leave their homes. Many of the interviewees have remained in their homes despite the recent cycle of flooding. These residents have lived in this community for decades

and have built their own communities to be a part of. The thought of losing this community makes the decision of moving to a dryer area a difficult one.

*What changes would you like to see in your community?*

When analyzing the question of what changes would the residents like to see in their community, there was a large array of answers. Many of the responses related to possible solutions to the issue of repeated flooding near their homes and around Horry County. One of the biggest changes that nearly all participants would like to see is more support from their communities. There is an obvious lack of both financial and emotional support for flood victims in our area when it comes to supporting their needs. When natural disasters occur, such as major flooding, government agencies and nonprofits are supposed to be there to assist victims. However, much of that support never seems to reach the hands of the people that are in need the most. Millions of dollars in support is sent to the state government in order to aid victims after disasters, however, many people impacted go without seeing much assistance, if any at all. There are so many different channels that the money must go through before reaching residents that it can be hard to even qualify for federal or state assistance. There is also a feeling among several interview participants that there is a lack of support for flood victims at the local and state government levels. Many feel that their local council members, senators, and congressmen are not doing nearly enough to advocate on the part of local victims of flooding. These are the people in the community that can make actual policy and regulations that could change how flooding affects residents, but their voices have been ignored. Many residents described their personal experiences of being shut down or overlooked by government officials. In the interview with Ms. Wilson, a long time Rosewood resident, she shared her frustrations with feeling

overlooked and not taken seriously. In her interview, she describes nearly feeling like screaming to get the attention of local politicians on the issue of flooding who have long ignored many communities' pleas for action.

Another one of the changes that many residents would like to see in the future are changes in planning and zoning policies. These types of changes are important to not only address the flooding issue in the area, but to also make actual policy changes to prevent it from happening again. Several interviewees discussed how many of the neighborhoods that flood frequently in the Horry County area are places that should have never been built on in the first place. Some of the communities that have been built over the last couple of decades may have been previously designated as marshes or swamp land. This is a big issue for residents of these communities because this area was originally a sanctuary for wetlands that were supposed to help to absorb water during floods. When there are fewer areas that can soak up flood water, it makes the impacts of heavy rain events more severe. Real estate and commercial companies come into these types of areas willing to pay for the land, without considering the potential consequences of overdevelopment. Many Rosewood residents feel they are now paying the price for those zoning decisions made by the local government. Sections of the county that had been in higher elevation and not in a flood zone are now the ones experiencing flooding events on a nearly annual basis. A potential solution brought up by one resident was the suggestion that some of these neighborhoods that were once marshland and swamps should be “put back to nature”. By removing the homes and allowing for it to go back to its original purpose, it might be able to negate some of the damage that has already been done. This process would require the state to buy out residents' homes in order to take back the land. The idea of buy outs and

returning the communities to nature are solutions that very few participants were completely on board with when it comes to changes that should be made. While buyouts may be an optimal solution for the residents that would like the opportunity to get out, many people are not willing to just up and leave their home. Others are afraid that their homes will be undervalued during the buyout process and will have to pay the remaining balances of their mortgages.

Lastly, one of the biggest changes that many Rosewood residents would like to see is an overall awareness of the issue of flooding. Many residents believe people within their own community and around the county are unaware of what is happening. People may see flooding on the news during hurricanes and other natural disasters, however, that attention is short lived. The news cycle moves on to the next story and the volunteers dwindle, yet residents whose homes have been destroyed are still left behind. In order to see the changes that the community wants, community stakeholders must first be aware of the issue. Among many of the people that were interviewed, there was a feeling that there is not enough education and advocacy being done for their community. As more people grow to understand how people in our area are being impacted by flooding, they have more voices advocating for their cause. Local organizations such as Horry County Rising and Rosewood Strong have been created to support victims and advocate for their cause, however there is only so much communities can do on their own. As more people become educated on the issue of flooding in this area, politicians can no longer ignore their voices.

## **Discussion**

When first starting this research project, my goal was to gain a better understanding of the health impacts that flooding has on individuals. This topic was inspired by my time as a

student in the Water and Women class that sparked my interest in the environmental aspect of Public Health. As a longtime resident of Horry County, I have seen the devastating impact that flooding can have on communities, and the lack of help and resources for victims afterward. People in my own personal life have been victims to the vicious cycle of flooding and have been displaced from their homes. Because of this, I have become more passionate about researching and advocating for flood victims in the Horry County area. I began this project with the idea of interviewing people around that county that had been previously affected by flooding. I became inspired by the Bushwick Action Research Collective to take a more participatory method of research by conducting interviews with residents and then recording and photographing their responses. Then I would disseminate these photos on social media to share with the public. However, this plan of action was never completely able to come to fruition. During my process of looking for research participants, it proved difficult to find people ready and willing to participate. I made posts on social media and in local flood victims support groups. When this proved to not be bearing much fruit, I moved on to the idea of attending an in-person event. I attended a local planning and zoning meeting for residents living along Highway 90 in Horry County. I passed out flyers and talked with residents, many of whom were new to the area. When talking with them, many of the new residents were concerned about their homes flooding in the future and how that could impact them. Many had heard the stories of this area flooding during storms and hurricanes from locals after they had already purchased their homes. Although this was a great networking opportunity and allowed me to talk with a lot of residents about the issues in our county, I was not able to meet many people that had already experienced flooding. This led to a change of direction for my research, and I began focusing on analyzing the interviews taken as part of the Flooded Afterlives project.

In our analysis of the interviews, the information was broken down by the three main research questions. The primary research question was to understand how people's health had been impacted by flooding. One of the main findings from this question was the effect flooding had on the mental health of victims. Many residents had discussed stories of PTSD-like symptoms and anxiety. This was especially true for residents that had experienced their homes flooding more than once. There were also reports of potential physical health hazards coming from the flood water itself. Because much of the water that flows into South Carolina comes from North Carolina, there were accusations of flood water being contaminated by hog farms. This claim is quite concerning and could potentially cause serious issues for human and environmental health.

When it comes to things that residents wish others knew in the community, a lot of their responses had to do with the aftermath of your home being flooded. The economic losses that many people faced after flooding were extremely devastating, especially for those who have been repeatedly affected. Learning to navigate through insurance policies and government systems such as FEMA in order to receive assistance was a difficult task. In some cases, people were not even eligible for receiving payouts from their insurance company and had to lean on credit cards and SBA loans from FEMA. Another detail residents wish more people in their community knew about was the true toll that flooding can have on people and their families. Dealing with a natural disaster that has destroyed your home and community can be emotionally devastating. In our results, it was discussed about the difficulties of losing personal and sentimental items that are irreplaceable. Losing things such as family heirlooms and pictures to flood water or mold can take a toll on residents.

Looking at the last question, there were many different changes residents recommended that could help flood victims. One of the most important changes that was discussed was receiving more support from both the local and state government. From many of the stories that participants shared, there was an obvious lack of support for victims. Rosewood and other communities around the county have been fighting for local government to hear their pleas for changes in things such as zoning and planning regulations that could avoid disastrous flooding. There is also a strong sentiment among residents that there should be more financial support to victims during the aftermath of floods. After major disasters South Carolina receives millions of dollars in aid for victims, however, many feel that those resources are not reaching the people truly in need. Programs like FEMA offer support only to people who fill certain requirements and are limited in the amount that they offer victims. It is commonplace that many residents are forced to take out credit cards and SBA loans in order to recover from their homes flooding. Making the process of receiving aid easier and more impartial could be game changing for flood victims and their communities.

## **Conclusion**

In summary, the analysis of these interviews has shown light on an abundance of important issues that affect flood victims. The interviews conducted with Rosewood residents gave an insightful view into the true costs of this continued cycle of flooding in the Horry County area. It is important to understand the story of these individuals in order to offer better solutions and aid when these types of natural disasters occur. From the results, it is clear that people's health and well-being is being affected by flooding. This is especially true when looking

at the participants' feelings about their own mental health. There is currently a large gap when it comes to research into this area that could potentially reveal long term effects from experiencing flooding and the aftermath. During my search for resources and references, it was very difficult to find articles that focused on the health of individuals after experiencing flooding. In order to offer long term solutions for victims, it is important that projects like the Flooded Afterlives continue their work and inspire others to do the same. It is crucial that people begin looking at this issue of flooding as a community problem, and not the fault of the individuals. It will take more education and advocacy around the state and county for true change to happen for victims of flooding. Without the support from local government and legislators, these communities will continue to be overlooked. The solution to this complex problem is not a one size fits all fix. However, in order to protect more people in our area from falling victim to the constant floods something must be done.

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