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Flooding Schools: School Mental Health Providers and the Climate Crisis

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Abstract

This study provides an example of using a problem-solving model to explore the impact of the climate crisis on schools. Using publicly available climate change and flooding prediction data, we estimate that by 2100, assuming a “medium” climate change scenario, more than 1677 schools in the coastal United States are expected to flood every year and more than 2262 schools are expected to flood every 10 years. Within the data, “medium” is defined as warming levels that will lead to an estimated five feet of sea level rise by the year 2100. Limitations in the data suggest these numbers are likely overly conservative estimates and preclude the analysis of more extreme climate models. Potential actions, the role school mental health providers, and the involvement of students in climate advocacy are discussed.

Keywords

crisis response, crisis preparedness, climate change, advocacy

Flooding Schools: School Mental Health Providers and the Climate Crisis

In recent years, educators around the United States have watched in dismay as major floods have devastated cities such as New Orleans during hurricane Katrina, Houston during hurricane Harvey, and New York City during hurricane Sandy. Harvey alone caused \$128 billion dollars in damage, the deaths of 89 people, and its related flooding displaced 30,000 people (NOAA National Centers for Environmental Information, 2019). Since 2010, flooding and major hurricanes (often occurring in concert) have cost the United States an estimated \$472 billion and 3755 lives (NOAA National Centers for Environmental Information, 2019). The emotional toll, the toll of lost educational opportunities, and the toll of displacement on school communities around the country is enormous and difficult to calculate. This toll is not distributed equally, with already vulnerable communities bearing the brunt of the devastation (see Kazmierczak & Cavan, 2011 for an example). The damages of flooding occur within a context of increasing climate-related disasters of all kinds, including wildfires, economic disruption, disease, heatwaves, droughts, forced migration, and armed conflict (see Clayton, Manning, Krygsman, & Speiser, 2017 for an overview of climate disasters and the links to mental health).

The physical health and mental health concerns in children following natural disasters are well-documented (Carroll & Frakt, 2017; Shultz & Galea, 2017; Van Susteren, 2018). In addition to the broad mental health concerns due to climate-related disasters and the existential threat of climate change, school flooding in particular has a plethora of negative consequences. The economic costs of flooding to school districts are extremely high. For example, estimates place the damages to school infrastructure from Harvey at over \$970 million dollars in Texas alone (Hemmer & Eliff, 2019; Morath, 2017). In addition to the costs of school infrastructure damage, decreases in property values resulted in a school funding gap of approximately \$1 billion (Morath, 2017). Flooding can also expose previously existing hazards, such as asbestos, that significantly increase the cost of repairs (Hemmer & Eliff, 2019). The Houston Independent School District closed 75 schools due to “major or extensive flood damage” caused by hurricane Harvey (McWilliams & Trotta, 2017). It is further estimated that Harvey caused 3,062 school closures due to flooding, power outages, and/or structural damage, with at least 811 of these closures involving flooding (Jackson & Ahmed, 2020). Extensive time and administrative resources are spent addressing the burden of insurance claims, construction contracts, and procurement processes following flooding (Hemmer & Eliff, 2019). School districts also have to contend with how to make up instructional minutes lost to the disaster or to obtain waivers foregoing those minutes (Hemmer & Eliff, 2019). Schools that do not sustain extensive damage are often converted into temporary shelters and resource centers for students, families,

and community members. For example, following Harvey, approximately 100 Texas schools were converted to temporary shelters (Morath, 2017). Nearly 1.4 million students were directly impacted by Harvey and 112,000 of those were displaced by the storm (Morath, 2017). In one Texas district, the number of homeless students tripled following hurricane Harvey (van Hamersveld, 2019). More than 5,000 students were reported missing after hurricanes Katrina and Rita, approximately 50,000 students missed school following Katrina and Rita, and roughly 15,000 children did not attend school at all during the 2006-2007 school year after Katrina and Rita (Pacheco, 2018). Flooding also endangers the safety of drinking water, particularly in low-income areas (Pacheco, 2018). Finally, it is a well-established research finding that traumas with an interpersonal component tend to lead to increased symptom severity when compared to accidental traumas (Alisic et al., 2014). As the causes, consequences, and existential threat of climate change are now clear, young people may come to see erroneously framed “natural” disasters as caused by the inaction or neglect of older generations, adding a larger interpersonal element to climate-related distress.

It is from this backdrop that many school mental health providers have had to quickly determine how to best serve their students, families, and schools during acute climate crises like hurricanes and flooding and manage the on-going chronic psychological and emotional impacts of climate change. Although we write from the perspective of our work in school psychology, in this paper we refer to school mental health providers to include the full range of professionals in this work: school social workers, school counselors, school psychologists, behavior analysts, nurses, and others. The American Psychological Association (APA) has released two major reports related to this topic, titled *Psychology & Global Climate Change: Addressing a Multifaceted Phenomenon and Set of Challenges* (Swim et al., 2009) and *Mental Health and Our Changing Climate: Impacts, Implications, and Guidance* (Clayton, Manning, Krygsman, & Speiser, 2017). Neither report mentions the role of school mental health providers in responding to the climate crisis. Schools are already contending with increasingly severe natural disasters – both at the level of responding to the educational needs of students following the traumatic events of climate-related disasters and at the infrastructure level of damaged school buildings. The National Association of School Psychologists (NASP) released a guidance document for supporting students following a natural disaster (NASP, 2016) but has yet to release a policy statement on climate change, nor to our knowledge have the American School Counselor Association or the School Social Work Association of America. The American Medical Association, the American Academy of Pediatrics Council on Environmental Health, and the National Association of School Nurses have all issued policy statements regarding the health threats of climate change (American Medical Association, 2019; Council on Environmental Health, 2015; National Association of School Nurses, 2019). The

position brief released by the National Association of School Nurses cites negative mental health outcomes and worsening social inequities as consequences of climate change and calls for school nurses to share evidence-based information to increase awareness of the effects of climate change due to their ideal position of working within schools and communities.

Social work organizations have also issued several position statements and guidance documents regarding the role of social workers responding to the climate catastrophe. For example, the Australian Association of Social Workers released a policy document in 2017 and officially declared a climate emergency in 2019 (Australian Association of Social Workers, 2017; Australian Association of Social Workers, 2019). The International Association of Schools of Social Work and the American Academy of Social Work & Social Welfare have also called on social workers to support environmental justice (Campanini & Lombard, 2018; Kemp & Palinkas, 2015). Social workers are also researching responses to climate change from a variety of angles including migration, the impacts on island communities, and climate change activism – all of which have attendant overlaps with school systems (Booth, 2019; Joseph, 2017; Powers et al., 2018). As the intensity of the climate crisis continues to rise, school mental health providers across disciplines can join behind these position statements, and advocate for the creation of more like these, while lending their skills as data-based problem solvers, researchers, prevention and advocacy experts, crisis responders, and mental health providers.

School mental health providers are uniquely positioned to use a data-based, problem-solving model to prepare for and respond to the effects of the climate crisis on schools. In this paper, we develop a worked example of applying a problem-solving model (i.e., problem identification, problem analysis / solution development, solution implementation, and solution evaluation; Bergan & Kratochwill, 1990, Kratochwill, Altschaeffl, Bice-Urbach, 2008) to the issue of flooding schools in the United States. Above, we briefly identified the problem of the climate crisis and flooding as it relates to schools in the United States. Below, we analyze the problem of school flooding through a review of publicly available flood prediction data from a collection of scientific models. We then attempt to generate potential actions to address the problem that uniquely involve the role of the school mental health provider. We adopt this problem-solving process in order to encourage conversation and action in the field. We hope school mental health providers will implement a variety of prevention and response solutions to school flooding as well as evaluate the effectiveness of various solutions.

Method

To certify the problem of school flooding, state-level data was aggregated for every coastal state available in the public data from the *Surging Seas Risk*

Finder website (<https://riskfinder.climatecentral.org>). The site uses peer-reviewed studies and government reports to create risk predictions across several climate change scenarios. The reader is referred to <https://riskfinder.climatecentral.org/about> for an in-depth accounting of the site's analytical choices and scientific backing. For our analysis, we selected a "medium" climate change risk model in calculating projected sea level rise (i.e., an estimated five feet of sea level rise by year 2100). Two flooding scenarios were used to estimate additional water levels beyond sea level rise: a "mild" flooding scenario (defined as a flood that is expected to occur approximately once a year) and a "moderate" flooding scenario (defined as a flood that is expected to occur approximately once every 10 years). The causes of flooding beyond sea-level rise are multiply determined (i.e., storms, increased precipitation, tides, wind, infrastructure), thus the "mild" and "moderate" flooding scenarios are based on the likelihood of flooding over time – not on the causes of the flood per se. This method was used to calculate the likelihood that schools will flood in coastal states. Inland states also face flooding exacerbated by climate change, but this information is not available in the current data set. Lastly, data from the same website were used to compile how many schools in coastal states sit below the estimated high-water mark under these two different flooding scenarios.

Results

Given the data, we estimate that by 2100 under a "medium" climate change risk model prediction (i.e. five feet of sea level rise by 2100), approximately 1677 schools in the US will flood every year. Under the same climate change prediction, an estimated 2262 schools will flood every 10 years. These two flooding scenarios amount to high water levels that are expected to be 6.2 to 7.2 feet (1.89 to 2.19 meters) above average high tide. These results and a breakdown by state are presented in Table 1.

Discussion

Implications

Above, we certified the problem of school flooding using publicly available prediction data. This problem has wide-ranging implications – the full scope of which are well beyond the purview of this brief report. Beyond economic cost and loss of life, for example, it is well established that natural and climate-related disasters lead to increases in several health concerns, including mental health concerns among children (Carroll & Frakt, 2017; Shultz & Galea, 2017). Loss of educational records, interruptions of time on learning, population displacement, the

Table 1: Results

State	Mild flood water level	Moderate flood water level	Schools below mild flood water level	Schools below moderate flood water level
ME	7.5	8.2	2	2
NH	6.3	7.1	0	1
MA	6.7	7.7	68	74
RI	6.4	7.5	0	0
CT	6.7	8.1	16	21
NY	6.7	8.1	167	216
NJ	6.8	7.8	125	141
DE	6.8	8	5	7
MD	6.2	7.3	15	17
DC	6.3	8.4	ND	ND
VA	6.2	7	15	28
NC	5.3	6	18	26
SC	6	6.7	29	41
GA	6.1	6.7	17	25
FL	5.6	6.8	500	889
AL	5.2	6.6	2	2
MS	5.2	6.6	1	4
LA	7.7	9.5	477	509
TX	6.2	7.1	56	92
CA	5.1	5.5	126	126
OR	6	6.8	5	5
WA	5.4	6.1	28	31
HI	5	5.2	5	5
AK	ND	ND	ND	ND
	mean 6.2 ft. above high tide	mean 7.2 ft. above high tide	1677 total schools	2262 total schools

Note: All predictions are based on a “medium” climate change risk model. A “medium” climate change risk model estimates approximately 5 ft. of sea level rise by 2100. Mild Flood: A “mild flood” is a flood that is expected to occur approximately every year. Moderate Flood: A “moderate flood” is expected to occur approximately once every 10 years.

physical damage of school facilities, and the potential need to relocate entire schools are just some of the many implications of school flooding made worse by the climate crisis.

We turn now to brainstorming potential solutions as the next step of this problem-solving model. We claim no particular expertise in the political, engineering, city planning, and emergency management skills that will undoubtedly be needed to move forward. Rather, we brainstorm solutions to spur conversations, action, and evaluations of ways to move forward as school mental health providers. The “CARE” framework for addressing climate change – clinical, administrative, research, and educational – may be a useful organizing strategy for schools in responding to the problem posed by school flooding (Cloverdale et al., 2018; Stewart, 2018). Another useful organizational tool may be the socio-ecological model discussed by Sheffield et al. (2017) that organizes environmental health initiatives for climate resilient schools across the following domains: School level, district level, and the regional/national level. The following paragraphs discuss potential avenues within and across these four areas that may be particularly relevant to school-mental health professionals. Lastly, school mental health providers may be especially well suited to organize planning and response efforts into new or pre-existing multi-tiered systems of support models that spans universal, selective, and indicated initiatives within the school community.

One area in which school mental health providers are uniquely situated is, of course, in responding to the mental health needs of students before, during, and after flooding. For example, this might include providing a multi-tiered model of services to address psychological trauma (Reinbergs & Fefer, 2018). Consistent with the PREPaRE model of school crisis response, school mental health providers will also likely be asked to be involved in developing plans for how the school will respond to disasters to help students (Brock et al., 2016). This may involve identifying students and schools most likely to experience the harshest effects, conducting table-top exercises to ensure preparation for response, and identifying large venues on higher ground to use both during and following the crisis. Research has examined screening and triage for negative mental health effects following flood exposure, interventions to reduce absenteeism following school flooding, and the disruption in availability of psychiatric medication after hurricane Harvey (Dodd et al., 2019; Echterling, 1989; Pullins et al., 2005; Russoniello et al., 2002; Storch et al., 2019). Research has also noted that dealing with grief related to climate change may be another important clinical intervention point (Consolo & Ellis, 2018). School mental health providers are well-positioned to assist with these concerns.

In addition to planning for the adverse mental health outcomes following a natural disaster, school districts will also likely need to develop plans regarding how to respond when the physical infrastructure of their buildings are

compromised. Most notably, coastal communities may soon need to make difficult decisions regarding fortifying existing schools against the risks of flooding or moving them to higher ground. Both options would require significant financial expenses that are not likely to be raised without the support of state and federal governments. As professionals with training in prevention and crisis response, school mental health providers would be well-suited to have a seat at the table for this type of large-scale planning.

One possible action is to leverage the data and resources from the *Surging Seas Risk Finder* used by this article in professional learning communities of educators, with students, or with parent groups. A lesson plan could quickly be developed using the resources from the *Surging Seas Risk Finder* that would spur discussion among stakeholders regarding what they would like to do with the information. For example, as part of an assignment in a science class, students could look up the data for their state or community on the *Surging Seas Risk Finder* and explore the predictions for their area under a wide variety of climate risk and flooding scenarios. Using the website, they could then examine what infrastructure in their community would be affected (including schools) under each scenario. They might then develop a plan to present the data to key stakeholders (i.e. parents, administrators, school committee members, government officials) and urge them to take seriously the issue and develop plans. This type of lesson would integrate scientific literacy, communication skills, and involve students in advocating for their futures. It could also spur related projects such as making schools more energy efficient, reducing reliance on fossil fuels, community resource preservation campaigns, study circles on climate justice issues, and/or advocating for science-based climate education in the general curriculum.

Additionally, school mental health providers help could teach students, parents, and school staff about research regarding the psychological impacts of climate change, findings from psychological science regarding why it is so difficult to confront the challenge of climate change, and insights from the research on what framings and mental skills may be important in helping individuals take valued action regarding the future of the planet. In one example, a youth model of Acceptance and Commitment Therapy was used in a webinar format to educate youth about climate change, equip them with skills to deal with climate-related distress, and to empower them to respond to the challenges of climate change (Hayes, 2020). School mental health providers could contribute to this work and further conduct applied research in this area.

While the path toward developing crisis response plans and caring for students in the aftermath of potentially traumatic events is perhaps familiar to school mental health providers, other obstacles present clear challenges that may be less comfortable. These include advocating with financial decision makers about revamping school infrastructure plans, communicating to the public about how the

climate crisis will affect the education system, and partnering with students, parents, community members, and political leaders to advocate for immediate responses to the climate crisis. Such advocacy can be a powerful source of change despite many obstacles, including convincing organizations in the education sector that confronting climate change is within their mission (see Guthrie, 2019 for several relevant examples of this challenge). School mental health providers, as advocates for children, also may play a role in supporting youth-led efforts to call attention to this issue. Student-led climate strikes from school, for example, are taking place throughout the world to pressure adults to act (Associated Press, 2019). As advocates for public education, school mental health providers may also be suited to stand against corporate interests taking advantage of floods to privatize school systems similar to events in New Orleans after Katrina (Anderson, 2010; Klien, 2007).

Lastly, districts may be severely challenged when surrounding districts flood even if their own buildings were spared. Large influxes of students from surrounding flood-affected districts can create enormous strain across many aspects of the school system: changes class sizes, changes in transportation demands, the need to register large numbers of students quickly who may not have access to formal documentation, the need to implement large numbers of individualized education plans (IEPs) for students with disabilities created by different teams in different districts, and the need to attend to the mental and physical health needs of these new students. One participant in a qualitative study of school nurses following the flooding in Louisiana from hurricanes Katrina and Rita stated: “Our school system was overwhelmed by evacuees. We, as school nurses, were expected to care for our previous number of students (which was very high for each nurse) and to assume care for traumatized, vary large numbers of new kids. It was overwhelming and very stressful” (Broussard, Myers, & Meaux, 2008, p. 81). School mental health providers are likely to face similar challenges across both special education and general education populations.

Limitations

This study has several important limitations, many of which are due to limitations present in the data set used for this analysis. For example, estimates for some coastal areas (Washington DC and Alaska) were unavailable, meaning the true number of affected schools is likely greater than the current estimate. For the purposes of this project, only data from coastal states were aggregated. Flooding is of course also an issue in non-coastal states (Pew Charitable Trusts, 2017), which again suggests these results underestimate the severity of the impacts of flooding schools. Additionally, the school location data used by the *Surging Seas Risk Finder* is a decade old (2010) and thus does not reflect any changes to school

locations (closings, openings, moves) during that time. In this analysis, school flooding is predicted to occur in schools that are below the water level reached through climate change and flooding. However, this is an oversimplification as local variations in terrain and drainage may collect or divert water in more complex patterns.

Concerningly, climate science tells us that a “medium” climate change scenario leading to approximately 5 feet (1.5 meters) of sea level rise by 2100 is increasing unlikely (DeConto & Pollard, 2016). The upper range of climate change risk scenarios estimate approximately 11.5 feet (3.5 meters) of sea level rise by 2100 (see Sweet, Kopp, Weaver, Obeysekera, Horton, Thieler, & Zervas, 2017). The choice of examining mild flooding (expected once a year) and moderate flooding (expected once every 10 years) may also underestimate the true severity of possible flooding. For example, hurricane Harvey was Texas’s third ‘once-in-500-year flood’ in three years (Ingraham, 2017). The analytic predictions used by the *Surging Seas Risk Finder* assume no change in the severity of storms and assume uniform global sea level rise, both of which are not accurate assumptions. These limitations again point to our analysis underestimating the true risk posed by flooding. The reader is referred to <https://riskfinder.climatecentral.org/about> for a more in-depth discussion of modeling simplifications used in the original data. The original data source is limited to the United States. While we hope the analysis and ideas presented in this article prove useful for an international audience, those outside the United States will need different data sources to inform their local problem-solving process.

Lastly, the authors of the current report are not climate scientists and relied on information about flooding models available to the general public. While this has the advantage of using data and tools that a wide range of school mental health providers can easily access, it may mean that important nuances are lost without the expertise of climate scientists in interpreting this work.

Conclusion

This article aggregates state-by-state data to highlight the risk of flooding that U.S. schools face under the looming realities of climate change. The methods used in this manuscript are perhaps overly simplistic for the task at hand and can only provide a rough estimate. However, using publicly available data from an interactive website has the advantage of being easily used, adapted, and repurposed for local stakeholders by school professionals. Importantly, however, these findings align with region specific climate-change research predicting school infrastructure damage using more sophisticated methods (for example, Heberger et al., 2011).

We agree with the conclusion of Sheffield et al. (2017, p. 11) outlined in their environmental health work on climate resilient schools: “Better surveillance,

more research, and federal oversight of environmental factors in schools (specific to climate risks) is necessary, as exposures result in short- and long-term negative health effects and climate change risks will increase over time." By framing this data in the context of the problem-solving role of the school mental health provider, the authors hope to spur discussion about the roles all school-based mental health providers will need to take on in order to continue to provide high quality educational and mental health services to all students in a changing world. In so doing, we recognize the many skills and unique positioning of school mental health providers and would like to honor all educators who have fought for their students following the many recent flooding tragedies and those to come.

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