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Well-being and Mental Health Impact of Household Flooding in Guyana, the Caribbean

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Introduction

Floods are the most common type of disaster globally, and they are responsible for about half of the deaths caused by all types of natural disasters (Alberman et al., 2012). A report from the World Health Organization (WHO) posits that flooding is expected to occur more frequently over the coming decades, at a higher intensity and for longer durations as a consequence of climate change and sea level rise (WHO, 2009). The steady rise of sea level puts coastal regions at high risk of flooding especially for storm surges and big waves. Flooding has significant social, economic, and environmental consequences on both individuals and communities (Alberman et al., 2012). The effects of flooding are felt unequally and are dependent on the location, vulnerabilities, and capacities of the communities they affect, and the ability of healthcare providers and public health practitioners to quickly assess community needs

ABSTRACT

Guyana has annually experienced excessive rainfall and flooding since 2005. This study investigated the general well-being and mental health problems among occupants of households affected by the December 2008 flooding in Guyana. A cross-sectional study design was used to administer validated questionnaires, which included sections on demographics, environmental exposure, general health, and personal behavior. The response rate to the survey was 70% (130/185). The findings indicate an increased self-reported poor health for study participants who smelled moldy odors inside of their home (OR: 4.1, 95% CI: 2.0–12.0) and for individuals who had mold or mildew inside of their homes (OR: 3.0, 95% CI: 1.2–7.5). Individuals whose homes had flooded previously were also shown to be slightly more at risk for experiencing diminished interest in daily activities (OR: 1.3, 95% CI: 0.5–2.9) as well as diminished involvement in social activities (OR: 1.9, 95% CI: 0.7–4.8). Also, participants who had their houses previously flooded reported an increased difficulty in concentrating (OR: 2.4, 95% CI: 0.9–6.4). Flooding might be a possible risk factor for well-being and mental health problems among the occupants of affected households.

Keywords: flooding, health outcomes, Guyana, mental health

and allocate resources effectively and efficiently.

Flooding is associated with short- and long-term health outcomes. The short-term health impacts of flooding have been well documented by the scientific community and include injuries, water-borne diseases, respiratory diseases, vector-borne diseases, exposure to toxic substances, skin rashes, exacerbation of asthma, and malnutrition (Ohl & Tapsell, 2000). Researchers have established that the levels of indoor dampness in homes following a flood are higher in homes inundated with water compared to those that were not inundated, making the inundated homes more susceptible to higher levels of mold (Riggs et al.,

2008; Azuma et al., 2013). In many developing countries, the damage and impact of floods persisted at least 6 months following the initial event (Oluwatayo, 2013; Kirsch et al., 2012). Rose and Akpınar-Elci (2015) found a statistically significant relationship between the presence of mold inside of a home and respiratory symptoms experienced among the occupants of the flooded homes in Guyana. Because floods disrupt the normal course of life for many people, it is possible that flooding may cause or exacerbate certain aspects of health including chronic conditions, psychological stress, depression, emotional trauma, and anxiety. Bei et al. (2013) found that flooding was associated

with adverse psychological impacts especially among older adults.

Guyana's coastal regions experience two rainfall seasons each year, with the major peaks occurring in June and December (Bovolo et al., 2009). Prior to January 2005, the average amount of annual rainfall in Guyana was 7.3 inches over the previous 100 years (GINA, 2005). Since 2005, Guyana has annually experienced excessive rainfall over shorter periods. From January 2005 to February 2005, Guyana experienced torrential rains that amounted to over 60 inches (GINA, 2005). Since then, several areas of the country have been subject to frequent flooding. In December 2008, Guyana experienced extreme rainfall that affected many of the low-lying communities (Grosvenor, 2009). The coastal lowland areas of Guyana are below sea level and are therefore more prone to frequent flooding events of these residential communities. This predisposes them to not only damage to their property, crops, and livestock but also to illnesses associated with flooding and subsequent stagnant water (Lane et al., 2013).

In this study, we focused on the Atlantic coastal communities of Guyana that were affected by a major flood in 2008. The aim of this study was to examine the potential effects of flooding events on mental health and overall well-being among occupants of affected households.

Methods

Study Design

The study was conducted in 2009 in Cove and John, Guyana, which is often prone to flooding, given its proximity to the coast. Methodological study details of the project and

selection criteria can be found in our previous publication (Rose & Akpinar-Elci, 2015). Approval was received from the institutional review board from St. George's University before data collection began.

Study Population and Data Collection

Criteria of inclusion of households in the research study include "(1) have experienced flooding in December 2008 and have been at least 30% of the community flooded during the December 2008 flooding, (2) have between a minimum of 100 and a maximum of 500 households, (3) have 75% or more of its homes as wooden homes, and (4) be a residential community" (Rose & Akpinar-Elci, 2015).

In total, 185 households were generated from the criteria and they were invited to participate in the study, and 130 households completed the study (Rose & Akpinar-Elci, 2015). Three trained interviewers were responsible for the data collection. In total, 349 questionnaires were collected from participants who were 16 years and older from 130 households.

An adapted version of the questionnaire designed by the U.S. National Institute for Occupational Safety and Health was used by the research team to assess health-related variables in the affected communities (Rose & Akpinar-Elci, 2015). The questionnaire was used to ascertain self-reported information about feelings of depression, general health, level of physical activity, social life, self-reported symptoms, physician diagnoses, demographic and environmental characteristics, the presence of chronic diseases, and family history (Rose & Akpinar-Elci, 2015).

Data Analysis

Using the SPSS statistical software package, Version 24, the data were analyzed to predict the prevalence of self-reported poor health, feelings of downheartedness or depression, and the level of interference with social and daily activities. Fisher exact test was used to determine if there is a nonrandom association between variables. Measuring depression by age, gender, race, income, and education level, we adjusted unconditional logistic regression models by comparing flooded and not-flooded household occupants. The odds ratio (OR) was also calculated to determine the strength of the association, including 95% confidence interval (CI). The unconditional logistic regression model was used to control for uncertainties related to the limitations of cross-sectional study, such as failure to establish causality among variables and the lack of comparability between households.

Descriptive analysis was conducted to examine the demographic, environmental exposure, personal behavior, and health-related characteristics of the study population. Table 1 summarizes the results of the descriptive statistics.

Results

The median age of the participants was 41 years ($SD = \pm 18.1$ years), 52.4% were female, 75.1% reported as East Indian origin, and 19.8% reported as African origin. Among the participants, 59.6% had less or equal to primary education, and 47.3% made less than \$50,000 GYD (Guyana dollar) monthly (1 USD \approx 200 GYD). The results also showed that there were 77.8% who reported owning their home and 76.8% who reported having their home flooded during the December 2008 flooding. Of the respondents,

TABLE 1

Self-reported house and household occupants' characteristics.

Characteristics	Participants	
	<i>n</i>	%
<i>House characteristics</i>		
Flooded in 2008	268	76.8
Previous flooding	312	89.4
House owner	272	77.8
Roof leaking	151	43.0
Visible mold inside the house	37	10.7
Smell of mold	36	10.6
<i>Household occupants characteristics</i>		
Poor health	46	13.3
Less interest in daily activities	161	46.1
Trouble to concentrate	147	42.1
Interference with social life	133	38.2
Feeling downhearted	183	52.4

52.4% indicated experiencing feeling downhearted and depressed since the flooding. A total of 46.1% reported having less interest in daily activities due to emotional problems such as depression and anxiety since the flooding (Table 1).

The analysis indicated a statistically significant association between having residual mold on the surface inside of the home and self-reported poor health ($p < .05$, Fisher exact test: 0.034). A statistically significant relationship was also found between the smell of

moldy odor inside of the house and self-reported poor health ($p < .05$, Fisher exact test: 0.000). Fisher exact test is used in place of chi-square to determine if there is a nonrandom association between variables.

There was an increased risk of self-reported poor health for participants who experienced previous flooding (OR: 4.9, 95% CI: 0.6–39.4), for individuals who smell moldy odors inside of their home (OR: 4.1, 95% CI: 2.0–12.0), and for participants

who reported having mold or mildew inside of their home (OR: 3.0, 95% CI: 1.2–7.5) (Table 2). There was a slight nonsignificant increase in feelings of depression or downheartedness for individuals who reported having their home previously flooded (OR: 1.4, 95% CI: 0.6–3.1), for people who had mold or mildew on surfaces inside of their home (OR: 1.3, 95% CI: 0.6–2.8), and for participants who reported smell of moldy odor inside of their home (OR: 1.5, 95% CI: 0.6–3.3). Slight, nonsignificant increase was also found in interest in daily activities for individuals who reported having their home previously flooded (OR: 1.3, 95% CI: 0.5–2.9) and for participants who reported smell of moldy odor inside of their home (OR: 1.2, 95% CI: 0.6–2.7). Participants who had their home previously flooded were at an increased risk of having trouble concentrating (OR: 2.4, 95% CI: 0.9–6.4). This was also found to be true for people who reported having their homes flooded during the December 2008 flooding (OR: 1.4, 95% CI: 0.7–2.6). In addition, individuals who had water coming in their home because of roof or window damage reported a slight nonsignificant increase in difficulty with concentrating (OR: 1.2, 95% CI: 0.7–2.0).

TABLE 2

Risk factors of self-reported health-related perspective among the study participants.

Risk Factors	OR (95% CI) ^a				
	Feeling Downhearted and Depressed	Poor Health	Interest in Daily Activities	Interference With Social Activities	Trouble Concentrating
Previous flooding	1.4 (0.6–3.1)	4.9 (0.6–39.4)*	1.3 (0.5–2.9)	1.9 (0.7–4.8)	2.4 (0.9–6.4)*
Mold inside home	1.3 (0.6–2.8)	3.0 (1.2–7.5)*	0.9 (0.4–1.9)	1.2 (0.5–2.5)	1.1 (0.5–2.3)
Smell of mold	1.5 (0.6–3.3)	4.1 (2.0–12.0)*	1.2 (0.6–2.7)	1.7 (0.8–3.7)	1.5 (0.6–3.2)

^aAge, gender, income, race, and education adjusted.

* P -value < 0.05

Discussion

This study investigated the overall well-being and emotional health of people who continued to live in homes in coastal Guyana that were flooded in December 2008. The findings of this study indicated that participants who had previous flooding reported poor health. Previous research also indicates that individuals who are affected by repeated flooding events exhibit adverse health outcomes over time (Trugeon, 2006; Wieslander et al., 2007).

Riggs et al. (2008) found that a higher level of mold was found in homes that experienced repeated floods. Furthermore, Reponen et al. (2010) established a consistently high association between the presence of microbial concentrations and homes with moldy odors. The microbial exposure was associated with asthma development and reduction of the individual quality of life. Our study identified the increased prevalence of self-reported poor health for people who reported having mold or mildew on the surface inside of the home and for participants who smelled moldy odor inside of the home. Mendell et al. (2011) found a consistent association between indoor mold and multiple respiratory health issues.

The results of our study indicate a slight risk of feeling downhearted and depressed for people who had their homes previously flooded, for people who had visible mold inside of the home, and for those who smell moldy odors inside of their home. Our results indicated that participants who reported previous flooding also reported decreased interest in daily activities, had trouble concentrating, and participated less in social events due to emotional problems. Research

has established that flooding exacerbates psychological problems, such as stress, depression, and anxiety (Azuma et al., 2013; Alberman et al., 2012; Chae et al., 2005). In addition, emotional problems such as depression and anxiety might impact the people's social and physical activities negatively (Steger & Kashdan, 2009). Furthermore, Munro et al. (2017) have established that people who were displaced from their homes due to flooding were more likely to experience post-traumatic stress disorder, depression, and anxiety.

Although the need of mental health services for flooding victims has been well documented in the United States, other countries are still lagging. Although there is little data, the prevalence of mental health disorders in Guyana is 10% to 15% (WHO, 2008). However, only 1% of health care resources are devoted to mental health in Guyana. Flooding responses need to include mental health components to their disaster response and relief plans in order to better address a population that is already subjected to a high level of mental health disorders.

Flooding often disrupts social interactions that are beneficial to people's mental well-being. Mental health resources for short- and long-term flooding responses are critical and should therefore be included in disaster management plans. The impacts of flooding in developing countries are much higher compared to developed nations regarding the loss of life, infrastructure, health, and well-being. As changing climate threatens to exacerbate the rate of these events, the lack of proper local governance and inadequate economic support puts these communities who are already impacted by major flood-

ing events at even higher risk. The impacts of floods in developing countries have become more devastating on the livelihood, security, health, and well-being of the affected population (Oluwatayo, 2013; Walker-Springett et al., 2017).

Some of the limitations of this study are related to cross-sectional study design and the use of self-reported and recalled information due to the lapse of time between the December 2008 flood and the start of data collection. Further studies using qualitative design might help to understand the psychosocial needs of people whose communities are affected by repeated flooding. The strength of this research is backed by a representative sample, which consisted of the entire community, high participation rate, and the use of the previously validated and tested data collection instrument.

Our results showed that individuals who had mold or mildew inside of their home were at an increased risk of poor health. These individuals were also at a slightly risk of depression, have less interest in activities, and have trouble concentrating. Addressing psychological and emotional problems such as depression and anxiety is essential for improving the well-being and quality of life for everyone, especially those who are recovering from a natural disaster. In light of the impact of floods on the mental health and the well-being of the exposed population, it is essential that the local and state leaders understand the long-term effects of floods on all aspects of health and integrate coping measures in all levels of flooding management response in order to safeguard and improve the quality of life among those affected.

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