Understanding excess mortality from not-so-natural disasters

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Hurricane Maria made landfall in Puerto Rico on Sept 20, 2017, as a high-end category 4 hurricane, only weeks after the island had been affected by another hurricane. Puerto Rico experienced severe weather associated with the hurricane, including storm surges and flash flooding. The hurricane severely affected basic infrastructure such as electricity and water for several months, initially leading to a complete collapse of the power grid, affecting all 3·4 million inhabitants.

Early reporting on the death toll of the hurricane by the government and media was confusing and contradictory, and led to several law suits. Ultimately, Carlos Santos-Burgoa and colleagues were tasked with determining the actual death toll of the hurricane, which they now report in *The Lancet Planetary Health*.[1] Beyond political reasons, some of the initial controversy can certainly be attributed to the methodological difficulties of determining excess mortality in post-disaster situations of high complexity. Mechanisms and dynamics of excess mortality might not be obvious and hence cause difficulty in correctly attributing mortality to the disaster. Additionally, studies on excess mortality need to consider issues such as internal displacement and disaster-related migration, which change population baselines. Santos-Burgoa and colleagues[1] accounted for these factors and, using all-cause mortality data from the Puerto Rico Vital Statistics System, estimated 2975 excess deaths (95% CI 2658–3290) from September, 2017, to February, 2018. The uneven distribution of those deaths along socioeconomic and age strata they noted begs further investigation. It is important to understand not only absolute numbers of excess deaths but also the mechanisms and dynamics underlying the excess mortality and hence the reasons for the uneven distribution.

Although it can be argued that the hurricane was responsible for those deaths, it has to be acknowledged that this unequal distribution shows that more than the actual disaster caused by a natural hazard is responsible for excess mortality in such situations and that issues such as development, planning, and other human and societal factors strongly contribute towards turning natural hazard events into disasters. Hence, we need to rethink our use of the term "natural disaster". Although hardly a new idea,[2] there has been increasing attention to the problematic assumptions underlying it.[3] Although the proposed term of "disaster associated with a natural hazard" is lengthy, it is certainly more accurate. Another correct term would simply be "disaster". Both the immediate and long-term situations in Puerto Rico show that the disastrousness of so-called natural disasters is in fact not so natural.

Understanding these not-so-natural underlying human and socioeconomic factors, which contribute not only to excess mortality after hurricanes and other disasters but also to excess morbidity is of vital importance. Hurricanes can affect human health through many mechanisms both in the short term and in the medium-to-long term. Immediate concerns include the risk of drowning and traumatic injury from flooding, high winds, and debris.[4-6] In the medium and long term, health concerns related to hurricanes shift towards communicable diseases, especially those due to remaining flood water and potentially unsafe conditions in shelters.[4,6] In the long term, hurricanes also exacerbate other health issues because of their impact on infrastructure and health systems, leading to a potential increase in the severity of non-communicable diseases and lack of appropriate treatment for other conditions, such as traumatic injury.[4,6] Finally, both the disaster itself as well as the potential socioeconomic decline associated with it can have substantial mental health impacts.[4,6] The severity of the impact of a hurricane is, however, not solely determined by the severity of the hurricane but also by the resilience of the systems in place, including the health system, basic infrastructure, and building codes.

Such systems urgently need to be reinforced and augmented with mitigation measures to reduce the impact of hurricanes on coastal and island communities. Climate change affects ocean and air temperatures; rainfall and precipitation; sea levels; and oceanic and atmospheric circulation.[7] These factors can influence both the severity and the frequency of hurricanes and other tropical storms. Intensity of tropical storms is estimated to increase by 2–11% by 2100 as a result of greenhouse gas emissions, with changes to frequency depending highly on the model being applied.[8] This potential for increased severity and changed frequency, together with the outlined public health concerns related to hurricanes means that communities with an increased risk of

exposure to such hazards need to be better protected. The most vulnerable groups in particular need to be considered in any resilience-building and mitigation efforts because they bear the brunt of excess mortality, as Santos-Burgoa and colleagues[1] have shown.

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I declare no competing interests.

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