Haiti: The potential transgenerational effect of disasters

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Commentary

The scale of the problem

The scale of the damage wrought on the population of Haiti by the recent earthquakes has resulted in almost unprecedented efforts to render aid to a disaster-stricken populace.1 After the immediate aftermath of the earthquakes, it is essential that aid work continues so that the infrastructure can be rebuilt, displaced people re-housed, food supplies unhindered and medical care optimised. This aspect of aid is clear to all. However, the impact of such catastrophes not only on the current inhabitants of Haiti but on future generations has received scant attention.

Effects of disasters on neonatal outcomes

There is a clear effect on the generation of neonates born after a disaster on the magnitude of the Haitian earthquake. A study of births after an earthquake of a similar magnitude that occurred in the Wenchuan province in China, showed an overall decrease in mean birth weight as well as an increase in the proportion of births that were classed as underweight.2 The authors also detected an excess in birth defects occurring in neonates who had been in utero at the time of the earthquake. Can these findings be generalized to other populations and potentially other types of catastrophe? The answer is unfortunately ‘yes’. In utero exposure to the grain famine in Zambia was associated with significantly slowed infant growth trajectories later in life.3 Even disasters in developed countries, where the level of aid to the population exposed would be considered exceptionally high, are associated with an excess of low birth weight in neonates born after the event.4

Long-term implications for health

This increase in the rate of low birth weights will have an effect on the health of succeeding generations. The impact of low birth weight on health in later life has been intensively studied in a series of well-defined populations from the UK and Finland. Studies undertaken in these cohorts have identified low birth weight and subsequent slow infant growth rates as highly significant risk factors for later metabolic and cardiovascular disease.5 Mortality from coronary heart disease was increased in neonates whose birth weight was ≤2.5 kg compared with those weighing ≥4.3 kg at birth [hazard ratio (HR) 1.37, 95% confidence interval (CI) 1.00–1.86]. Findings were similar for type 2 diabetes mellitus or impaired glucose tolerance (HR 6.6, 95% CI 1.5–28). An interaction between birth weight and hypertension was also noted. Recent work in the same population has uncovered a potential impact of low birth weight on measures of intelligence later in life.6 Intriguingly even with a minimal effect on birth weight, in utero exposure to famine is still able to exert a strong influence on glucose tolerance.7

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This suggests that pre-natal adverse events have a long-last effect on long-term health outcomes that can manifest in a manner to subtle to be detected by simple measurements of birth weight.

Would the impact of the earthquake finally have dissipated one generation after the disaster? There is evidence to suggest not. Pembrey and colleagues studied an isolated community in Sweden and found that relative risk of mortality was dependent on the availability of food to an individual’s grandparents. This risk was communicated in a sex-specific manner from grandfathers to males and from grandmothers to females. The mechanism underlying these effects is currently unclear, but several possibilities exist. One is epigenetic alterations. These include DNA methylation and post-translational modification of DNA-binding histones. The methylation of various genes involved in metabolic diseases are known to differ between siblings exposed or not exposed to famine at the time of conception but current studies fall far short of definitive proof. The epidemiological data of Pembrey and co-workers raise the interesting possibility that, if epigenetic mechanisms do underlie this effect, similar changes may linger into succeeding generations. Epigenetics is certainly not the sole possibility. Maternal malnutrition, especially early in life, has been shown to have a lasting effect on placental development in subsequent generations. This could result in similar transgenerational effects but without any epigenetic alterations. Only future studies will be able to elucidate which mechanism is the key.

**Need for action**

These results highlight the critical importance of good nutritional support for unborn generations following a catastrophe such as the earthquake in Haiti. The best method to do this has not yet been fully elucidated but given the effect of maternal birth weight on fetal development, nutritional strategies will have to be targeted towards future mothers of all ages. Unless efforts are directed towards this particularly vulnerable unborn cohort, not only will there be morbidity from the immediate effects of malnutrition and starvation but also an aftershock of further adverse health outcomes may wait to overwhelm an already impoverished health system. Decades after the disaster, when no doubt global attention will have shifted elsewhere this may impact heavily on the Haitian infrastructure.

The potential epigenetic impact of disasters on the genetic regulation of the population affected is an aspect that has not been previously considered. The study of epigenetic epidemiology is currently in its infancy but governments and aid agencies in the future will likely have to take into account the effect of their actions on multiple generations following catastrophes on the scale of the Haitian earthquakes. It may turn out that disasters are writ large in the expression of the human genome in survivors and in the offspring of those survivors.

**Conclusions**

It seems highly likely that the impact of a disaster on the scale of the earthquakes in Haiti will not dissipate in a single month, a year, a decade or perhaps even a century. It is vital that the efforts of the international community to mitigate the deleterious effects of this horrific event are exerted across a similar timescale, no matter the fickle nature of media coverage, and with great care for the vulnerable succeeding generations in Haiti as well as those immediately affected.

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**References**


