DISASTER PARASITOLOGY: ~~BIRTH OF~~ A NOVEL CONCEPT IN DISASTER MANAGEMENT

Abstract

Overtime parasitology has witnessed the sprouting of intra-disciplinary spurs aside its traditional branches; a situation that has advanced the rapid academic and professional development of the discipline. This article summons an intellectual beam on yet another intra-disciplinary spur birthed out of necessity to respond to emerging demands in global development issues. Owing to rising occurrences of natural disasters and current incessant spates of human-induced catastrophes, especially wars, all sublimating in a growing incidence of mass population displacement, new, multidisciplinary partnership is required to build capacity for appropriate response. Medical and health response constitute a major aspect of partnership in the broader concept of disaster management. Disaster parasitology, or crisis time parasitology, finds relevance in this context, where the need for pre-disaster surveillance, vector ecology assessment, transmission monitoring and evaluation, post-disaster risk assessment /evaluation, health impact assessment, laboratory diagnosis, health education, etc. is of essence. This discourse thus advocates the development and concentration of a new body of knowledge of parasitology that is applicable in disaster management.

Introduction

Sometimes the inert components of nature jostle aggressively against humanity; sometimes man induces intense havoc on himself and nature. In both scenarios, man and the environment would experience catastrophes with lingering impacts. A disaster is *a sudden, calamitous event that*

seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources.[1] Natural or man-made, disasters develop from hazards, which could have sudden or progressive occurrence, especially under lack or insufficient response capacity, as ~~is the case~~ in developing ~~regions of the world~~. Natural disasters~~, which~~ can be geophysical (e.g. earthquakes, tsunami, volcanic eruptions), hydrological (e.g. avalanches, floods), climatological (e.g. extreme temperatures, wildfires, drought), meteorological (e.g. cyclones, tropical storms) or biological (e.g. disease epidemics, insect/animal plagues), are ~~most often~~ more impactful on the human ecosystems. Disasters can also emanate from human activities, e.g. complex emergencies and conflicts, complex accidents (e.g. transport, nuclear), famine, environmental pollution, ~~etc~~. [2,1]

Disasters are inherently fatal, with losses of unpredictable dimensions; taking toll on human lives and property as well as socio-economic amenities and the environment, depending on the type of event. However, the impact or fatalities of disaster emerge from a two-prong source; during the event, and after the event; implying that the elements of disaster management intervention must be deployed both on- and post-event. This involves emergency, safety and rehabilitation systems comprising a cascade of rescue, rehabilitation, resettlement and health response interventions. As timely, rapid and efficient as on-event response should be, post-event response is not just necessary but expedient; and this demands full deployment of disaster medicine due to expectable deterioration of health systems, environmental structures and concomitant disease outbreaks.

While concerns of disaster management are wont to beam on all stages of such uncontrollable hazards, (before, during and after event), mass population displacement as the aftermath of disasters is what tends to arouse public health concern and disaster medicine intervention

primarily. The risk factors for communicable disease outbreaks after disasters are ~~known to be~~ associated primarily with population displacement, where indices such as access to safe water and sanitation, the degree of crowding, the underlying health status of the population, and access to healthcare are of essence. This might inform lower disease outbreaks in natural disasters which do not cause mass population displacement, than man-made disasters such as conflicts. [3]

Medical response during disasters constitutes disaster medicine, one of the newest branches of medicine that deals with the medical management of crisis situations; a team-based medicine with a requirement of multidisciplinary and complementary approaches.[4] Disaster medicine is supposedly a holistic health response approach to calamitous emergencies involving the medical and allied sciences; while disaster management in whole represents a syndicated intervention orchestrated by expertise derived from diverse disciplines that cut across medicine, biological, social and information sciences, engineering and logistics, ~~etc.~~; and, depending on the event, would involve an interrelation of specialized activities such as evacuation, transportation, communication, first aid and other medical aids / healthcare services, temporary resettlement of victims, hygiene, epidemic prevention~~, etc~~. In wars, for example, it involves full deployment of the art and science of military medicine.

Concept of Disaster Parasitology

While the discovery and description of parasites is obviously held as the cradle of parasitology as a discipline, [5] the latter had developed alongside other branches of related sciences, since the heralding of taxonomy with Carl Linnaeus' output in zoological nomenclature in his 10th edition of *Systema Naturae* (1758). Today parasitologists ~~are~~ engag~~ing~~ in a diversely challenging sphere in their discipline, from symbiosis to ecology and from epidemiology to disease control~~, etc~~.

Specific focus on specialized concepts within the discipline has been developing with time. For example, the concept of environmental parasitology began to receive increased intellectual beam from the past decade, though aspects of ecology and epidemiology had been there. The emergence of environmental parasitology actually primed parasitologists to concentrate attention on parasites and parasitic diseases from the perspective of the environment and not solely from the perspective of the laboratory. As it were, environmental parasitology has emerged as a bridge between the environment and public health; and knits with yet another intra-disciplinary spur; Public health parasitology. While the concept may be novel, this notion is held not because such relationship was erstwhile inexistent, but because some aspect of the discipline (parasitology) has been focused and developed as a point of interdisciplinary bridge. This intra-disciplinary spur (environmental parasitology) identifies parasitologists who seem to concentrate on field parasitology; ecology, epidemiology, and application of modern environmental tools and procedures (e.g. geographic information systems), to study parasites and parasitic diseases. [6,7] Owing to the intricate relationship between the parasite and the environment, environmental parasitology certainly has interdisciplinary relation with the broad field of environmental health. It finds a place in the health-environment mix. Under stable environmental conditions, studies in this area might not evoke unusual alarm; but it could, under crisis situation.

In disasters, when environmental structures break down, in which case the once intact ecological parameters are disorganized, the indices of the parasite-disease complex are destabilized; ensuing remarkable impact on known trends, especially transmission patterns, host preferences, and infection frequencies. Such must be studied. The focus on such scenarios of crisis time parasitology would constitute a whole body of knowledge. There lies the concept of disaster parasitology.

Disaster Parasitology (or crisis time parasitology) is hereby defined as the branch of parasitology that deals with the management of parasitic disease trends in crisis. It is the application of environmental and public health parasitology in disaster management.

Rationale for parasitology in disaster

The onset of disaster creates an emergency; and the capacity to contain or manage an emergency depends, amongst other factors, on partnership. The elements of disaster management include disaster preparedness planning, disaster response, rehabilitation and reconstruction, and disaster mitigation; as disaster management is aimed at reducing or possibly avoiding the potential losses from hazards, assuring prompt and appropriate assistance to victims, and achieving rapid and durable recovery. [2] In other words, the essence is to rescue the trapped, revive the injured, safe-keep the survivors and restore the ecosystems. Understanding this means understanding that in a disaster event, there are three theatres namely, the impacted ecosystems, where the disaster struck; the transit camp, where the injured are revived; and the displacement camp, where the survivors are quartered. In these, three phases of activities are considered; the pre-disaster, disaster and post-disaster phases. Pre-disaster phase activities include disaster management elements such as preparedness planning~~. Here is~~ where the aim of reducing or avoiding potential losses from hazards comes in. At this stage some kinds of disasters can be averted, or mitigated. These occur at the first theatre. At the disaster phase, the catastrophe is here ~~already~~. The relevant disaster management element here is Response, with the aim of delivering prompt and appropriate assistance to victims. T~~his~~ is still on the first theatre, ~~the impacted ecosystems,~~ which bears the brunt of the disaster. This is the critical point where response must be rapid and appropriate, with such activities like rescue and evacuation of the injured and the unscathed. The evacuated may be attended to in makeshift camps or health institutions away from disaster-struck

area. This is the next disaster theatre. At the post-disaster phase, the event might have ceased; recovery activities set in, the ruins are attended to, the dead are packed, losses are counted. At the same time, defined displaced persons' camps have been established where the survivors are securely and safely settled. This is the third disaster theatre, called resettlement camp, refugee camp or internally displaced persons' (IDP) camp, as the case may be. Ideally the approach to these activities depends on the type of disaster.

The stages of disaster-related / management cascade of events are here consciously demarcated and christened as theatres to re-paint an obvious vivid picture to guide a clear understanding of what and who are/should be involved when disaster strikes. One thing is clear; from the pre-disaster to post-disaster phases, there is the need and relevance of partnership to build capacity for intervention. Each phase of the disaster chain or each theatre of the disaster event has requirement for the components of disaster medicine, military medicine, environmental health, and other health-related disciplines. The inter-disciplinary relationship between environmental health on the one side and environmental parasitology and disaster parasitology on the other was noted earlier above.

The parasitologist is useful in the partnership to build capacity for response to emergency created by disasters. At the post-disaster stage, mitigation activities are needed to reduce the presence and effects of hazards; in this context, referring to disease hazards that could result in outbreaks (disease disasters), or escalate during other kinds of disasters (e.g. flooding related disasters). At disaster stage, where social support systems might have broken down heightening the risk of disease outbreaks and infection, response for relief includes healthcare and environmental health components, which must be delivered by partnership. As pointed out earlier, the stages that evoke

the deepest concern for medical and health intervention are those that capture mass population displacement, which is the major feature of disasters. These involve the disaster and post-disaster stages, where the displaced persons are evacuated, temporarily camped, and eventually resettled. These scenarios play out at local, regional, national or global scales. Often times displaced people are received in terrific numbers across international borders.

Health statistics are comparatively worse in displaced persons' camps than under normal conditions.[8] A host of diseases are known to be associated with disasters, some of which could attain endemic and epidemic status; and are mainly bacterial, protozoal or viral infections. These range from water-related diseases, including diarrheal diseases ~~such as~~ cholera, leptospirosis, balantidiasis, dysentery, typhoid fever, Hepatitis A and E~~, etc;~~ vector-borne diseases~~, such as~~ malaria and other mosquito-borne infections~~;~~ and crowding-associated communicable infections~~,~~ ~~such as~~ acute respiratory infections, tuberculosis, meningitis~~, etc~~. [9,3,10] However, various other infections are possible during and after disasters, depending on the prevailing environmental, economic and sociocultural circumstances, which could also cause escalation in magnitude of existing or emerging diseases, post-event. The potential role of international refugees in the globalization of some infectious diseases has been noted. [11] These would explain the relevance of medical and health response in the whole concept of disaster management. Disaster parasitology finds relevance in this context.

Two issues are evident at this point~~;~~ traditionally, diseases and infections usually associated with disasters are mostly bacterial and viral. Although mortalities due to parasitic disease infections in refugee camps are known, [12] parasitic diseases are largely played down in such considerations. Also, and deriving from the above, the traditional role of parasitologists in emergency situations

is usually limited to the laboratory, specifically for identification of parasites/parasitic infections using basic laboratory techniques or rapid diagnosis. [13] These provoke salient questions, which border on the management of environment-parasite-infection complex; and these questions beam on the rationale and significance of crisis time parasitology:

At pre-disaster phase:

1. Are data on parasite ecology, transmission pattern and epidemiology not relevant to disaster mitigation, which involves risk assessment (hazard and vulnerability assessment)?

At disaster phase:

1. What happens to the ecology and reproductive potential of water-related vectors of parasitic diseases and the adjoining human population (whereby breeding sites are created / exposed either due to breakdown of water supply systems or surge from natural systems, e.g. hurricanes, floods, etc.)?

2. How do disasters relating to wind storms (e.g. cyclones, typhoons and hurricanes) and waves (e.g. tsunami) influence transmission (dispersal) of parasite infective stages, such as cysts, ova/larvae? What is the public health implication of this?

3. Are soil-transmitted helminths (STHs) not of considerable risk during disasters/emergencies?

4. In the context of One Health concept, what about zoonotic infections during disasters and emergencies?

At post-disaster phase:

1. As priority goes to bacterial (mostly GIT) infections during disasters, what about protozoal, helminthic and emerging parasitic infections in refugee/resettlement/IDP camps?

2. What is/are the influence/s of myriads of indices such as overcrowding, poor hygiene, environmental pollution, lack of access to safe water and sanitation, poor housing condition, social / religious habits, lack of vector control / preventive measures, poor / lack of access to preventive and responsive healthcare, zoonosis, ecology, etc. on incidence and prevalence of parasitic diseases in refugee/resettlement/IDP camps?

3. What is the impact of refugee/resettlement/IDP camping or immigration on the (parasitic) disease profile of the host (receiving) / adjoining population/communities?

There are many questions. For concerns about healthcare of disaster victims to be earnest, disaster medicine intervention must be inclusive especially at the post-disaster phase.

Knowledge gap and role of the disaster parasitologist

There does not seem to be a knowledge gap; rather there exists paucity in knowledge application in this regard. There are many studies on refugees/IDP resettlement that reveal the relevance of parasitology in disaster displacement management;[11,12,14] but parasitologists today need to align knowledge with need, in order to make relevant and consequential impact on prevailing or emerging development issues. Parasitology as a discipline cannot be waived away in its role and contribution to public health and medicine, animal health and agriculture; and other derived contributions to socioeconomic development. Disasters are not normal occurrences; they are crisis conditions, which must be managed for the human population to contain it. Parasitologists have significant contributions to make in the disaster management partnership in the areas of pre-disaster surveillance, including parasitic zoonosis surveillance; vector ecology assessment, transmission monitoring and evaluation, post-disaster risk assessment / evaluation, health impact assessment, laboratory diagnosis, health education (pre-disaster and post-disaster/resettlement stages).

Elements of disaster parasitology

The major aim of sharing this novel concept is to arouse attention on the need to develop a body of knowledge on disaster parasitology. This is commencing a campaign to provoke gradual

development of curricular modules that could be infused into our curriculum in the universities, in order for parasitologists to expand their scope of contribution to development issues, in this case, disaster management. The major elements of disaster parasitology would include risk identification (identification of risk factors, at all three phases of the event, depending on the type and nature of disaster), ~~P~~post-disaster risk assessment, health impact assessment, intervention and resettlement studies, epidemic prevention, and health education.

~~Conclusion~~

This treatise intends to create an identity for disaster parasitologists in the context of the need for parasitologists to apply their knowledge in providing solutions to emerging global development issues. It advocates the development and concentration of a body of knowledge that is applicable in disaster management. Owing to rising occurrences of natural disasters and current incessant spates of human-induced catastrophes, especially wars, all sublimating in a growing incidence of mass population displacement, knowledge is required from every angle to respond appropriately. Parasitologists should not stop at taking spot academic studies; they should harness their knowledge and expertise in public health and epidemiology appropriately to emergency response and disaster management. ~~T~~his way, they will add ~~to~~ their contribution to regional, national and global development issues. ~~This is expedient; a~~s our planet experiences a changing climate, now is the era of disaster parasitology.

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