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Disaster response under One Health in the aftermath of Nepal earthquake, 2015

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Abstract Until now, an estimate quotes that 1100 healthcare facilities were damaged and over 100,000 livestock lost in the two earthquakes that occurred in April and May of 2015 in Nepal. Threats of infectious diseases, mostly zoonoses, could affect Nepal's economy, trade, and tourism, and reaching the targets of the United Nations Millennium Development Goals. Historically, outbreaks of infectious diseases, including zoonoses, were largely associated with the aftereffects of the earthquakes. It has been documented that zoonoses constitute 61% of all known infectious diseases. Therefore, the purpose of this communication was to examine the infectious disease outbreaks after earthquakes around the world and explore the risk assessment of the zoonoses threats reported in Nepal and highlight adopting One Health. Our summaries on reported zoonoses in Nepal have shown that parasitic zoonoses were predominant, but other infectious disease outbreaks can occur. The fragile public health infrastructure and inadequately trained public health personnel can accelerate the transmission of infections, mostly zoonoses, in the post impact phase of the earthquake in Nepal. Therefore, we believe that with the support of aid agencies, veterinarians and health professionals can team up to resolve the crisis under One Health.

1. Introduction

Each year, more than a million earthquakes occur in the world [1], and over 530,000 deaths have been reported from earthquakes in the past 25 years [2]. The 2015 Nepal earthquake which killed more than 8622 people (as of May 21, 2015) and injured more than twice as many, occurred in Barpak,

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Gorkha district (epicenter) on April 25, 2015 with a moment magnitude of 7.8. Following this, a second earthquake occurred on May 12, 2015 with a moment magnitude of 7.3 in Chilankha, Dolakha district (epicenter). At least 3000 landslides have been triggered consequent to the earthquakes causing large land mass movement in the Himalayan nation, as assessed by the International Centre for Integrated Mountain Development, Kathmandu. The death toll in the neighboring countries of China, India, and Bangladesh was 126 [3].

Nepal may be one of the most beautiful countries in the world, but it is also one of Asia's poorest, with a total Gross Domestic Product of US $19.921 billion [4], and requires external support for a major reconstruction. Nepal's total health expenditure per capita is US$80 [5]. Geographically, the country is divided into the capital Kathmandu along with a few district headquarters and the rest of the country of rugged mountainous terrain. Two distinct modes of healthcare delivery exist; one that is dominated by district and zonal hospitals in the capital and district headquarters, and the remainder of the country served by primary healthcare centers and village health posts with inferior infrastructure and inadequately trained healthcare personnel that cannot sufficiently support the healthcare needs of the rural people [6]. Until now, an estimate quotes that 1100 healthcare facilities were damaged and >100,000 livestock lost in the two earthquakes. Consequently, 87 international medical teams have been mobilized which have treated >100,000 people [7].

Taylor et al. [8] documented that among the 1415 species of infectious organisms known to be pathogenic to humans, zoonoses constitute 61%, with humans as the primary reservoir for just 3%. Among 175 infectious species considered to be emerging, 75% are zoonotic. In addition, of all human food-borne illnesses, about 90% are from foods of animal origin. In the past, infectious disease outbreaks following natural disasters have been reported as a result of the interruption of public health measures ensuing destruction of the local infrastructure [9]. Hence, the potential for zoonoses outbreaks and transmission is high in the earthquake devastated Nepal. Nonetheless, the impact of zoonotic diseases on human and animal health is not monitored, prevented, and treated in an integrated way, despite the fact that the etiologies and treatments of these diseases are generally similar across species. Therefore, the purpose of this communication was to examine the infectious disease outbreaks after earthquakes around the world, explore the risk assessment of the zoonoses reported threats in Nepal, and highlight adopting the systems approach based One Health to control prevailing zoonoses and preempt postearthquake outbreaks in Nepal. All of our search results were restricted to publications in PubMed–the largest free access health information database for human and veterinary disciplines.

2. Infectious disease outbreaks after earthquakes

Broadly, earthquakes (geophysical disasters) and landslides (geomorphologic disasters) followed by secondary effects of the disaster exacerbate synergic risk factors (change in the environment, in human conditions and in the vulnerability to existing pathogens) for outbreaks and infectious disease transmission resulting from substantial population displacement into unplanned and overcrowded shelters and degradation of sanitary conditions, with limited access to food and safe water [8]. The prolonged health impacts associated were: collapse of healthcare facilities and healthcare systems, interruption of ongoing healthcare delivery, disruption of surveillance and health programs (immunization and vector control programs) and limitation or destruction of farming activities leading to food insecurity.

Some of the outbreaks of infectious diseases associated with earthquakes and landslides that occurred in different parts of the world in the past three decades are succinctly provided here as an overview for a foresight in Nepal, as we did not find any documentation in PubMed pertaining to Nepal. In 1991, a huge increase in the incidence of malaria was recorded after the earthquake and floods in Costa Rica as a result of an increase in mosquitoes caused by deforestation and changes in river flow patterns [10]. In Southern California, after the 1994 earthquake, an unusual outbreak of coccidioidomycosis, caused by the fungus *Coccidioides immitis*, occurred; the infection was associated with exposure to increased levels of arthrospores in dust clouds generated by the earthquake [11]. A report [12] after the 2001 El Salvador earthquake showed that 30% of 594 affected people experienced upper respiratory tract infection. In Iran, 1.6% of the 75,586 persons displaced by the Bam earthquake in 2003 were infected with diarrheal diseases due to poor hygiene, crowding, lack of potable water, and ineffective sanitation, and 14% had respiratory tract infections due to lack of protection in freezing winter nights [13]. In Turkey, 2004, following epidemiological and social factors arising after the earthquakes, there were