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RESEARCH ARTICLE

EBOLA AND ITS ASSOCIATED SOCIAL DETERMINANTS OF HEALTH – A PUBLIC HEALTH PERSPECTIVE

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ABSTRACT

Background: The Ebola outbreak is a deadly disease of the African population which has captured the interest of the global community. The pace and fatality rate of the disease requires a 'global intervention', with public health strategies to halt transmission and prevent further outbreaks at the source. Ebola in comparison to other conditions has been delayed in vaccine development due to several reasons including poverty of host nations, complexity of the disease and its reproductive rate (R_0), pharmaceutical companies focusing on commercial viability of products and lack of penetration in western nations.

Materials and methods: This article is a review of the Ebola outbreak of its source of origin, demographic spread and also provides perspectives on the public health approaches that could be used to efficiently manage Ebola.

Results and conclusion: There is an unmistakable link with poverty to social inequity and health disparity as the African nations were under colonialism of the western nations. There is also a requirement of diversification of public health management within Africa and on a global scale to manage and prevent diseases such as Ebola becoming pandemics. Thus Ebola could be efficiently managed by implementing public health approaches at individual, familial and community levels.

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INTRODUCTION

Ebola virus disease (EBV), formerly known as 'Ebola hemorrhagic fever' (EHF) is a zoonosis which has resulted in a recent catastrophic outbreak causing fatalities in the African population (WHO, 2014). The Filoviridae family constitutes the Ebola virus and the related Marburg virus which are filamentous and contain a single stranded RNA (Ribo-nucleic acid) with a negative sense (Sullivan *et al*., 2003). Ebola virus particles have a uniform diameter of 80 nm with a wide range of lengths up to 14,000 nm (Sanchez, 2007). Out of the five variants of Ebola virus such as Zaire, Bundibugyo, Sudan, Reston and Cote d'Ivoire, the former three variants have been accountable for the African outbreaks whereas Reston Ebola virus is mostly observed in Asian animals (Yuan *et al*., 2012). The first Ebola outbreak was recorded in 1976, where there were two simultaneous outbreaks in the remote villages of Central Africa namely Nzara, Sudan and Yambuku, Democratic Republic of Congo with case fatality rates of 53% and 88% respectively (Laupland, 2017). Since 1976, there has been more than 20 outbreaks with the recent outbreak in 2014 resulting in the more fatalities than previous outbreaks (Breman, 2014). It is discovered that Zaire variant is responsible for the recent outbreak in the West Africa (WHO, 2014).

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MATERIALS AND METHODS

This article is a scoping literature review of the Ebola outbreak of its source of origin, pathogenesis, demographic spread and also provides perspectives on the public health approaches that could be used to efficiently manage Ebola.

DISCUSSION

Pathogenesis and mode of spread

Whilst there is lack of clarity in the specific source of virus, fruit bats are considered to be the most common reservoir and are responsible for the disease transmission to human as they are a local delicacy (Donovan, 2014). The virus is also usually transmitted through direct contact with bodily fluids primarily blood, open wounds and carcasses, and consumption of the infected animals and physical contact with infected persons or cadavers in cases of customary burials (Laupland, 2014). Breman suggested that the route of infection has direct relevance to the severity, exposure and onset of disease, for

example transmission through contaminated needles resulted in death of all 85 people hospitalized in Yambuku Mission Hospital (Feldmann, 2011). Ebola cripples the body's immune response by targeting white blood cells and replicating RNA proteins attacking the spleen, adrenal glands and hepatocytes of the liver causing patients to die as a result of septic shock, multiple-organ failure and Disseminated Intravascular coagulation (Casey, 2015). The onset of disease ranges from 2-21 days and are characterized by fever, myalgias, nausea, rashes, gastro-intestinal and bleeding in extreme cases with the person not contagious until the symptoms develop (Fauci, 2014). Since it is hard to distinguish Ebola from malaria, typhoid and meningitis, there are some investigative tests to confirm the diagnosis of Ebola which should be performed under strict protocols (WHO, 2014). The primary confirmatory test for Ebola virus infection is a positive reverse transcriptase polymerase chain reaction (RT-PCR) which gives faster results than enzyme linked immunosorbent assay (ELISA test) (WHO, 2011).

Reasons for the delay in vaccination

As Ebola is not a new epidemic, it is inexplicable that there has still not been focus on vaccine development in the past 40 years. As there are vaccines currently in the verge of phase-3 trials, it is appropriate to discuss about the delay in the development of the vaccine. It is noted that scientists in America and Canada commenced the vaccine trials for EBV on primates 10 years back but the research was halted due to lack of funds (Grady, 2014). There are several other scientific, social, demographic and political factors pertaining to the delays in vaccine development. Scientific complexity of the virus is a key reason for the delay as there is no clarity of the underlying pathogenicity of the disease. The virus is composed of 2 proteins VP 35 and VP 24 which enables the virus to change its shape at will and blocks the interferon to sense it as a foreign particle hindering vaccine development (Feldmann, 2011). EBV can be compared to the other vaccinatable infectious diseases in terms of reproductive rates data. Reproductive rate (R_0) is the dissemination of the infection in a vulnerable community without any therapeutic interventions (Chowell, 2014), R_0 for the recent outbreak EBV is estimated to be 1.5 to 2.5 based on SEIR (susceptible-exposed-infectious-recovered) model in 2 studies (Althaus, 2014 and Gomes, 2014). Comparing to the R_0 of other diseases that have vaccines such asmeasels with R_0 of 17, R_0 of 3.5 to 6.8 for small pox (Eichner, 2003) R_0 of 10-15 for poliomyelitis (Fine, 1999), and R_0 of 2.2 to 3.7 for SARS (Lipsitch, 2013). It can be clearly seen that the R_0 for EBV is less than other epidemics which may have contributed to the delay in vaccine development.

Impact of globalization and privatization

The other main reason is the general focus of pharmaceutical companies. Large innovative organisations are mostly profit-driven organisations investing in affluent countries with little regard for developing nations and often pursing profit making commercially viable products (Karan, 2015). These companies stop production of a drug when there is no commercial incentives, for example the suspension of the drug eflornithine which failed as an anti-cancer drug but was effective against sleeping sickness in Uganda (MacDonald, 2001) Primary responsibility for health prevention and promotion cascades to global political systems like WHO and the UN, it is an ethical obligation of the pharmaceutical companies to be devoted towards the global health provision (Lassen, 2007). In addition to this first outbreaks occurred in small remote African villages and communities containing the disease due to lack of hosts. Whereas the scope of impact is increased as the new outbreaks has spread to the urban cities where there is no shortage of hosts (Peters, 1999). The confinement of disease in African countries with a small number of cases outside Africa may also have contributed to the delay (Oshinsky, 2013). If the Ebola outbreak occurred in the developed nations, there would have been a rapid response and a depository of EBV medications made available (Karan and MacDonald, 2001). The basis of this can be compared to the H1N1 virus (swine-flu) outbreak which originated in California on April 15, 2009 where 2 children residing in different places were diagnosed with the disease. This caught the attention of CDC (Centers for Disease Control and prevention) in the same week and concerns about the H1N1 virus transmission to humans was raised (CDC, 2010). The WHO addressed the world and raised the threat level to phase 6 it became a pandemic. Within days, there was a stockpile of protective equipment distributed across the country and the vaccine development was completed in a very shortperiod (CDC, 2010). It is interesting to note the pace at which the public health management and the vaccine development process was carried out in comparison to Ebola.

Link to other social determinants of health

In light to the global social determinants of health (SDH) in impoverished nations, there are significant health disparity in comparison to developed nations (Eshetu and Eshetu, 2011). As a result of continued civil war, countries like Liberia and Sierra Leone were severely crippled in terms of health and economic resources having had only one doctor for every 100,000 people before the epidemic outbreak (Rothstein, 2015) It is clear that poverty may be the primary factor that is responsible for poor health and disease stagnation in Africa as there is lack of basic needs and primary health settings (Wilkinson, 2003). Poverty is considered to be the central channel to ill-health, illiteracy, unemployment, poor sanitation, starvation and lack of access to basic health care services and therefore there is a great need to reconstitute the policy options and prioritize the social determinants of health in Africa to promote health (Eshetu and Woldesenbet, 2011). For example, the Australian government has adopted a similar strategy called 'Closing the gap' to manage the health and social inequality in the aboriginal population (Donato, 2013). The Commission on SDH has offered three key suggestions in context to fixing the health inequalities which are developing the basic needs and employment, resolving the social and economic inequity and settling the issues related to health disparity within and outside the countries (Eshetu, 2011).

Public health approaches

It is imperative to have decisive public health approaches at the familial, community, national and international levels (Kennedy, 2015). The main attributes of public health management and prevention focuses on sanitation, disease containment and supportive therapy (WHO, 2014). On the societal and familial level, it is crucial to create awareness to avoid consumption of bush meat and contact with infected animals (Frieden, 2014). On community grounds, it is important to have culturally appropriate education delivered to the local community about the perils of customary burials and

precautions required when handling cadavers (Kennedy, 2015) All the more important is fastidious infection control protocols in the health setting which was lacking in the Yambuku Mission Hospital causing nosocomial infection by contaminated needles resulting in many deaths including health hospital staff in 1976 (Mordi,, 2014). Therefore, it is mandated for a heath care worker to wear personal protective equipment and respirators to avoid the risk of infection (WHO, 2014) Disease containment involves separating infected family members from the healthy which is a culturally sensitive issue that must be handled appropriately. Finally, supportive therapy comprises of oral rehydration, pain relief, and broad-spectrum antibiotics to treat secondary bacterial infections whilst maintaining blood pressure and oxygenation (Feldmann, 2011), WHO suggested an intervention called 'MUST'-maximum use of supportive therapies involving intravenous fluids, feeding through nasogastric tube and access to medications that could relieve the symptoms (Casey, 2015). This can be compared to how other countries within and outside Africa have managed Ebola. Firstly within Africa, Nigeria has paved the way in eradicating Ebola by create awareness about the effects of Ebola in newspapers, magazines, social media and almost every office being mandated to install sanitizers to maintain good hygiene, therefore showing other countries to make use of the limited resources (Mordi, 2014). In contrast to this, the panic caused by handful of cases in America, Spain and Scotland have forced the western countries to take precautions in order to avoid outbreak in their soil (Rid, 2014). Developed nations have increased their surveillance, security and quarantine systems, for example countries such as Australia, Canada, Cameroon, Kenya and China prohibit travelers from Africa whereas America has incorporated mandatory isolation and examination of people arriving from Africa (Casey, 2015 and Mordi, 2014). As western countries have resources and sophisticated laboratories, they have the capacity to intervene the crisis with appropriate measures. Therefore, the western countries are obliged to this humanitarian cause to assist with the needs of nations in fighting against the health disparity and social inequity (Rid, 2014), Some commendable examples include the Cuban intervention who provided 165 expertise health workers to the African soil to battle the epidemic (Sifferlin, 2014). The World Bank has donated $500 million for Liberia, Sierra Leone and Guinea and the International Monetary Fund has alleviated $100 million debt from the Ebola struck countries mentioned (Talley, 2014 and Treanor,, 2015). Therefore, these kind of international responses are needed in order to fight the epidemics that can become complex humanitarian emergency. Since the fear of outbreak has permeated western countries, vaccine development is well underway. There are some vaccines which are in trials namely Glaxo Smith Kline's cAd3 which is a chimpanzee-derived cold virus to deliver Ebola virus genetic material from the Zaire strain of virus in phase-3 and U.S. National Institute of Allergy and Infectious Diseases (NIAID), and rVSV (recombinant vesicular stomatitis virus) from NewLink Genetics and the Public Health Agency of Canada , and also other drugs such as experimental cocktail of monoclonal antibodies known as ZMapp, which are hopeful to put an end to this disastrous outbreak (Donovan, 2014 and Kanapathipillai, 2014).

Conclusion

Ebola virus is a rare variant and represents only a small portion of the disease stagnation in Africa. Although the disease was understated in the past, it has now been redefined on a global dimension with global actions. Therefore, countries need to partner with each other in providing medical, political and financial support to fight the catastrophic outbreak. With increase in globalization, it is inevitable for the disease to turn into a pandemic and therefore public health management and development of a patent vaccine is vital to make this 'global village' a safe place to live.

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