

*Full Length Research Paper*

# Post-mortem of the 2007 Plague epidemic in Zambia

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Accepted 24 December, 2013

**Zambia's Petauke district experienced a plague epidemic in 2007, where there were a total of 425 cases and two deaths. What could have contributed to such a large number of cases? Due to the changing rainfall (and other climatic conditions) patterns, outbreaks of diseases such as plague are likely to recur. Identification and sharing of some of the lessons learned can greatly contribute to reducing morbidity and preventing mortality in future. The article presents a Case study of the 2007 Plague Epidemic in Zambia that highlights what went right and what went wrong in responding to the epidemic.**

**Key words:** Zambia, lessons learned, plague, rainfall patterns, outbreak.

## INTRODUCTION

Plague is a bacterial disease that primarily affects wild rodents and is spread by fleas (WHO, 2013). Outbreaks could be linked to heavy rain and flooding causing rats to invade inhabited areas (WHO, 1997). Climate change is currently a big threat to the world and the possible changes in rainfall patterns may lead to more outbreaks, therefore, there is need to share lessons learned from this experience.

The Plague is one of the diseases that does not affect people regularly and some medical and health practitioners have never encountered it in their careers due to its rarity. It is therefore important to share some experiences on how such outbreaks have been handled where they have occurred.

The World Health Organisation (2004) currently estimates the mortality of plague at 8-10%. However, in the pre-antibiotic era (1900 through 1941), mortality among those infected with plague was as high as 66% (CDC, 2013). It is therefore imperative that outbreaks are diagnosed early and quick action taken in order for the affected to access antibiotics and increase their chances of survival.

Zambia's Petauke district, experienced plagues outbreaks in 2001 and 2007. In 2007, there was a bubonic plague where a total of 425 cases were reported, with two deaths. Signs and symptoms of the disease typically included swellings in the groin, axilla and neck including difficulties in swallowing and laboratory tests yielded the bacteria *Yersinia Pestis*, sensitive to Tetracycline, Gentamicin/Streptomycin and Chloramphenicol. There were more females than males

affected, especially those within the age range of 15-20 years. In such rural settings, females of this age group spend more time indoors undertaking household and around granaries, thereby, increasing their chances of contact with rodents and their fleas.

Despite being preventable and treatable, the 2007 Plague recorded a high number of cases and claimed lives. What could have contributed to such a large number of cases? It is also important to take into account that the period of the epidemic was a farming season and therefore, there was likely a negative effect on productivity, especially at household level as a result of morbidity. Out of pocket expenditure to have the victims treated also placed an extra burden on households. It would also be important to consider opportunity costs incurred by absences from school due to illness.

Although the lessons learned from the last Plague took place more than 5 years ago, this experience sharing remains relevant as it is closely related to the important and ever increasing challenge of Climate Change. Plague epidemics in Zambia have been closely linked with increased rainfall and floods which could be effects of climate change. At the COP17 and DOHA 2012 Climate Change international conferences many agreed that climate change may be one of the greatest threats facing the planet but suffered the perpetual issues that include lack of media coverage, countries blaming each other, lack of funding and above all disagreements on how to address the consequences of climate change. Recent biological trends and changes in diversity have been linked to changes in climate (Parmesan and Yohe, 2003).

Sharing of lessons from the plague epidemics of Zambia can contribute to addressing the above mentioned challenges by increasing information dissemination and providing suggestions on how to address some consequences of climate change such as Plague epidemics. For diseases that do not occur frequently, especially Neglected Tropical Diseases, sharing of lessons learned or good practices is uncommon due to low demand from possible end-users of that information as compared to other challenges such as HIV/AIDS, TB and Malaria. The perception that lessons learned from Neglected Tropical Diseases is not equally important, may result in devastating consequences once an emergency such as a Plague epidemic occurs as the stakeholders may be caught unaware on the best ways to address the challenge.

## **METHODOLOGY**

A case study research involves the study of a case within a real life, contemporary context or setting (Creswell, 2013). The study was done using a qualitative approach as a Case Study approach and data collection methods included taking field notes, interviews, observations and review of records.

The article therefore is a description of the case and its context. As a limitation with most case studies, the findings cannot necessarily be generalised to a wider population and cannot usually draw a cause-effect relationship.

## **Lessons Learned**

Identification and sharing of some of the lessons learned can greatly contribute to reducing morbidity and preventing mortality in future.

The major weaknesses in the 2007 Plague Epidemic were intercepting it at an earlier stage and therefore the following factors were noted as having contributed to the high morbidity:

### **Delay in Identifying the Index Case**

When the Plague started, the signs and symptoms in most cases started as the common upper respiratory infections and were treated as such in the local health facilities. However, after a few weeks of rapidly increasing numbers of cases and changing symptomatology, an alert health worker who was part of the team that controlled the 2001 epidemic became suspicious and collected samples for laboratory testing which later revealed the diagnosis as Plague and not the ordinary upper respiratory tract infections that are treated the whole year round. An earlier diagnosis could have

resulted in curbing the epidemic at an earlier stage and could have resulted in less morbidity and probably no mortality. The delay in making a diagnosis demonstrates the importance of sharing information on Neglected Tropical Diseases, especially in the absence of an outbreak as opposed to when the outbreak has already occurred.

### **Community's Failure to Identify "Danger Signs".**

Prior and during the epidemic, residents of most villages noticed an increasing number of rodents invading their habitats, accompanied by fleas and some further observed some rodents appeared ill as they were falling from roofs and/or had swollen feet. The community should have interpreted all these as signs of an impending epidemic and should have quickly alerted the relevant authorities for action to be taken. The failure to interpret these "danger signs" also contributed to the magnitude of the epidemic.

The failure to note that the invasion of rodents with fleas into human habitats could be due to a perception that the rodents and their fleas were harmless. In contrast, if this habitat invasion was by snakes and not rodents, the community could have reported it immediately to the relevant authorities for action to be taken.

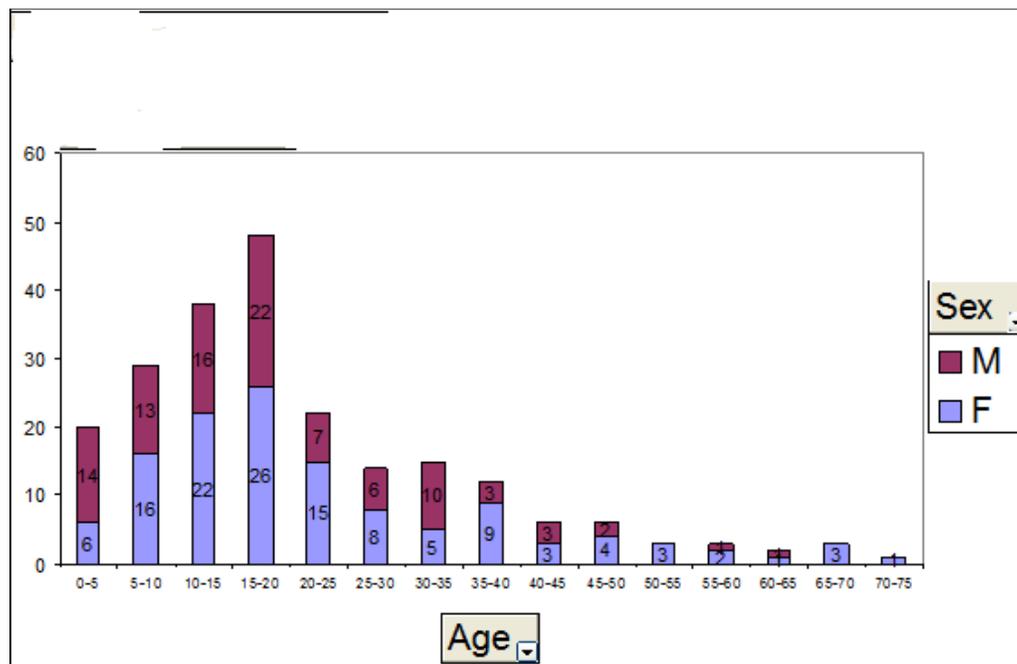
### **Insufficient Community-Health Facility Interaction.**

Petauke district is about 7,886 square km with about 34 health facilities, which means the average distances of residences from health facilities exceeds the recommended 5 kilometres radius for easy access. Under such conditions, going to the health facility appears necessary when the illness is serious as there are direct and opportunity costs for going all the way to the health facility. Using resources for transport and missing school or work at the expense of going to a health facility, is likely to be a decision when the household thinks that the illness is serious enough. Such kind of decision-making processes can have contributed to delayed diagnosis and spread of the Plague.

Further, the district is situated in the Eastern Province that has had the lowest staff to patient ratios from 2003 to 2005 and a health facility utilisation rate of about 0.91 per capita, just falling short of the set standard of at least 1 per year (Ministry of Health, 2005). This slightly reduced interaction between the community and their health facilities could have also been a contributing factor to delayed diagnosis and spread of the Plague. More prompt and increased interaction of the first cases with health staff could have made the recognition of the epidemic quicker, thereby, prompting quicker intervention.



**Figure 1.**A boy with bubonic plague of mandibular glands.



**Figure 2.**Graph Showing Demographic Distribution of Patients.

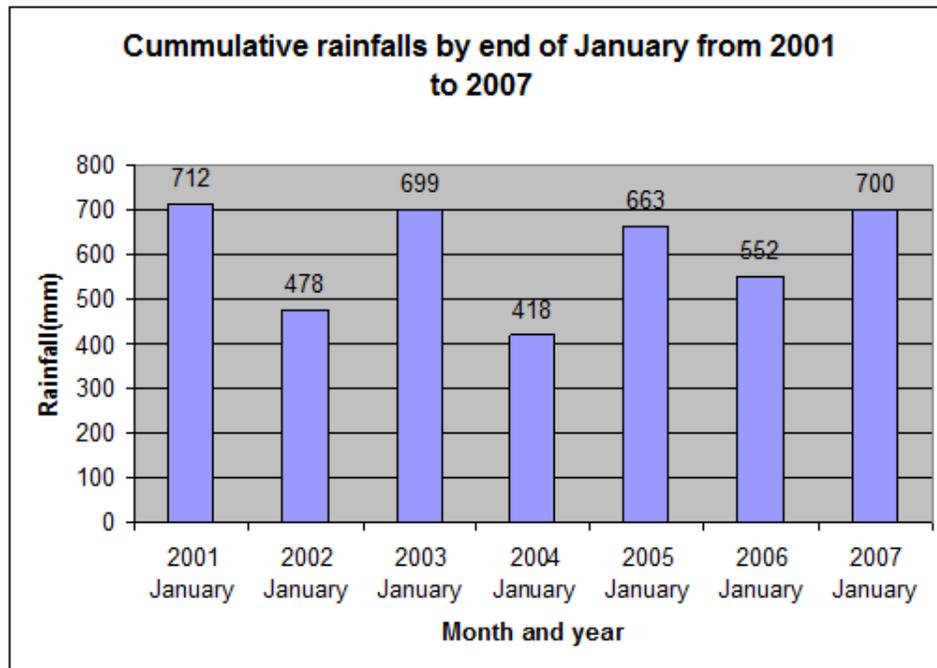
**Vulnerable Age Groups**

As shown in the table below, it was noted that the most vulnerable age group, were the adolescent females. This was attributed to the cultural practice, where adolescent females are the ones in charge of preparing food in villages; they get their stored raw food from granaries

next to their houses where rodents are usually found, therefore, having more exposure to the flea carriers.

**Un-established Relationship Between the Epidemic and Rainfall Patterns.**

Meteorological data shows a striking resemblance between



**Figure 3.** Graph Showing Rainfall Patterns.

between the two rain seasons in which the Plague occurred, i.e. 2001 and 2007. The primary resemblance is that floods occurred in both 2001 and 2007 and in both seasons, the outbreak commenced when the cumulative rainfall reached the mark of 700 mm as shown in the graph below:

It can be observed that 2001 and 2007 which recorded the highest figures also coincides with the occurrence of the epidemics. One could argue that 2003 and 2005 also had high cumulative rainfall figures, although they did not reach the 700mm mark. It was however noted that the accumulation of rainfall in 2003 and 2005 was not as rapid as the 2001 and 2007 seasons. Therefore, although the cumulative rainfall figures of 2003 and 2005 seasons are similar to 2001 and 2007, the latter accumulated these figures in a shorter period of time.

Both the 2001 and 2007 plagues commenced in the month of January and in both cases, the transition between December to January rainfall was characterised by a sharp increase in rainfall of over 100mm as compared to the December-January transitions of other seasons that had much less than 100mm. It could mean that the sudden flooding of rodent burrows forces them to seek refuge in human inhabited areas as opposed to a gradual increase, thereby predisposing the humans to Plague.

If this relationship between the rainfall patterns can be established then the plague epidemics can be predicted, and interventions put in place to avert the disease, after all rainfall patterns can be forecasted. Meteorological departments are able to predict rainfall

patterns even before the rain season commences, therefore, it makes it possible to predict the occurrence of a Plague epidemic way before it commences.

## DISCUSSION AND CONCLUSION

Upon confirmation of the diagnosis of, the Plague was effectively tackled by a multisectoral team of government officials, reducing the cases from over 400 to zero in less than two weeks. The excellent multisectoral cooperation that was observed in controlling the epidemic could be extended to preventive measures through the already existing Epidemic Preparedness Committees. The team could have prevented the cases from reaching the peak of 425 if delays mentioned above were not there. Delays in intervening in an epidemic are likely to lead to a less favourable outcome. With some of these learned lessons, a number of measures can now be put in place to enable a more rapid response to the Plague in future.

Primary Health Care workers need to be constantly trained on how to quickly diagnose Plague and other Neglected Tropical Diseases, as the daily routines of treating more common diseases draws attention away from other relatively uncommon diseases. There also need to be a more sustainable ways of making a diagnosis by putting systems or mechanisms in place for diagnosis rather than relying on one or two individuals with institutional memory, who may not always be there.

Communities in epidemic prone areas need to be educated on the basis of the disease especially on the pre-

predisposing factors and the importance of acting as a watchdog for the health and related authorities. If the invasion of rats into human habitats was reported early, the Plague could have been prevented or at least controlled at an early stage.

Since there were few staff with the ability to quickly diagnose the disease, who are mainly stationed at more central health facilities, outreach and mobile services should be scaled up. This should be coupled with transfer of knowledge, especially to the more peripheral health facilities in the epidemic prone areas.

In conclusion, the epidemic was effectively handled by a well organised multisectoral team, after the diagnosis was made. However, more resources such as financial, time and manpower could have been saved if more was done on prevention and early detection.

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