

Preliminary observations on factors responsible for long persistence and continued outbreaks of plague in Lushoto district, Tanzania

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Abstract

Human plague has been an important public health problem in Tanzania for over a century. Recorded outbreaks of the disease have been reported from various parts of Tanzania, including Iringa, Kagera, Singida, Mbulu, Arusha and Kilimanjaro since 1886. Since 1980 however, only Lushoto, Singida and Karatu districts have experienced outbreaks of the disease. Of these areas, Lushoto has disproportionately high incidences of the disease and this has persisted for nearly 17 years. Efforts to curb the disease through conventional methods, including control of vectors and reservoirs, chemotherapy and chemoprophylaxis, enforcement of sanitation improvement as well as health education, have been applied every year, but plague cases and deaths continue to occur in the area to date. During the period April 1980 to December 1996, a total of 6599 cases with 580 (8.8%) deaths were recorded. Biological factors, such as the presence of suitable rodent reservoirs, efficient flea vectors and plague bacillus, could be partly responsible for the long persistence and recurrence of the disease. Since such factors are also common in other plague foci where the disease has never been persistently recurrent, and where indigenous people are culturally different from those in Lushoto, it is assumed that socio-cultural factors play an important role as determinants of the disease in the latter district. This paper reports preliminary observations on socio-cultural, biological and environmental factors which are thought to be, at least partly, responsible for the long persistence and repeated outbreaks of plague in the district. These include traditional beliefs on the cause and health seeking behaviour for treatment of plague,

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sleeping and food storage habits, large populations of rodents and fleas, and status of the immediate environment. © 1997 Elsevier Science B.V.

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1. Introduction

Plague has been endemic in many parts of Tanzania since precolonial times. However, it was authenticated for the first time in the country in 1886 when an epidemic was reported by German doctors in Iringa district, south-west Tanzania (Simpson, 1914), in Msangi, 1968. According to the author, the local people were already familiar with the disease and they knew the involvement of rodents in transmission of the disease, long before the arrival of the Germans. The villagers had developed some traditional control methods which included burning of dwellings and killing any escaping rodent.

Since then, plague spread to many parts of the country and several foci became established. These include the Iringa, Lake Victoria, Central Tanzania, Mbulu, Meru, Kilimanjaro, South-Pare and Lushoto foci (Kilonzo and Komba, 1993). Many outbreaks of human plague involving large numbers of cases and deaths were reported from most of these foci between 1890 and 1979 (Rutasitara, 1969; Mtebe, 1972; Mrita, 1978). Since 1980, most foci have been inactive except those in Singida, Karatu and Lushoto districts. While Singida district (Central Tanzania) suffered the last outbreak in 1991, outbreaks in Lushoto where the focus was discovered in 1980, have persisted to-date and by the end of 1996, it had involved at least 6599 recorded cases with at least 530 (8.8%) recorded deaths (Temu, 1991; Kilonzo and Mhina, 1982, 1983; Kilonzo et al., 1991, 1992; Kilonzo and Komba, 1993; Health, 1997; RMO, 1995).

Plague control strategies in Tanzania have usually involved the killing of fleas and rodents, chemotherapy for patients, chemoprophylaxis for contacts, enforcement of environmental cleanliness and sanitary improvement, health education for leaders and communities in the affected areas, and quarantine of the affected localities when possible. These measures have been effective in most plague foci in the country and are probably responsible, at least partly, for the decline of outbreaks of the disease in such areas. In Lushoto district however, the same measures have been applied during and soon after each outbreak of the disease since 1980 (Fupi, 1988), but outbreaks continued to occur every year, usually from October/November to May/June. In 1987, a Permanent Plague Control Team (PPCT) was formed and trained, and directed to ensure prompt and proper implementation of all conventional plague control measures in the district. Despite the good work done by the team during the first year of its inception, the disease continued to occur every year, and the focus expanded from one village in 1980 to about 50 villages in 1996 (Table 1).

The long persistence, expansion of the focus, and the repeated outbreaks of the disease in the district, despite all the control measures taken, has caused serious concern among the relevant scientists, authorities and the affected communities.

It has been argued however, that some factors, including socio-cultural, socio-economical and environmental could possibly be responsible for maintaining the disease in the district. The biological and climatic factors (including presence of suitable reservoirs, efficient vectors and favourable climatic conditions), are however common in many other foci where the disease has been effectively controlled.

Earlier studies showed that some Lushoto villagers believed in witchcraft and/or evil spirits as causes of human plague (Kilonzo and Mhina, 1982). According to Ogen-Odoi (1993), some cultural practices are partly responsible for outbreaks and maintenance of plague in Nebbi district, north-western Uganda.

In Tanzania, proper studies on human behavioural factors in relation to plague outbreaks have not been done anywhere. However, many traditions and cultural practices differ from one ethnic group to another. It is therefore possible that some cultures, which favour persistence and outbreaks of the disease in Lushoto district, are non-existent in the Singida district where the disease has been successfully controlled. In view of this possibility, a need to study and determine socio-cultural and environmental factors which are possibly responsible for the long persistence and repeated outbreaks of plague in Lushoto district, as well as to determine the

Table 1
Recorded/suspected human plague cases and deaths in Lushoto from April 1980 to December 1996

Year recorded	No. of recorded clinical cases/suspects	No. of recorded deaths ^a	% recorded deaths ^a	No. affected villages ^b
1980	49	11	22.4	1
1981	9	6	66.7	1
1982	76	18	23.7	9
1983	569	49	8.6	2
1984	603	41	6.8	11
1985	129	22	17.1	20
1986	360	57	15.8	23
1987	470	57	12.1	28
1988	452	13	2.9	25
1989	29	5	17.2	9
1990	459	58	12.7	28
1991	1203	68	5.7	37
1992	16	2	12.5	2
1993	18	0	0	3
1994	444	50	11.3	19
1995	830	74	8.9	14
1996	832	49	5.0	24 ±
Total	6599	580	8.8	48 ^b

^a Compiled from the Lushoto District Hospital and GTZ Family Health Project (FHP) records.

^b Some villages do not experience outbreaks every year. The total number of villages refers to all villages which have experienced outbreaks at least once since 1980.

knowledge, attitudes and practice (KAP) of Lushoto people on plague, was considered desirable. The objective of this paper is to report preliminary findings of this study.

2. Methodologies

2.1. Villages and period of study

These studies were carried out at the villages of Manolo and Gologolo (Mavumo) in Mlalo Division, Emao and Masereka in Mtae Division, Malibwi and Mbwei in Mlola Division, and Magamba and Ubiri in Lushoto Division (Fig. 1), from September 1993 to April 1994. The choice of these villages was based on their involvement in human plague outbreaks at least once since 1980, their similarity in climatic, environmental and socio-economic features, as well as good cooperativeness of the villagers and their leaders with the researchers.

2.2. Study procedures

A local information workshop involving all relevant district, ward and village leaders as well as health personnel, was conducted. In collaboration with all participants in this workshop, it was decided that family health workers in the study villages (one male and one female in each village), would be the most suitable data collectors (enumerators) after being properly trained on the subject, since they were familiar to the villagers and well accepted by the communities. It was also decided that household heads would be the most relevant respondents. Several training seminars were then carried out for the selected enumerators, their supervisor and members of the District Permanent Plague Control Team. In collaboration with the trained team, a working strategy and sample size were determined.

In general, a multistage sampling strategy was adopted. The first step involved determining current numbers of households in each village, a process which was accomplished by counting. This was followed by cluster sampling whereby each village was divided into zones (clusters) which were basically the same as the existing localities. From each zone a sample of households from which respondents would be drawn was obtained, using a systematic sampling strategy. This was accomplished by picking every tenth name in the list of households in each zone until a sample equal to 10% of the total households was obtained. One of the villages (Manolo) however, was disproportionately large and 10% of its households amounted to about 300 homesteads. Due to limited resources for the study, it was agreed to compromise and take a sample of 100 households in the village, using similar sampling technique.

The trained enumerators were assigned their respective lots of questionnaires and conducted interviews with the relevant respondents as agreed. The questionnaires contained a variety of questions, mostly open-ended, which were designed to seek information on the Knowledge, Attitudes and Practice (KAP) of respondents on

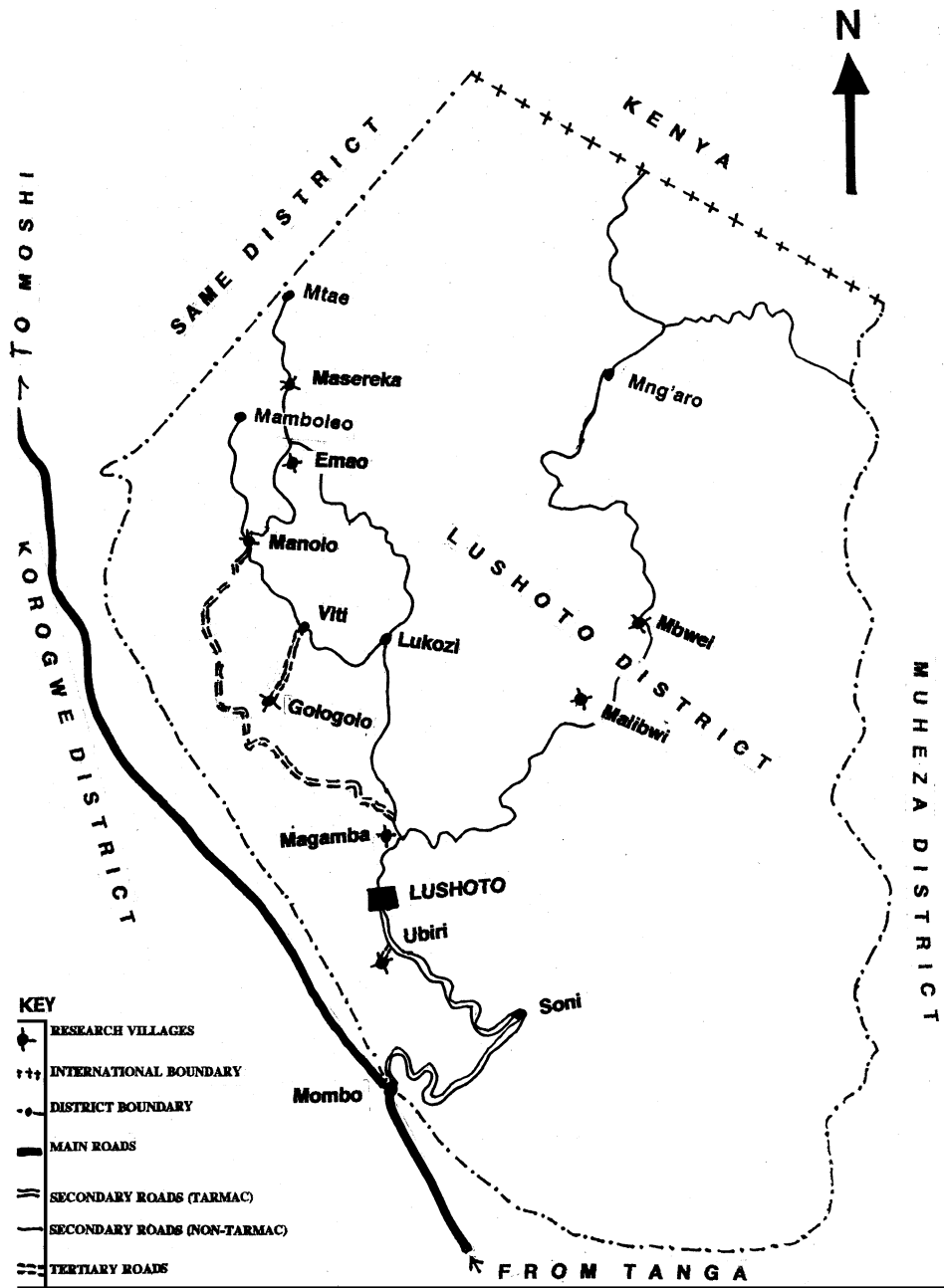


Fig. 1. Sketch map of Lushoto district showing villages used for studies of factors affecting persistence of plague.

plague causation, epidemiology and control. The major questions sought information on personal details (including age, period of residence in the area, family size, occupation and level of education); experience and knowledge on causes, symptoms and treatment of plague; personal views on the role of traditional healers in the management of plague; presence, abundance and control of rodents and fleas; type and size of residential houses; sleeping habits; food storage and garbage disposal practices, and environmental status of the household and its surroundings.

The enumerators visited the selected respondents during the latter's free times (usually in late afternoons or early evenings when most peasants were at home). Interviews were conducted with the heads of the selected households after getting their informed consent. Both Kiswahili (the national language) and either Kisambaa or Kipare (The major local vernaculars) were used in the interviews. Individuals in the selected households who had been previously or were currently infected with plague, were also involved as respondents after getting their consent. In cases where such respondents were too young to participate in the interview, the latter was conducted with one of the parents of the victim in question.

In addition to interviews, the data collectors also inspected the respondents' houses and surroundings, after getting permission from the owners. This process enabled the enumerators to substantiate some of the information reported by the respondents.

The enumerators were visited by the supervisor at least twice a week in order to offer necessary assistance and supervise the interviewing process closely. Two workshops were conducted during the course of data collection. At such workshops, activity and progress reports as well as problems encountered were presented and discussed by all researches, enumerators, data collection supervisors and members of PPCT.

3. Results

3.1. *Personal characteristics and family sizes of respondents*

A total of 646 respondents were successfully interviewed and questionnaires completed and analysed (Table 2). Of these, 254 (39.4%) were females and 392 (60.6%) were males. Their ages ranged from 20 to over 70 years, the majority being between 27 and 50 years. Most of the respondents were farmers (90.8%), followed by workers/artisans (3.0%). Others were businessmen, religious leaders, teachers and drivers. The education level of the respondents was mostly primary (74.4%) while 20.4% had attended adult literacy classes. Only 1% of the respondents had attended secondary schools. The remaining 4.2% were illiterate.

Most respondents indicated that they had lived in the same villages for 26–50 years, thus implying that they were born there. According to the respondents, family sizes were as follows: 3 (12.6%), 4 (16.2%), 5 (12.3%), 6 (15.3%) and 7 (12.3%) (Table 3).

Table 2
Samples analysed in each study village

Village	Analyzed questionnaires
Manolo	88 ^a
Gologolo	88
Emao	87
Masereka	76
Malibwi	86
Mbwei	77
Magamba	87
Ubiri	77
Total	646

^a 100 Respondents were involved. However, 12 questionnaires were incomplete and unanalysable, hence deleted from the sample.

3.2. Knowledge, Attitudes and Practice (KAP) of villagers on plague

A total of 181 (28%) respondents claimed to have had plague cases in their households, while 465 (72%) had not experienced any plague problems. As regards sex of plague victims known to the respondents, 54.6% were females and 33.3% were males. The remaining respondents did not know. When asked about symptoms of plague, 56.2% reported fever to be the main symptom, while 10.4% said that fever, headache and/or buboes were common symptoms. Cough, backache and headache were also reported as symptoms of plague (Table 4). When asked about possible factors responsible for the causation and persistence of the disease in the district, 58.1% indicated that rodents were responsible, 25.7% said dirty environment was responsible, 6% attributed plague persistence to both rodents and dirty environment, and the rest did not know.

As regards awareness of plague existence in other households and/or villages, (56%) of the respondents reported knowing other people suffering from the disease, while the rest did not know. Interviews with previously cured or currently infected

Table 3
Number of people living in the same house

No.	Frequency	%
1	31	6.7
2	45	9.7
3	92	17.7
4	105	20.5
5	76	14.3
6	59	10.6
7	54	10.6
Total	462	90.1

Table 4
Plague symptoms as reported by respondents

Symptom	Frequency	%
Fever	276	56.2
Fever/Cough	35	7.9
Fever/Headache/Buboes	45	10.4
Fever/Backache	9	2.5
All of the above	1	0.3
Total	366	99.5

plague patients indicated that 43% were children of 2 years or younger. When asked about the relationships between the victim and the head of their household, 41.5, 14.3 and 26% replied that the household heads were their fathers, mothers and children, respectively. Those falling under the last category were mostly aged 70 years and above. As regards the frequency of infection, 53.8% of the victims responded that they were infected once while the rest (46.2%) reported to have been sick more than once.

Responses to questions regarding health care, treatment of plague cases and health care seeking behaviour revealed that 55% of the victims had been visited by a health worker and that the latter clinically diagnosed the disease in 64.7% of the cases. Only 16.7% and 1.0% of the interviewed victims said that they were given medicines and health education, respectively, by the health workers. As shown in Table 5, the types of drugs given by health workers were reportedly tetracyclines (55.8%), sulphonamides (33.7%), and streptomycin (8.4%). Furthermore, 86.8% of the healthy respondents reported that they had been visited by health workers and that the major tasks during such visits were to advise on environmental cleanliness and use of pesticides, as well as distribution of medicines. When asked about the role of traditional healers in the management of plague, 68% of the respondents expressed strong belief that such healers could effectively treat plague patients. Another 13.7% said that the healers could sometimes cure plague cases. Only 16% believed that the healers were not able to cure plague. The rest (2.3%) did not know.

Table 5
Reported types of drugs given by health workers

Name of drug	Frequency	%
(1) Sulphonamides	32	33.7
(2) Tetracycline	53	55.8
(3) Streptomycin	8	8.4
(4) 1 and 2	1	1.1
(5) 1 and 3	1	1.1
Total	95	100.0

Table 6
Number of beds per house

No. of beds	Frequency	%
1	85	18.3
2	222	31.4
3	245	37.1
4	50	10.8
5	17	3.7
6	7	1.5

3.3. Houses, immediate environment and cultural practices

Interviews and physical inspection of respondents' residences indicated that 80% of the houses have loose floors while 73% have mud walls and 54% have very small windows. Furthermore, 79% of the respondents reported that their houses were generally less than 15 metres from one another. Furthermore, the majority of houses were either roofed with cedar tree barks or corrugated iron sheets. As regards conditions of the immediate environment, 61% of the respondents reported the presence of bushes or tall grasses near their houses.

When asked about food storage practices, garbage disposal as well as sleeping habits, the majority (91.5%) reported to store food crops in their residential houses, especially in ceilings (57.9%) and on floors (33.6%). Furthermore, 71% of the respondents, reported to dispose their garbage in pits dug close to homesteads. When asked about availability and use of beds, 86.8% of the respondents reported to have less than three beds per house (Table 6). Follow-up discussions with respondents showed that some members of the family, especially women and children, generally sleep on simple beddings laid on the floor while men mostly sleep in beds.

3.4. Presence and control of rodents and fleas

Presence of rodent burrows close to human residences was reported by 69% of the respondents. Of these, 70.2% reported presence of rodents in the burrows. Likewise, 68% of respondents reported that there were fleas in their domestic environments and that the insects were mostly biting at night. When asked about control methods for rodents and fleas, 40% said that chemical methods were best, while 27.1 and 13.7% reported keeping of cats and cleanliness of houses, respectively, to be the most effective measures (Table 7).

4. Discussion

The reported and observed personal characteristics were assumed to potentially influence the persistence and recurrence of human plague in the area. Low basic

education for example has a negative impact on the level of understanding of health education by villagers. Large families and poor economic status on the other hand make it difficult for every resident to have a bed. As a result, some family members are obliged to sleep on the floor, and hence become more vulnerable to flea bites and consequently get infected with plague. In fact 86.8% of the respondents said that they had less than three beds per house. Overcrowding in residential houses also facilitates transmission of plague from an infected person to several others by flea bite or droplet infection.

Analytical discussions with respondents suggested that in most houses where there were not enough beds for all the family members, men were the most likely to sleep in beds while women and children mostly sleep on simple mats, pieces of sacks or rugs laid on the floor. Further discussions with respondents in some villages revealed that most girls, unlike boys, were obliged to sleep on the floor because they were not capable of making their own beds. In fact they only sleep in beds when the latter fall vacant in their parents' or grand-parents houses.

This type of sleeping habit exposes women and children to higher risks of being bitten by fleas which normally breed in the soil, including dusty floors of houses and rodent burrows. The finding that fleas were present in 68% of respondents' houses and that the insects were mostly biting at night, further justifies the argument that people sleeping on the floor are more likely to be bitten by these insects than those sleeping in beds. Since some of these fleas are efficient vectors of plague, it can be justifiably argued that women and children are at higher risks of contracting the infection than men. The current observation that a large percentage of the interviewed plague victims were children, and the previous reports that women and children were more infected with plague than men (Kilonzo and Mhina, 1982, Kilonzo, 1992), can therefore be, at least partly, attributed to their sleeping habits.

The lack of adequate beds and the habit of sleeping on the floor by certain groups of family members, is also common in other parts of the country, including Singida and Mbulu which also harbour endemic plague foci (Kilonzo and Mtoi, 1983; Kilonzo, 1984). The practice is mainly attributable to large family sizes and poor economic status of the people. However, the disease has not been persistently active in such areas and hence studies on socio-cultural factors affecting its persistence have never been seriously considered, although such studies would be useful as a comparison with the situation in Lushoto District.

Table 7
Best methods of controlling rodents as reported by respondents

Best method	Frequency	%
Keeping of cats	193	27.1
Use of rodenticides	431	40.7
Cleanliness of houses	59	13.7
Filling wall gaps, holes, crevices	52	12.0
Clearing bushes	19	4.4

As regards knowledge of the local people about plague, the current findings suggest that the majority of Lushoto residents are quite conversant on the common symptoms of the disease and that they know the involvement of rodents as well as dirty environment in its persistence and prevalence. Furthermore, the findings in these studies reveal that the majority of respondents are visited by health workers and advised on environmental sanitation and use of pesticides, both of which are important in controlling and preventing outbreaks of plague. The observation that 68% of the respondents strongly believe that plague is cured by traditional healers can be interpreted to suggest that many Lushoto residents seek health services from such healers whenever they develop plague symptoms. This attitude results in delayed or nonreporting of cases to relevant health personnel. As such, appropriate control measures are not implemented promptly and hence the disease continues to persist, and break out. Moreover, patients being treated by traditional healers are not isolated and hence they are in continuous contact with many people who will in turn spread the infection to other parts of the district and consequently facilitate expansion of the focus. This observation further explains previous observations that most deaths due to plague occur at home or at health centres when the patients report late (Fupi, 1988).

The information obtained from respondents and observations made by researchers and enumerators suggest further that most dwellings and their surroundings provide favourable sites for harbourage and breeding of rodents and fleas, thus facilitating close contacts between humans, rodent reservoirs and flea vectors. As such, the type and status of houses and immediate environment may have a direct or indirect effect on the persistence and repeated outbreaks of the disease in the district.

Furthermore, the mode of food storage and garbage disposal attracts rodents into or close to human residences and hence facilitates contacts between humans, rodents and fleas, and consequent transmission of plague. The close proximity of houses on the other hand facilitates movement of rodents and fleas from one house to another, thus spreading the disease if there are patients in one or more houses in the village.

Traditionally, Lushoto residents keep domestic animals, especially dogs for guarding and hunting purposes. The current studies show that 70% of the respondents keep these animals in their homes. Since about 5.5% of domestic dogs in the district are efficient plague carriers (Kilonzo et al., 1992), the possibility that they (dogs) play a potential role in maintaining the infection in the district cannot be ruled out.

5. Conclusion and recommendations

It can be preliminarily concluded from the current studies that the long persistence and repeated outbreaks of human plague in Lushoto District is attributable to a complexity of factors. These include socio-cultural, socio-economical, environmental and biological. In depth ethnographical studies are recommended in order

to thoroughly understand the attitudes of Lushoto communities regarding plague prevention and management. The information obtained from such studies can then be applied in preparing appropriate recommendations for effective interventions. According to the current findings, appropriate intervention should include a carefully designed programme of health education that is socially and culturally acceptable to the villagers and their leaders. As such, the communities can, in the long run, willingly change their attitudes about causation and treatment of plague and hence be prepared to report cases promptly and fully participate in carrying out effective control and preventive measures against the disease.

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