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Flu-like Epidemics in Wild Bonobos (*Pan paniscus*) at Wamba, the Luo Scientific Reserve, Democratic Republic of Congo

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INTRODUCTION

Epidemics such as some respiratory diseases, poliomyelitis, and Ebola hemorrhagic fever have caused significant mortality in the wild chimpanzee population at long-term study sites^{1,2,3,4}. It is possible that increased contact with humans has caused some of these epidemics.

The high risk of disease transmission from human to apes, and *vice versa*, necessitates the institution of procedures to prevent disease transmission by investigators who study wild animals closely related to humans, such as apes.

We observed two epidemics of a flu-like disease, one in 2003 and one in 2008, in the wild bonobo population at Wamba, which has been under study since 1973. In the present paper, we report the symptoms and transmission of the disease and discuss the effects of the social contact between bonobos and humans at the study site.

METHODS

The subjects were the bonobos (*Pan paniscus*) of the E1 group at Wamba (0°11'8"N, 22°37'58"E) in the northern sector of the Luo Scientific Reserve in the Democratic Republic of Congo. This group has been studied since 1973⁵. The Luo Scientific Reserve was established in 1990, and people have been allowed to live in a village on the Reserve and use the protected areas in their traditional way⁶. Although the study was interrupted by political disorder in 1991 and two civil wars between 1996 and 2001, it was resumed in 2002. All 19 bonobo group members, including those who were born or immigrated during and after the disorder, were

identified in March 2004⁷. We attempted to locate the E1 group six days per week and to follow the parties from sleeping site to sleeping site. Observations were usually made by one or two researchers and two research assistants. After 1996 the bonobos were never provisioned with food. All members were well habituated to the environment.

RESULTS

The First Epidemic of a Flu-like Disease

MM and research assistants noted that one adult male was coughing severely during the last week of October 2003. On November 5, an adult female began coughing. The flu-like symptoms spread rapidly, and most of the group members had the symptoms by November 7. They coughed and had difficulty breathing through their noses. They did not eat well or travel a long distance, and they spent much time lying on the ground. On November 11, they began to recover and eat a variety of food as usual. Only two individuals continued to have symptoms on November 15, but they eventually recovered. No bonobos died from this flu-like disease. The people in the village did not experience any respiratory epidemic at this time.

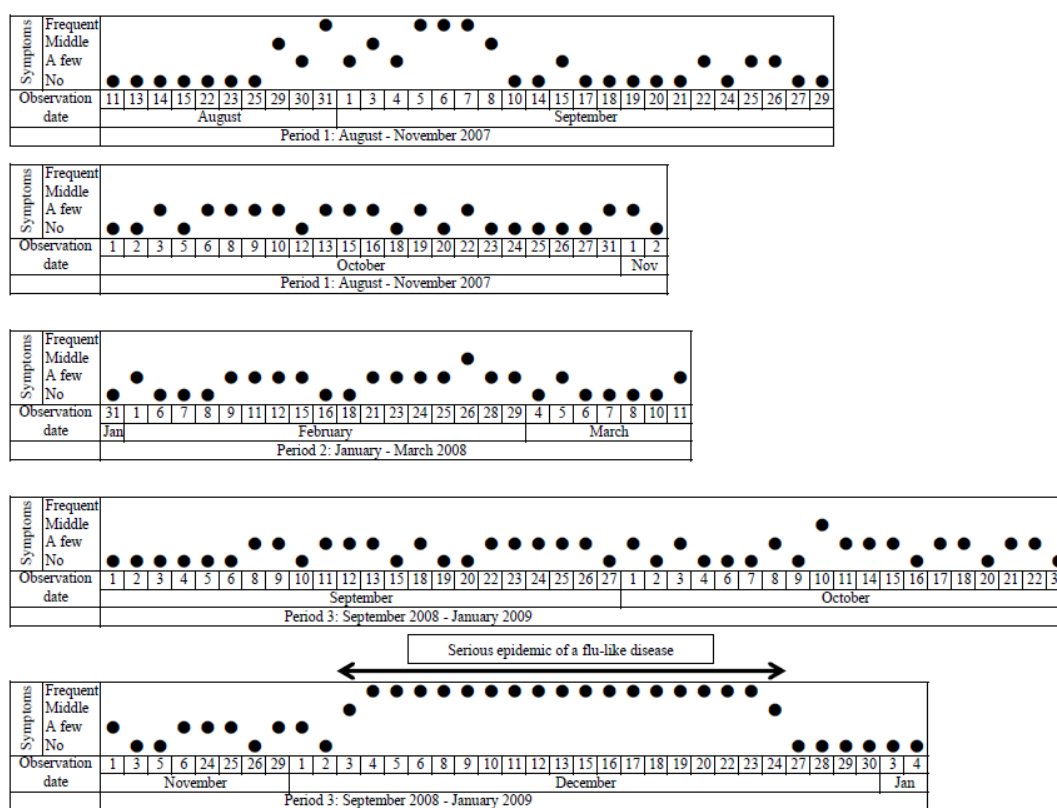


Fig. 1. The fluctuation of flu-like symptoms (i.e. coughing, sneezing, and/or picking one's nose) during the study periods of TS (Period 1: August 11–November 2, 2007; Period 2: January 31–March 11, 2008; Period 3: September 1, 2008–January 4, 2009). The extent of symptoms in the group on each day was divided into four categories; "No": no symptoms were confirmed during observation; "A few": symptoms were confirmed in 1–5 1-min observation units (OU); "Middle": symptoms were confirmed in 6–10 1-min OU; "Frequent": symptoms were observed in more than 10 1-min OU.

The Second Epidemic of a Flu-like Disease

TS and research assistants observed the second epidemic of a flu-like disease between December 3 and 24, 2008. Fig. 1 shows the fluctuation of the disease symptoms during the study periods (Period 1: August 11–November 2, 2007; Period 2: January 31–March 11, 2008; Period 3: September 1, 2008–January 4, 2009; The total observation time was 1141 h and 57 min in 156 days). During these periods, the E1 group consisted of 23–26 individuals. All occurrences of flu-like symptoms, *i.e.* coughing, sneezing, and/or picking one's nose, observed or heard were recorded. The symptoms observed on each day were divided into four categories: "No": no symptoms were confirmed during observation; "A few": symptoms were confirmed in 1–5 1-min observation units (OU); "Middle": symptoms were confirmed in 6–10 1-min OU; "Frequent": symptoms were observed in more than 10 1-min OU. Fig. 1 shows that flu-like symptoms did not always lead to disease outbreaks. The most serious epidemic of a flu-like disease occurred between December 3 and 24, 2008. Flu-like symptoms were frequently observed in the group between August 29 and September 8, 2007, but to a lesser degree.

Fig. 2 shows the daily and the total number of individuals that exhibited flu-like symptoms (coughing, sneezing, sniffing, and/or picking one's nose) between December 3 and 24, 2008. It is likely that the number of individuals exhibiting symptoms was underestimated when the bonobos formed large parties because it was often difficult to identify coughing and/or sneezing individuals when they were in the trees. On December 3,

TS confirmed coughing for six 1-min OU in one juvenile male (Jiro). By the next day, the symptoms had spread rapidly to more individuals (flu-like symptoms were confirmed in 37 1-min OU). A subadult female (Fuku), an adult female (Hoshi), and an adult male (Nord) had severe coughs. From December 8, the group split into small parties and did not travel long distances. They ate only a few kinds of foods each day. As an example of the altered behaviors observed by the researchers, on December 9, Hoshi and her 1-year daughter (Hina) arose at 8.55h (bonobos of this group usually arose at 6.00h), and Hoshi stayed in the trees with only Hina. She coughed severely all day and never climbed down to the ground. She ate only Musanga fruits and returned to the same bed at 14.31h. We followed an adult female (Sala) with her 4-year son (Shiba) for all observation days during the epidemic. Sala and Shiba first exhibited flu-like symptoms on December 13 and 17, respectively. On December 17, we confirmed that Sala had had a newborn infant who died. We could not confirm whether it was a live or stillbirth. She carried the corpse for two days. On December 22, Sala's coughing began to decrease, and on December 23 she reunited with some other group members. December 24 was the last day on which symptoms were confirmed in the group. Sala's newborn infant was the only member of the E1-group who was confirmed to have died during the period of the flu-like disease. However, Hoshi's daughter, Hina, may also have died during this period because she has not been observed by local assistants after TS left Wamba in January 2009.

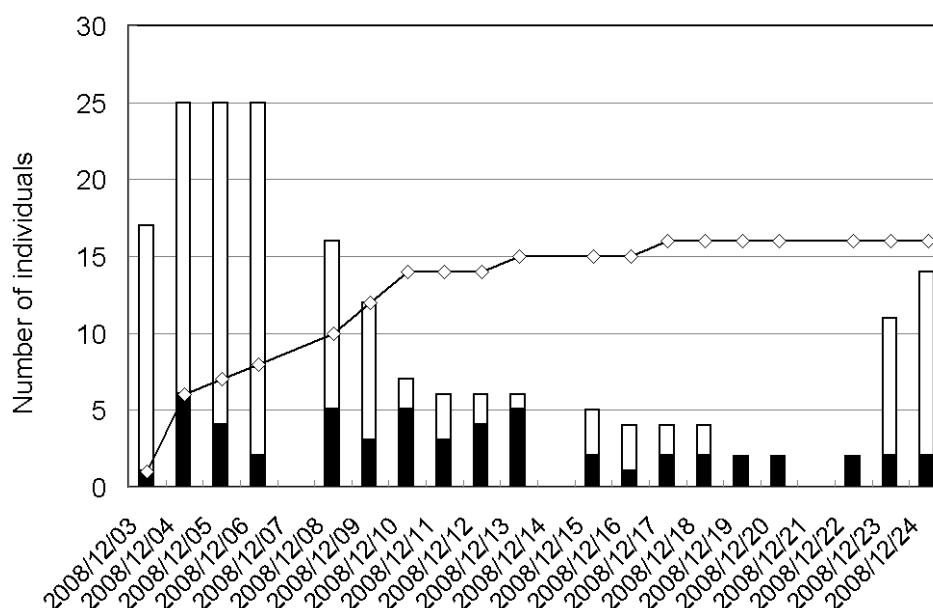


Fig. 2. The observed flu-like symptoms. Solid bar: The number of observed individuals who showed flu-like symptom(s) (coughing, sneezing, sniffing, and/or picking one's nose) on each day. Open bar: those who did not show symptoms on each day. Line: the accumulated number of individuals who showed symptom(s) at least once between December 3 and 24, 2008.

During the serious epidemic, flu-like symptoms spread to at least 62% of the group. No symptoms were confirmed in four adult males and in two adult females and their infants. However, these individuals were observed only at the beginning and the end of the epidemic period (except for one adult male who had not been observed between August 2008 and January 2009), and it is possible that they had contracted the disease when they were not being observed. If that is the case, nearly all of the group members contracted the flu-like disease.

Several of the people in the village had flu-like symptoms in November and December 2008. No data are available to confirm that people had any similar disease at this time, but we were aware of the symptoms because we stayed at a research station in the village; that is, we saw some people coughing, having a fever, and/or being laid down in a week or more. TS also observed some goats and a duck coughing in the village in December. People in the village continued to exhibit flu-like symptoms until at least the beginning of January 2009, when TS left the study site.

DISCUSSION

Several individuals in the bonobo study group were observed to have flu-like symptoms between October and November 2003; this was the first serious epidemic to be observed in the group at Wamba since study began in 1974. No evidence shows that this epidemic was transmitted from people to the bonobos. Researchers at Wamba were always at least 10m from the bonobos while observing them. In contrast to the chimpanzees in the Mahale Mountains National Park in Tanzania, who are habituated to humans and are known to approach them (Sakamaki, personal observation), the bonobos in the Wamba study group rarely came closer than 10m to the human observers. A limited number of tourists visit Wamba, and although the people in the village entered the study group's habitat on a daily basis, neither group approached bonobos in the same way as the researchers. Therefore, there was little risk of infection-including droplets being transmitted from humans to bonobos at Wamba.

It is possible that the flu-like disease in the second epidemic was transmitted to the bonobos from infected people. Flu-like symptoms were observed in several people and domestic animals in the village in November 2008. A gap of about a month occurred between the disease outbreak in the village and that in the bonobo population. In addition, two researchers from outside the village visited Wamba and began observation of the bonobos at the end of November, just before the disease outbreak. However, because no diagnostic analysis was conducted, we have no evidence that the flu-like symptoms exhibited by the bonobos were caused by a contagious virus transmitted to the group from humans.

As the number of people who visit primate research sites increases, we must be aware of the potential risks this additional social contact brings. In addition to researchers, people who visit Wamba today include people from NGOs who support forest conservation and the livelihood of the villages, television teams covering the bonobos, poachers, and peddlers traveling between towns and villages. We must put in place measures to decrease the risk of disease transmission between humans and apes, and it is imperative that researchers establish and update observation guidelines that minimize the transmission of infections from humans to bonobos.

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