

Infant play drives chimpanzee respiratory disease cycles

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The signature boom-bust cycling of childhood respiratory diseases was long attributed to environmental cycling. However, the effect of school holidays on rates of social contact amongst children is increasingly seen as another major driver. New research on chimpanzees suggests that this effect of social connectivity on disease cycling may long predate attendance of children at schools, with chimpanzee infant mortality rates cycling in phase with rates of social play amongst infants.

Published in the journal *PLoS ONE*, the new study examined more than two decades of infant mortality data from two chimpanzee communities in the Taï National Park, Côte d'Ivoire. Previous work by the authors, from the Max Planck Institute for Evolutionary Anthropology in Leipzig Germany, had shown that chimpanzees at the site were killed by respiratory viruses repeatedly introduced from humans. The new study found evidence for mortality cycling at two distinct intervals. On an annual scale, outbreak deaths peaked during the period of high food availability, when chimpanzees are most gregarious. However, infant mortality also cycled on a roughly three year period.

"What is fascinating about this three year cycle is that it appeared to be self-organized," said Hjalmar Kuehl, the lead author on the paper. "That is, the cycles were not forced by some extrinsic environmental cycle but emerged naturally from the demography, developmental ontogeny, and social behavior of chimpanzees." Climate cycles such as those caused by the El Nino Southern Oscillation were not good predictors of infant mortality patterns.

The key to the three year cycle was the ontogeny of playfulness in chimpanzee infants. Chimpanzee newborns are not very social but infants become increasingly playful with age, reaching a peak in social play at about two years old. Thus, each cycle started when an outbreak killed a group of infants, thereby synchronizing the reproductive cycles of their mothers. One year later, a large cohort of infants was born which, another two years further on, matured to peak play age.

These highly playful infants produced a social bridge between community members who might otherwise engage in little direct interaction: ideal conditions for community-wide propagation of a new outbreak. The study provides a nice link between population dynamics and the behavioral issues traditionally studied by primatologists", said Yasmin Moebius, who did the analysis of play ontogeny.

It also has important implications for the conservation of chimpanzees, which are classed as Endangered by the World Conservation Union (IUCN), as well as Critically Endangered gorillas. Ape tourism has been heralded as a means of providing monetary value to governments and local communities. However, close approach to habituated gorillas and chimpanzees by tourists poses a serious disease transmission threat. "Our analyses not only tell us that disease transmission from tourists and researchers is a major problem", said Peter Walsh, another coauthor. "They tell us when the risk is greatest and, consequently, when measures such as vaccination would be most effective."

"We need to be more proactive about taking steps to minimize the disease transmission risk posed by both tourism and research," added Christophe Boesch, a coauthor who initiated the Tai Chimpanzee project in 1979. "We also need to expand our vision to include disease management measures such as vaccination as important parts of the ape conservation puzzle."

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