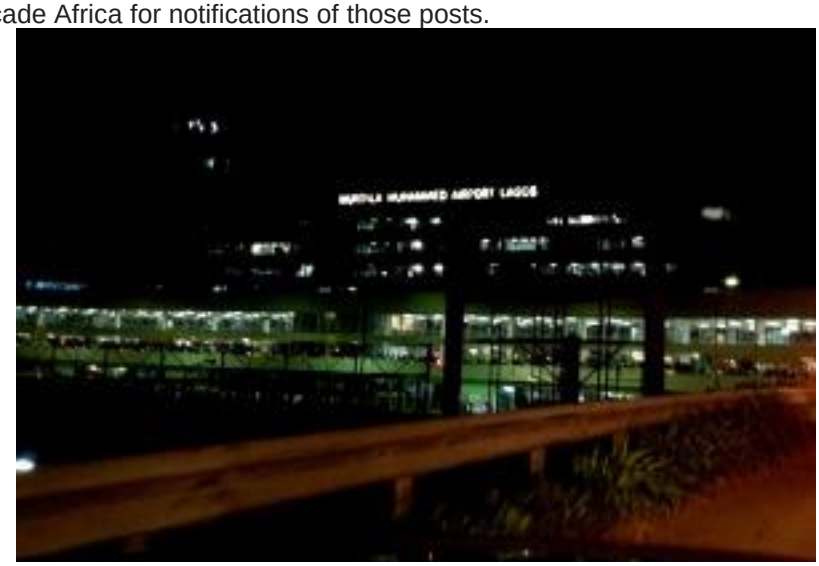
Ebola's History, 1: Introduction

For immediate information on how to help prevent the further spread of Ebola and how keep yourself safe, please consult and share the Ebola Facts website.

The terrible news that a man—who we now know was an American citizen on his way home to Minnesota—died from Ebola upon arriving in Lagos from Liberia jolted me when I read about it a couple of days ago. Ebola—the disease my older sister used to give me nightmares about after she read *The Hot Zone*—seemed oceans away when I was researching in Lagos several weeks ago, where car crashes, malaria, and Boko Haram seemed like much more immediate fears.

But now, in a matter of hours, via one single horribly unlucky man on one ill-fated flight, the disease has arrived in Nigeria's megacity—a city where as many as 20 million or more people live without a reliable source of power, without a well functioning sanitation system, and without much infrastructure whatsoever. The people of Liberia, Sierra Leone, and Guinea along with the health workers bravely working to treat those affected have already suffered horribly from West Africa's first outbreak of the Zaire strain of Ebola—an outbreak that has killed at least 1,500 people since early 2014—and it is terrifying to think of the virus traveling to a major international city like Lagos where the toll could be even more horrific and from where it could more easily spread beyond West Africa (over seven million passengers traveled through Murtala Muhammed International Airport in 2011 alone).

With fear for my friends in Nigeria in mind, I decided to research more about the deadly disease, and have been writing a summary of the virus's history because the wikipedia entry didn't provide much information and because the double mystery surrounding Ebola *and* Central Africa—still imagined by many in *Heart of Darkness* terms—is in part why many people find the disease so terrifying. Over the next few days I'll upload a series of posts on the history of Ebola, so check back or follow Arcade Africa for notifications of those posts.



Murtala Muhammed International Airport (Mark Duerksen 2014)

Ebola's History, 2: Biology

While there are numerous virology and pathology articles trying to pin down the scientific facts of the elusive Ebola virus, social scientists do not seem to have thoroughly studied the dreaded virus…and it's not hard to imagine why historians and anthropologists would shy away from field research on a disease like Ebola.

I haven't researched Ebola in the field, and when reading this historical summary please note that I am not a doctor, nor am I a historian of science, so please consult the sources cited for more thorough

information. That being said, as compellingly argued in a recent Journal of African History article on the social history and biology of HIV/AIDS in Africa, scientific understanding and treatment is often enhanced by a greater awareness of the social and cultural contexts in which diseases have developed and spread. These kind of historical insights are why I hope I'm able to offer something by giving an account of Ebola from an African historical perspective without having an advanced background in biology.

However a quick synopsis of Ebola's basic biology is of course necessary. Ebola virus disease (EVB) or Ebola hemorrhagic fever (EHF) is an RNA virus that is part of the Filoviridae Family of diseases of which there are three members—Marburg Virus, Cueva Virus, and, our concern, Ebola Virus. Within its branch of the Filoviridae tree, Ebola comes in five species: *Zaire ebolavirus* (EBOV, discovered in1976), *Sudan ebolavirus* (SUDV, 1976), *Tai Forest ebolavirus* (TAFV, 1994), *Reston ebolavirus* (RESTV, 1989), and *Bundibugyo ebolavirus* (BDBV, 2007). Amongst these five strains, *Zaire*, *Sudan*, and *Bundibugyo* are responsible for the deadly outbreaks in Africa, while *Reston* has never caused human illness or death despite several people testing positive for it (they remain asymptomatic), and there has been only one known human case of *Tai* and the victim fully recovered within six weeks.[1]

Ebola is a public health nightmare because it can be contacted relatively easily (especially in a hospital setting where proper precautions are not taken) and is almost always fatal. Ebola is introduced into human populations from contact with the highly contagious blood or body fluids of infected animals such as monkeys or bats, and then spreads through human-to-human transmission. There is also some inconclusive evidence that the virus has the ability to spread through airborne nasal and throat secretions.[2] The signs and symptoms of Ebola have been well publicized, and they include the sudden onset of fever, sore throat, extreme weakness, headache, and muscle pain within 2 to 21 days of infection. Additional symptoms soon appear that make transmission more likely, including vomiting, diarrhea, rashes, both internal (gastrointestinal) and external (gums, nose) bleeding.[3] There is no known treatment for Ebola (although vaccines are in the works), and once the onset of symptoms occur, victims usually die within 5 days with *Zaire ebolavirus*'s fatality rate nearing 90% and *Sudan*'s being slightly less between 53% and 66%.[4]

Bats on an island in Lake Kivu (Mark Duerksen 2014)

One of the greatest mysteries surrounding Ebola has been identifying the "reservoir"—the animal that asymptomatically carries the virus between outbreaks, allowing it to go silent for years at a time. Scientists have come to consider fruit bats as the most likely reservoir candidates after capturing and testing thousands of African animals, and after numerous attempts to infect various animals and plants, which confirmed fruit bats could contract and carry the virus.[5] However most human cases are thought

to be the result of exposure (hunting or eating) to infected nonhuman primates and duikers (small deer) that have acquired the virus from bats.[6]

[1] WHO, “Ebola virus disease Fact Sheet,” April 2014.
Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[2] C. J. Peters and J. W. LeDue, “An Introduction to Ebola: The Virus and the Disease,” *The Journal of Infectious Diseases*, 179 (1999), *ix-xvi*.
Online:http://jid.oxfordjournals.org/content/179/Supplement_1/ix.full.pdf
[3] WHO, “Ebola virus disease Fact Sheet,” April 2014.
Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[4] A. S. Carroll et al., “Molecular Evolution of Viruses of the Family Filoviridae Based on 97 Whole-Genome Sequences,” *Journal of Virology*, 87(2013), 2608-2616.
Online: http://www.ncbi.nlm.nih.gov/pubmed/23255795
[5] *Ibid*; and Xavier Pourrut et al., “The natural history of Ebola virus in Africa,”*Microbes and Infection*, 7(2005), 1005-1014. Online:
[6] A. S. Carroll et al., “Molecular Evolution of Viruses of the Family Filoviridae Based on 97 Whole-Genome Sequences,” *Journal of Virology*, 87(2013), 2608-2616.
Online: http://www.ncbi.nlm.nih.gov/pubmed/23255795

Ebola’s History, 3: Pre-1976

Although 1976 marked the first discovery of Ebola by international scientists, the virus likely has a much deeper history lurking in Central Africa. By testing stored blood samples of 790 chimps and gorillas from Cameroon, Republic of Congo, and Gabon, scientists determined that primates had acquired Ebola prior to known human outbreaks in the areas where the samples were originally taken.[1] Subsequent blood samples of people living in Central Africa have shown that as much as 32.4% of the population possess Ebola antibodies (igGs), which they likely developed from exposure to fruit contaminated by bat saliva containing inactive strands of the virus.[1B] These findings have led the researchers to conclude that the virus has long circulated in the vast forests of Central Africa, infecting human and nonhuman primates.

Chimpanzee in tree, Kabale National Park, Uganda (Mark Duerksen, 2011)

Further evidence of a lengthy history of Ebola outbreaks comes from recent calculations based on the mutation rates of Ebola and Marburg viruses (unusually slow for RNA viruses) that show that the two filoviruses diverged from a single common source around 700 to 850 years ago—around the time when larger and more centralized Bantu speaking societies began to emerge in Central Africa.[2] Given this timeframe for Ebola’s emergence, it is highly probable that isolated human cases of Ebola occurred at least occasionally for several centuries before 1976. [Of course humans could have contracted other

older forms of Filoviruses long before this timeline, and there has been speculation that ancient plagues such the one that struck Athens in 430 BCE were actually caused by Ebola-like filoviruses.[3]]

The reason why international scientists were unaware of the Ebola's existence prior to 1976 may be in part explained by the research of Barry Hewlett, a medical anthropologist from Washington State University and a member of WHO's Ebola response teams. Hewlett's socio-cultural findings suggest that the people of Northern Uganda and Congo have developed effective methods for containing epidemic diseases such as Ebola. When the Acholi people realized that they were dealing with a more serious affliction (*gemo* instead of *yat*) during the 2000 Ebola outbreak in Gulu—Northern Uganda's largest city—they implemented a protocol that prevented an even larger outbreak. This protocol included isolating victims in huts at least 100m from other homes, encouraging everyone to limit their movement, allowing only survivors of the illness (or, if not possible, an elderly person) to treat and bury the victims, and only eating meat freshly butchered from cattle. While the Acholi incorporated modern medicine into their local beliefs and treatments throughout the outbreak, the elders were adamant that the *gemo* protocol existed before the late nineteenth century arrival of Europeans. Their assertion has yet to be historically verified, but the specificity of the regiment and the degree to which it is enmeshed in the language and religious belief system of Acholi people suggest that they developed the emergency procedures over numerous generations in response to outbreaks of Ebola or other similar diseases.[4] Indigenous medical measures such as the Acholi's may explain why prior to 1976 Ebola failed to erupt into outbreaks large enough to attract international attention.

[1] E. M. Leroy et al., "A Serological Survey of Ebola Virus Infection in Central African Nonhuman Primates," Journal of Infectious Diseases, 190(2004), 1895-1899.
Online: http://www.ncbi.nlm.nih.gov/pubmed/15529251
[1B] Dieudonne Nkoghe et al, "Risk Factors for *Zaire ebolavirus*—Specific IgG in Rural Gabonese Popultions," *The Journal of Infectious Diseases* 204(2011), S768-S775.
[2] A. S. Carroll et. al., "Molecular Evolution of Viruses of the Family Filoviridae Based on 97 Whole-Genome Sequences," *Journal of Virology*, 87(2013), 2608-2616.
Online: http://www.ncbi.nlm.nih.gov/pubmed/23255795
[3] Constance Holden, "Ebola: An Ancient history of a "new" disease?" *Science*272(1996), 5268.
Online: http://search.proquest.com.ezp-prod1.hul.harvard.edu/docview/213553956/79244C745EFA4C4DPQ/2?accountid=11311
[4] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008.

Ebola's History, 4: Sudan, Zaire, 1976

International ignorance of Ebola's existence changed in 1976 when near simultaneous outbreaks occurred 500 miles apart in Nzara, Sudan and Yambuku, Zaire, killing a combined 431 people.[1] The existence of a (very poorly supplied)[2] Belgian mission hospital in Yambuku may have actually amplified the outbreak into an event that attracted international attention, as nosocomial cases (those originating in a medical setting) accounted for 234 of the 318 cases, and it was only after the surviving medical staff shut down the hospital that transmission slowed.[3] By the time an international medical team arrived in Yambuku, 95% of the cases had already occurred, and the local people had managed to contain the virus after the hospital's closure through a series of similar responses to the ones that Hewlett would observe decades later in Gulu.[4] A large and active hospital in the town of Maridi near Nzara played a similar role in amplifying the outbreak in Sudan.[5]

Although they arrived at the tail end of active cases, researchers were eventually able to piece together partial details of the outbreaks. They determined that the two outbreak sites involved different strains of the virus—the strains subsequently named for each country—with Ebola getting its name from a river near Yambuku. They were also able to trace the 89% fatal *Zaire ebolavirus* outbreak in Yambuku back to a 44-year-old man who fell ill after he bought and ate monkey meat, and were able to link the 53% fatal Nzara case of *Sudan ebolavirus* back to a cotton factory where numerous bats were present.[6]

Despite the international medical community's surveillance for filoviruses after the European Marburg outbreak from imported African monkeys in 1967 and the Central African Ebola outbreaks of 1976, Ebola went silent. Only two isolated human incidents are known to have occurred between the initial '76 outbreak and 1990s resurgence.[7] There is speculation amongst researchers that this might be because the virus fortunately never contaminated hospitals (as it had in 1976) during that fifteen-year respite.[8]

[1] WHO, "Ebola virus disease Fact Sheet," April 2014. Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[2] The Belgian hospital owned only five syringes, which were constantly reused and subsequently linked to 85 of the Yambuku cases: J.G. Breman et al., "The Epidemiology of Ebola Haemorrhagic Fever in Zaire, 1976," in *Ebola Virus Haemorrhagic Fever*, Amsterdam: Elsevier/North-Holland Biomedical Press, 1978. Online: http://www.itg.be/internet/ebola/ebola-24.htm
[3] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008; and *Ibid*.
[4] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008.
[5] WHO/International Study Team, "Ebola haemorrhagic fever in Sudan, 1976,"*Bulletin of the World Health Organization*, 56(2): 1978. Online:http://whqlibdoc.who.int/bulletin/1978/Vol56-No2/bulletin_1978_56(2)_247-270.pdf
[6] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008; and Xavier Pourrut et al., "The natural history of Ebola virus in Africa," *Microbes and Infection*, 7(2005), 1005-1014.
[7] WHO, "Ebola virus disease Fact Sheet," April 2014. Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[8] C. J. Peters and J. W. LeDue, "An Introduction to Ebola: The Virus and the Disease," *The Journal of Infectious Diseases*, 179, 1999. Online:http://jid.oxfordjournals.org/content/179/Supplement_1/ix.full.pdf

---

Ebola's History, 5: 1990s Resurgence

In 1994 Ebola's eerie silence was broken when it reappeared in Gabon and Cote d'Ivoire. The single human case in Cote d'Ivoire occurred when a 34-year-old female Swiss ethologist contracted the disease while conducting a necropsy on a chimp that had died from a suspected outbreak of Ebola amongst a troupe of Chimpanzees in the Tai Forest bordering Liberia. Once symptoms appeared, physicians quickly transferred her to Switzerland where she soon made a full recovery without infecting anyone else (a precedent for the two Americans with Ebola currently being transferred back to the US). [1] This solitary case is significant because it is the only known human instance of *Tai ebolavirus*, and, prior to 2014, was the only known case of Ebola in West Africa despite many news agencies reporting that this year's outbreak is the first West African Ebola episode.

In Central Africa, the three chimpanzee-linked cases that occurred in Gabon between 1994 and 1995 were all relatively isolated, each infecting less than 60 people, but one victim did travel to Johannesburg where he infected a nurse who died days later without further transmitting the disease.[2] This episode provides a precedent for fears that the 2014 outbreak may travel far beyond the initial index case via international air travel, however the case was quickly contained to a single transmission.

[1] Tara Waterman, "Ebola Cote d'Ivoire Outbreaks," Stanford Honors Thesis, 1999. Online: http://web.stanford.edu/group/virus/filo/eboci.html
[2] Xavier Pourrut et al., "The natural history of Ebola virus in Africa," *Microbes and Infection*, 7(2005), 1005-1014. Online: http://www.sciencedirect.com.ezp-prod1.hul.harvard.edu/science/article/pii/S1286457905001437

Ebola's History, 6: Kikwit, 1995

In 1995 a major outbreak hit a major urban area for the first time. Kikwit is a large town of several hundred thousand residents in what is now central DRC, and despite two hospitals utilizing somewhat better sanitation practices than those used in 1976, the virus passed quickly from person to person,

infecting 315 and killing 254.[1] Although some recent media stories have stated that prior to 2014 Ebola occurred only in remote, rural areas of Central Africa, the Kikwit and previously mentioned Gulu (2000) cases contradict this myth and provide a precedent for how deadly—the deadliest two cases prior to 2014[2]—the disease can become in a dense, infrastructure-poor urban setting when it is not immediately identified (as it luckily was in Johannesburg and now Lagos).

Kikwit, 2014 (Image Source)

Kikwit is also notable because several researchers have subsequently conducted otherwise scarce social science research into the local responses and explanations for outbreak. The origin stories recorded by de Boeck (2000), and Kibari and Lungazi (1998) describe how the people of Kikwit had a history of resisting ruthless Belgian colonial and later kleptocratic Mobutu sese seko national exploitation and told the story of how the grave of Kungu Pemba (the town's chief who resisted the colonial state) would curse anyone who tried to sell the soil of Kikwit.[3] Many people in Kikwit believed Ebola was a result of this curse. A competing claim linked the outbreak to an American doctor whom locals believed to have introduced the virus from labs in Europe in revenge for residents accusing him of transforming into a hippo and attacking people.[4] By the time of the 1995 outbreak, the people of Kikwit had a long history of good reasons to distrust the broader world and to perceive that external forces were the cause of their suffering. Amplification of the disease in hospitals run by Western doctors did nothing to improve that trust, and, in fact, in the wake of Ebola's toll, the town did not have a functioning hospital for two years and boycotted a polio vaccination program in large part because of continued mistrust of biomedicine.[5]

These findings from Kikwit add a layer of context to consider regarding the stories we're currently hearing about tensions between health workers and some communities in West Africa. There may well be the similar historical reasons for communities in West Africa to mistrust Westerners who claim to want to help them; after all, colonialism claimed to be "helping" Africans. Prior to Hewlett, WHO Ebola response teams did not consult social scientists with knowledge of the people whom they were attempting to help, but hopefully, in trying to fight the current outbreak in West Africa, WHO and other health organizations are utilizing Hewlett's research along with liaisons who are more familiar with the local communities.

Even once this current outbreak is eventually stamped out in West Africa, the state of healthcare in the aftermath of Kikwit's outbreak demonstrates that WHO's job won't be finished, as there will still be work needed to be done in order to repair relations and rebuild trust with local communities. Likewise, as has been the case with past episodes of Ebola, international researchers will likely rush in once the danger has past in order to collect more information on the virology of the outbreak, potentially kindling further mistrust amongst local communities as was found to be the case by Hewlett in post-outbreak Gabon where locals complained of researchers drawing their blood and questioning them without providing explanations and then never returning with the results.[6] A 2009 review of scientific field research on Ebola in Africa found that only 15 out the 34 teams sought individual consent from research subjects, and only three consulted any form of research ethics committee.[7] Instituting measures to rebuild trust with local communities—including higher ethical standards for post-outbreak researchers—will likely improve local receptions of international response to the next outbreak, hopefully lessening its severity.

The next outbreaks after Kikwit were back-to-back in Gabon, followed by the major Gulu outbreak, and then, in keeping with the trend since 1994, followed every few years since by outbursts in Central Africa with the latest (prior to 2014) occurring in the DRC in 2012.[1] During these outbreaks researchers and witnesses have documented additional noteworthy social reactions to the deadly disease such as how people in Uganda and Congo responded to government bans on traditional handshakes by instead snapping fingers or bumping elbows.[2] In northern Uganda business largely ceased during the outbreaks due to fears that money might carry the infection, and in Sudan people resisted their loved ones being placed in WHO's windowless pop-up isolation units because they had no way to communicate and comfort them and were not allowed to see their bodies once they had died, leading to fears that the outbreak was concocted by the international teams in order to harvest villagers' organs.[3] In societies where belonging to a community is everything and where pain is often treated with the constant comforting presence of a family member or friend, the concept of complete isolation from the community during a disease is utterly foreign and terrifying. This insight into local peoples' thinking from Sudan may also help explain villagers' fear of international health teams employing isolation units in West Africa.

[1] Xavier Pourrut et al., "The natural history of Ebola virus in Africa," *Microbes and Infection*, 7(2005), 1005-1014. Online: http://www.sciencedirect.com.ezp-prod1.hul.harvard.edu/science/article/pii/S1286457905001437
[2] WHO, "Ebola virus disease Fact Sheet," April 2014. Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[3] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008.
[4] *Ibid.*
[5] *Ibid.*
[6] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008.
[7] Philippe Calain, "Research Ethics and International Epidemic Response: The case of Ebola and Marburg Hemorrhagic Fevers," *Public Health Ethics*, 2(2009), 7-29.
[1] WHO, "Ebola virus disease Fact Sheet," April 2014. Online:http://www.who.int/mediacentre/factsheets/fs103/en/
[2] Barry S. Hewlett and Bonnie L. Hewlett, *Ebola, Culture and Politics: The Anthropology of an Emerging Disease*, Belmont, CA: Thomson Wadsworth, 2008.
[3] *Ibid.*

Ebola's History, 7: Trends

As social scientists studied communities affected by the slew of outbreaks that swept through Central Africa in the 1990s and 2000s, virologists began to wonder if the unprecedented number of cases was somehow connected. Initially they developed a theory that a single Ebola outbreak from a single index case was slowly simmering through Zaire (and then DRC), Gabon, Congo, CAR, Sudan, and Uganda. The reality that the outbreaks included several species of the virus and multiple suspected index cases

squashed the theory of a single outbreak, but still the question remained, why this sudden and prolonged string of separate and distinct outbreaks?

Scientists next looked for larger environmental patterns that might connect the Central African cases. Most outbreaks of Ebola occur in between the dry and wet seasons, but there has been speculation that broader climatic event might be connected to the sustained spike in cases. The 1976 simultaneous outbreaks of separate species only a few hundred miles from each other also points to an environmental occurrence activating the virus and allowing it to jump from the reservoir to monkeys and humans. Scientists have been studying satellite photographs of the Congo Basin from the past few decades in an attempt to detect any environmental changes that overlap spatially with flare ups of Ebola. These studies have found that especially arid dry seasons disrupt jungle ecosystem, causing animals to move beyond their normal confines in search of food and water, which results in increased human to animal contact.[1] If this is accurate, global warming has serious implications for Ebola outbreaks.

Another study that may lend further support to the environmental activation hypothesis was conducted in 2010 when scientists examined living African bats and rodents and found ancient "fragments" of filoviruses in their genomes. Through recent advances in the fascinating subfield of paleovirology the researchers were able to estimate that filoviruses are likely tens of millions of years old based on the evidence from the genetic remnants of the disease shared by the mammals coupled with the scientists' knowledge of the mammals' shared evolutionary trees. If rodents and bats have carried filoviruses for tens of millions of years as they migrated across the world, it's no surprise that strains of Ebola exist in both Sub-Saharan Africa and the Philippines. The study goes on to suggest that other rodents, marsupials, and bats may carry yet unknown forms of filoviruses in the Americas.[2] The fact that we've only seen the virus pass from reservoir to human in Central Africa and the Philippines, lends credence to the idea that it is something particular to the Central African environment (that the Philippines may share) that is "activating" or allowing the virus to jump from the reservoir to larger mammals. Could global warming activate latent filoviruses in other regions of world? [Or, alternatively perhaps other New World strains are similar to the *Reston* species in that they don't cause human illness when spread to humans and therefore have eluded detection so far.]

As promising as the research has been into detecting an environmental link, in focusing on identifying climatic trends connecting the past twenty years of outbreaks, scientists have failed to consider the often-horrific human history of Central Africa as a potential source of explanation for the spate of outbreaks. In the aftermath of the Rwandan civil war and 1994 genocide, the deadliest conflict since World War II unfolded across Central Africa, killing over four million people, displacing many millions more, and dragging in soldiers from throughout the region. The First and Second Congo Wars have not received nearly as much scholarly attention as they require, but books such as *Africa's World War* written by Gerard Prunier begin to document the devastating bloodbath that occurred as troops from Rwanda and Uganda marched across lawless Zaire to evict Mobutu from his rotting seat of power in Kinshasa. Two decades later, the conflict continues to this day with fighting between Kagame's Rwanda and rebel groups such as M23 in eastern DRC. Additionally South Sudan has suffered its own bloody history that persists despite independence from northern Sudan, and the Lord's Resistance Army has terrorized Northern Uganda and CAR for many years, displacing thousands of people.

Charcoal mural in an IDP camp near Gulu, Uganda (Mark Duerksen, 2009)

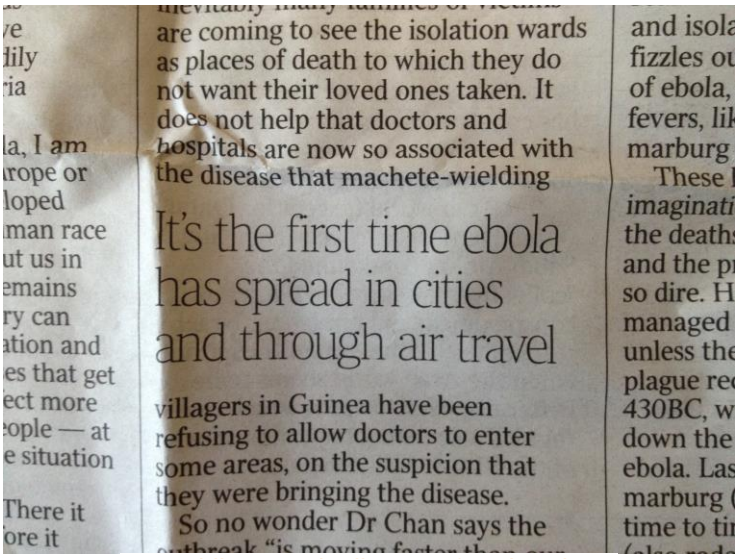
The result of the countless armed conflicts in Central Africa has been an upheaval of communities across region, causing an increased likelihood of human exposure to Ebola as starving refugees and soldiers turned to bush meat while they roamed through the Congo's dense forests, and as they displaced animals by burning and logging forests, which may have put primates in greater contact with both humans and the reservoir. It would be interesting to see what further spatial research might reveal that traced the conflict and the virus over the past 20 years.

Scientists' omission of the deadliest conflict since WWII from their considerations and the dismal results of the ethics review of Ebola research suggests a troubling trend where the scientists studying Ebola in fact know very little about the region and the people affected by the virus whom they're supposed to be helping.

[1] Stephen Pincock, "Seeing Ebola from Space," *The Scientist*, May 1, 2006. Available online: http://www.the-scientist.com/?articles.view/articleNo/23952/title/Seeing-Ebola-from-space/
[2] Derek J Taylor, et al., "Filoviruses are ancient and integrated into mammalian genomes," *BMC Evolutionary Biology*, 10(2010), 1471-2148.

Ebola's History, 8: West Africa, 2014

As we are well aware, this year the two-decade trend of isolated outbreaks in Central Africa every few years was broken by a much larger and more prolonged series of cases in West Africa. The outbreak began when a two-year-old child in southeastern Guinea contracted the most deadly species of the virus (*Zaire ebolavirus*) in early December last year, putting into motion the initially slow and then progressively faster spread of the virus to Liberia, Sierra Leone, and now Nigeria. Unlike the past twenty year's string of Central African outbreaks that were each unique and separate despite initial speculation otherwise, this year's West African outbreak does seem to be the result of a single index case followed by human-to-human transmission. Here's a good time-lapse map of that transmission through West Africa. Summaries of the specifics of this year's outbreak are widely available online, so I won't go into too much detail here, but I will offer a few pieces of analysis based on the history I've covered in the previous posts.



are coming to see the isolation wards as places of death to which they do not want their loved ones taken. It does not help that doctors and hospitals are now so associated with the disease that machete-wielding

It's the first time ebola has spread in cities and through air travel

villagers in Guinea have been refusing to allow doctors to enter some areas, on the suspicion that they were bringing the disease.

So no wonder Dr Chan says the

Matt Ridley gets it all wrong for The Times

First there's a need to correct a few of pieces of misinformation that continue to circulate with this year's outbreak. A more minor error is that this is not in fact the first time that there has been a West African case of Ebola as many news outlets have reported. Previously a zoologist working in Cote d'Ivoire caught the Tai Forest species of the virus and then fully recovered in Switzerland. Another minor error in the same vein is that this is not the first time the virus has spread via air travel. In 1996 an infected man traveled from Gabon to Johannesburg where his nurse there caught the virus and died.

A more substantial and almost ubiquitous error in the media is that the virus has previously been restrained to only rural, remote areas of Central Africa. As we've seen, two of the deadliest previous outbreaks occurred when the virus struck the relatively large cities and regional hubs of Kikwit and Gulu. These Central African cities might not have quite the same level of transportation infrastructure linking them to other urban centers as West African cities do (although I know plenty of people board buses every day in Gulu bound for several cities and countries), but these two cases do provide a precedent for urban outbreaks of Ebola. And although these previous urban outbreaks were incredibly deadly, the cities were able to eventually contain the virus's spread within a matter of months. So, in searching for a reason why this year's outbreak has spread so far and killed so many, the answer is not as simple as stating that this is the first time the virus has appeared in an urbanized setting.

Other explanations have included the slow recognition and response time of international medical teams. Again, a look at the history of the virus shows that response time is not a unique factor in considering why this outbreak is so much worse. In the cases of the 1976 Sudan and Zaire outbreaks and several subsequent episodes, international teams were slow to recognize the virus's appearance and did not arrive on the scene until after the local communities had already contained the spread of the virus. This fact suggests that one reason for the extent and deadliness of this year's outbreak might be partly found in the local community's responses. As Hewlett observed in Gulu, the DRC, and Gabon, many communities in Central Africa possess long practiced social procedures such as quarantine and modified burial practices that they employ when their communities recognize that they are dealing with an especially virulent affliction. I do not know if communities in West Africa have similar procedures, but it would not be surprising if they don't due to the fact that they're not used to seeing diseases like Ebola, or, alternatively, if they did previously possess similar response techniques, the long civil wars in Liberia and Sierra Leone destroyed that local knowledge as violence and insecurity ripped communities apart.

Whatever the cause(s) behind the severity of this year's outbreak, the fact is that *Zaire ebolavirus*'s path through West Africa has been more deadly than all previous Ebola cases combined, and I have to admit that when I initially heard that the virus had arrived in Lagos—the impetus for this series of posts—I feared that Ebola might finally find in the fast life, international networks, and rancid infrastructure of Sub-Saharan Africa's largest city what HIV/AIDS found in the reused medical needles, sex trade, and migrant networks of 1970s Kinshasa and Brazzaville—that is, the lethal mixture of social and environmental conditions that would allow the virus to eventually explode into a global epidemic.

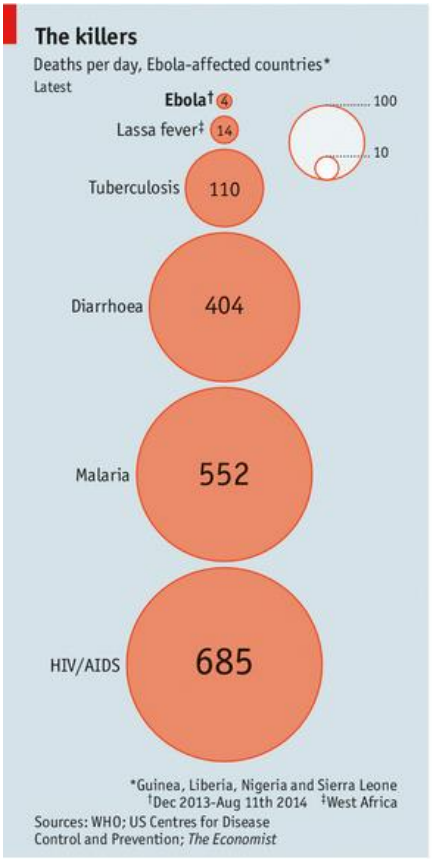
Waste disposal in Lagos (Mark Duerksen 2014)

Being a Central African originating RNA virus linked to primates and transmitted through body fluids, comparisons of Ebola to HIV/AIDS were bound to occur. However there are several important differences that will likely yet prevent Ebola from boiling into an epidemic the way HIV/AIDS did. The first significant difference is the length of time from infection to fatality (or recovery for 10-60% of Ebola patients). HIV can hole-up and multiply inside an infected person's immune system for months, years, or even a decade, slowly destroying T-cells until it has killed so many that doctors consider the person to have developed AIDS. Over these months or years while HIV festers into AIDS, a person with HIV may be completely asymptomatic, but all the while still able spread the virus through sexual contact or blood transfusions. This slow and silent development timeline means that an HIV carrier might not even realize that he or she has become infected for years or even a decade and all the while be transmitting the virus to numerous people, allowing HIV to creep into a critical mass of carriers before it is even detected. This quiet buildup of an infected mass of people is exactly what happened for decades in Central Africa, and by the time doctors "discovered" HIV/AIDS, it was already an epidemic throughout the region.

Ebola on the other hand asymptomatically incubates for a few days or up to a few weeks, during which time the victim cannot transmit the virus to another person. Once symptoms develop after the incubation period, the patient's health declines quickly and death is then generally a matter of days away, leaving only a very small window to further spread the virus (although it can still be contracted from infected corpses, so that is an additional concern and why burial practices are crucial to containing Ebola). One important note here is that those who recover from Ebola can still transmit the virus through semen or possibly breast milk for a number of weeks. While Ebola is easier to transmit during its small contagious window than HIV/AIDS is during its more prolonged window, Ebola still has a low transmission rate,[1] requiring direct contact with infected bodily fluids, and the virus cannot be transmitted through the air in the same way that respiratory diseases can be. Despite the horrific extent and fatality numbers of Ebola in West Africa, the virus will likely burn itself out due to its short contagious window (although it

might take severe quarantine and curfew measures as we're now seeing in West Africa) before it ever reaches a critical, completely uncontrollable mass in the way HIV did.

Perhaps the greatest optimism-inspiring difference between HIV/AIDS and Ebola is the two viruses' rates of mutation. While both likely simmered in the forests of Central Africa long before scientists officially detected and classified them, Ebola's genetic structure has hardly changed since the first confirmed cases in 1976 while HIV/AIDS has mutated incredibly rapidly, making treatment for HIV/AIDS much more difficult to square with virus's continually changing genetic configuration. Ebola's steady genetic structure makes the prospects for a cure much more promising, and as we've seen with the initial success of ZMapp, cures seem to be on the near horizon. Now we just have to hope treatments can be produced and distributed asap because, while Ebola is not likely to become a global epidemic, it is causing untold suffering in West Africa that we likely won't realize the true extent of for some time yet. Ebola's destructive path through West Africa includes not only the direct victims of the virus, but also those caught in the clashes between soldiers enforcing quarantines and those trying to flee its path, survivors who are now shunned by their communities, communities that no longer trust doctors and hospitals, businesses and entire economies that have taken a massive hit, and medical infrastructure throughout the region that has been depleted, abandoned, and looted, causing other illnesses to proliferate in the absence of treatment facilities. Still it is worth noting that the statistics on HIV/AIDS and other deadly diseases deaths per day dwarf Ebola deaths in the Ebola-affected countries–a reminder that those preventable diseases also require immediate attention and that serious long term work to repair medical infrastructure and communities' relations with medical personnel will be imperative to West Africa's health once this outbreak is contained. slow



(image source)

[1] Daniel G Bausch, et al., “Assessment of the Risk of Ebola Virus Transmission from Bodily Fluids and Fomites,” *Journal of Infectious Disease*, 196(), S142-S147. Available online:http://jid.oxfordjournals.org/content/196/Supplement_2/S142.full