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# The Kivu Ebola Epidemic

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## Abstract

The **Kivu Ebola epidemic**[note 1] began on 1 August 2018, when four cases of Ebola virus disease (EVD) were confirmed in the eastern region of Kivu in the Democratic Republic of the Congo (DRC).[2][3][4] The disease affected the DRC, Uganda, and is suspected to have also affected Tanzania, though the Ministry of Health there never shared information with the WHO.[5] The outbreak was declared ended on 25 June 2020, with a total of 3,470 cases and 2,280 deaths.[6][7]

Other locations in the DRC affected included the Ituri Province, where the first case was confirmed on 13 August 2018.[1] In November 2018, it became the biggest Ebola outbreak in the DRC's history,[8][9][10] and by November, it had become the second-largest Ebola outbreak in recorded history,[11][12] behind only the 2013–2016 Western Africa epidemic. On 3 May 2019, 9 months into the outbreak, the DRC death toll surpassed 1,000.[13][14] In June 2019, the virus reached Uganda, having infected a 5-year-old Congolese boy who entered with his family,[15]but this was contained.

Since January 2015, the affected province and general area have been experiencing a military conflict, which hindered treatment and prevention efforts. The World Health Organization (WHO) has described the combination of military conflict and civilian distress as a potential "perfect storm" that could lead to a rapid worsening of the situation.[16][17] In May 2019, the WHO reported that, since January of that year, there had been 42 attacks on health facilities and 85 health workers had been wounded or killed. In some areas, aid organizations have had to stop their work due to violence.[18] Health workers also had to deal with misinformation spread by opposing politicians.[19]

Due to the deteriorating security situation in North Kivu and surrounding areas, the WHO raised the risk assessment at the national and regional level from "high" to "very high" in September 2018.[20] In October, the United Nations Security Council stressed that all armed hostility in the DRC should come to a stop to address the ongoing outbreak better.[21][22][23] A confirmed case in Goma triggered the decision by the WHO to convene an emergency committee for the fourth time,[24][25] and on 17 July 2019, the WHO announced a Public Health Emergency of International Concern (PHEIC), the highest level of alarm the WHO can sound.[26]

On 15 September 2019, some slowdown of cases was noted in the DRC.[27] However, contact tracing continued to be less than 100%; at the time, it was at 89%.[27] In mid-October the transmission of the virus had significantly reduced; by then it was confined to the Mandima region near where the outbreak began, and was only affecting 27 health zones in the DRC (down from a peak of 207).[28] New cases decreased to zero by 17 February 2020,[29] but after 52 days without a case, surveillance and response teams confirmed three new cases in mid-April.[30][31][32]

As a new and separate outbreak, was reported on 1 June 2020 in Équateur Province in north-western DRC, described as the eleventh Ebola outbreak since records began;[33] after almost two years the tenth outbreak was declared ended on 25 June 2020, with a total of 3,470 cases and 2,280 deaths.[34][7]

## Epidemiology

For the outbreak strain Ituri Ebola virus[35], the final death toll was 2,280 with a total of 3,470 cases in DRC in almost a two year period. Managing the outbreak was made very difficult due to the ongoing military attacks in the region, despite there being a vaccine.[36] rVSV-ZEBOV or Ebola Zaire vaccine live, is a vaccine that prevents Ebola caused by the Zaire ebolavirus.[37] The **Figure 1** graph of reported cases marks those not able to have a laboratory test sample before burial as *probable cases*.[38]

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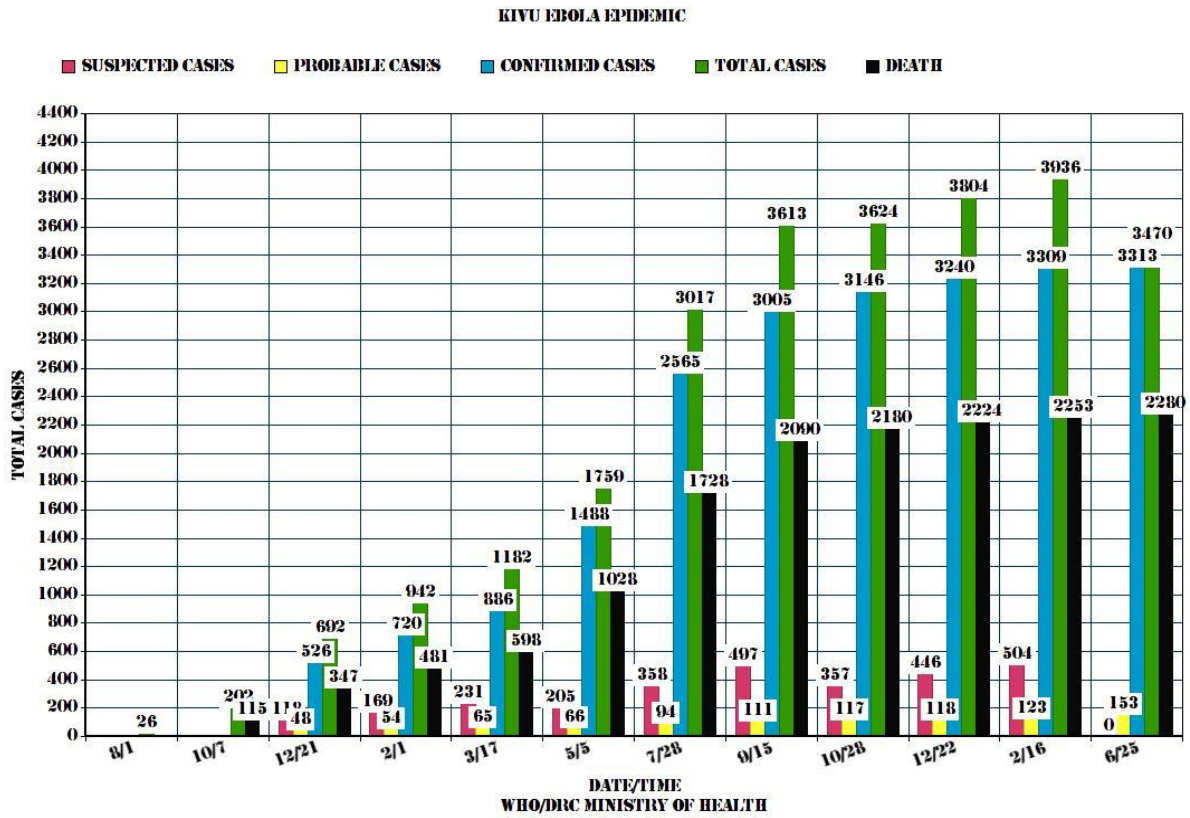



**Figure 1| Note** *Above graph begins in Aug. 2018 at one month intervals, then progresses to two month intervals as the outbreak intensifies at beginning of 2019, then finally has a four month interval until it is declared over (due to a flare up just days prior to the first two 21 day period to call the outbreak over per WHO, which caused a restart of the coutdown)*
*2018–19 Kivu Ebola epidemic (total cases-deaths as of 25 June 2020)[7]
*[x] indicates (2) 21 day periods have passed and outbreak is over
*Ozzie Anis , CC BY-SA 3.0*

## Democratic Republic of Congo

On 1 August 2018, the North Kivu health division notified Congo's health ministry of 26 cases of hemorrhagic fever, including 20 deaths. Four of the six samples that were sent for analysis to the National Institute of Biological Research in Kinshasacame back positive for Ebola and an outbreak was declared on that date.[39][40]The index case is believed to have been a 65-year-old woman who died on 25 July in the town of Mangina; soon afterwards seven members of her immediate family also died[41].This outbreak started just days after the end of the outbreak in Équateur province.[42][43]

By 3 August, the virus had developed in multiple locations; cases were reported in five health zones: Beni, Butembo; Oicha; Musienene; and Mabalako in North Kivu province as well as Mandima and Mambasa in Ituri Province as shown in **Figure 2**.[44] However, one month


**Figure 2** | Map of the Democratic Republic of the Congo; North Kivu (orange, middle) South Kivu (dark red, bottom) and Ituri (green,top)
*Ozzie Anis, NordNordWest, and DaB. , CC BY-SA 3.0*

later there had been confirmed cases only in the Mabalako, Mandima, Beni and Oicha health zones. The five suspected cases in the Mambasa Health Zone proved not to be EVD; it was not possible to confirm the one probable case in the Musienene Health Zone and the two probable cases in the Butembo Health Zone. The first confirmed case in Butembo was announced on 4 September, the same day that it was announced that one of the cases registered at Beni had actually come from the Kalunguta Health Zone.[45]

On 1 August, just after the epidemic had been declared, Doctors Without Borders/Médecins Sans Frontières (MSF) arrived in Mangina, the point of origin of the outbreak, to mount a response.[46] On 2 August, Oxfam indicated it would be taking part in the response to this outbreak in the DRC.[47] On 4 August, the WHO indicated that the current situation in the DRC, due to several factors, warranted a "high risk assessment" at the national and regional level for public health.[48]

In November, it was reported that the EVD outbreak ran across two provinces (and 14 health zones). ***Table 1***. *Timeline of reported cases* reflects cases that were not able to have a laboratory test sample prior to burial as *probable cases*.[38] By 23 December, the EVD outbreak had spread to more health zones, and at that time 18 such areas had been affected.[49]

### Becoming 2nd biggest EVD outbreak

On 7 August 2018, the DRC Ministry of Public Health indicated that the total count had climbed to almost 90 cases,[50] and the Uganda Ministry of Health issued an alert for extra surveillance as the outbreak was just 100 kilometres (62 mi) away from its border.[51] Two days later the total count was nearly 100 cases, **Figure 3** indicates new Ebola cases per week.[52] On 16 August, the United Kingdomindicated it would help with EVD diagnosis and monitoring in the DRC.[53] On 17 August 2018, the WHO reported that there were around 1,500 "contacts", while noting that certain conflict zones in the DRC that could not be reached might have more contacts.[54]Some 954 contacts were successfully followed up on 18 August; however, Mandima Health Zone indicated resistance, so contacts were not followed up there.[55] On 4 September, Butembo, a city with almost one million people and an international airport, recorded its first fatality in the Ebola outbreak. The city of Butembo, in the DRC, has trade links to nearby Uganda.[56][45]

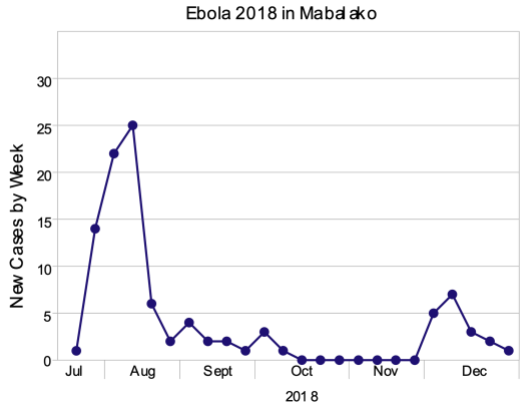
On 24 September, it was reported that all contact tracing and vaccinations would stop for the foreseeable future in Beni due to a deadly attack by rebel groups the day before.[57] On 25 September, Peter Salama of the WHO indicated that insecurity was obstructing efforts to stop the virus and believed a combination of factors could establish conditions for an epidemic.[58] On 18 October, the U.S. Centers for Disease Control and Prevention (CDC) raised its travelers' alert to the DRC from level 1 to level 2 for all U.S. travelers.[59] On 26 October, the WHO indicated that half of confirmed cases were not showing any fever symptom, thus making diagnosis more difficult.[60]

According to a September 2018 survey in the *Lancet*, 25% of respondents in Beni and Butembo believed the Ebola outbreak to be a hoax. These beliefs correlated with decreased likelihood of seeking healthcare or accepting vaccination.[61]

On 6 November 2018, the CDC indicated that the outbreak in the east region of the DRC was potentially non-containable. This would be the first time since 1976 that an outbreak could not be curbed.[62] On 13 November, the WHO indicated that the viral outbreak would last at least six months.[63]

On 29 December 2018, the DRC Ministry of Public Health announced that there had been *"o new confirmed cases detected because of the paralysis of the activities of the response in Beni, Butembo, Komanda and Mabalako"* and no vaccination had occurred for three consecutive days.[64] On 22 January, the total case count began to approach 1,000 cases, (951 suspected) in the DRC Ministry of Public Health situation report.[65] The graphs below demonstrate the EVD intensity in different locations in the DRC, as well as in the West African epidemic of 2014–15 as a comparison:

A



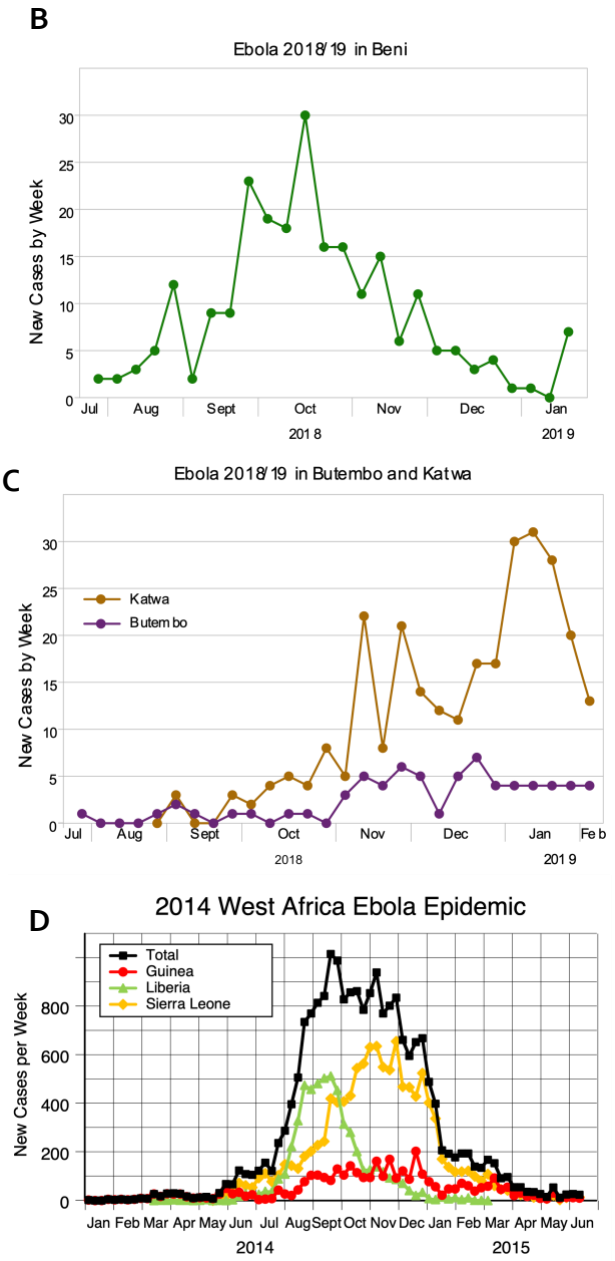



**Figure 3** | New Ebola cases per week in regions **A)** Mabalako between 2018-07-16 and 2018-12-31, **B)** town Beni between 2018-07-23 and 2019-01-28, **C)** Katwa (orange) and Butembo (purple) between 2018-07-23 and 2019-02-04, and **D)** Western Africa Ebola Epidemic (for comparison with current outbreak).
*A-C) Gregor Rom, D) malanoqa, CC-BY-SA 4.0*

On 16 March 2019, the director of the CDC indicated that the outbreak in the DRC could last another year, additionally suggesting that vaccine supplies could run out.[66] According to the WHO, resistance to vaccination in the Kaniyi Health Zone was ongoing as of March 2019.[67] There was still a belief by some in surrounding areas that the epidemic was a hoax.[68]

On 25 November 2019, violence had broken out in Beni again, to such a degree that some aid agencies had evacuated. According to the same report, approximately 300 individuals might have been exposed to EVD via an infected individual.[69]

Until the outbreak in North Kivu in 2018, no outbreak had surpassed 319 total cases in the Democratic Republic of the Congo as shown in **Figure 4**. By 24 February 2019, the epidemic had surpassed 1,000 total cases (1,048),[73][74] and a year later, it had surpassed 3,000.

On 10 May 2019, the U.S. Centers for Disease Control and Prevention indicated that the outbreak could eventually surpass the West African epidemic.[75]

The 12 May 2019 issue of WHO Weekly Bulletin on Outbreaks and Other Emergencies, indicates that: "*continued increase in the number of new EVD cases in the Democratic Republic of the Congo is worrying...no end in sight to the difficult security situation*".[76]

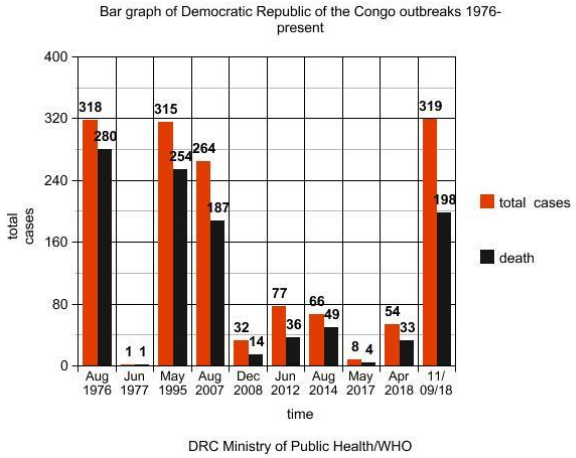



**Figure 4** | Democratic Republic of the Congo EVD outbreaks 1976-9 November 2018
(Note: total cases for this date does not reflect *52 suspected cases* nor does it reflect the final case numbers)[8][70]
(***Uganda*** has second most EVD cases '00–'01/425[71] ***West African Ebola virus epidemic*** '13-'16/ >28,000[72])
*Ozzie Anis, CC-BY-SA 4.0*

## Spread to Goma

On 14 July 2019, the first case of EVD was confirmed in the capital of North Kivu, Goma, a city with an international airport and a highly mobile population of 2 million people located near the DRC's eastern border with Rwanda.[77][78][79][80] This case was a man who had passed through three health checkpoints, with different names on traveller lists.[25] The WHO stated that he died in a treatment centre,[81] whereas according to Reuters he died *en route* to a treatment centre.[82] This case triggered the decision by the WHO to again reconvene

an emergency committee,[24][25] where the situation was officially declared a Public Health Emergency of International Concern.[26]

On 30 July, a second case of EVD was confirmed in the city of Goma, apparently not linked to the first case.[83] Across the border from Goma in the country of Rwanda, Ebola simulation drills were being conducted at health facilities.[84] A third case of EVD was confirmed in Goma on 1 August.[85] On 22 August 2019, Nyiragongo Health Zone, the affected area on the outskirts of Goma, reached 21 days without further cases being confirmed.[86]

### Spread to South Kivu Province

On 16 August 2019, it was reported that the Ebola virus disease had spread to a third province – South Kivu – via two new cases who had travelled from Beni, North Kivu.[87][88] By 22 August the number of cases in Mwenga had risen to four, including one person at a health facility visited by the first case.[89]

## Uganda

In August 2018 a UN agency indicated that active screening was deployed to ensure that those leaving the DRC into Uganda were not infected with Ebola.[90] The government of Uganda opened two Ebola treatment centers at the border with the DRC, though there had not yet been any confirmed cases in the country of Uganda.[91][92] By 13 June 2019, nine treatment centers were in place near the affected border.[93]

According to the International Red Cross, a "most likely scenario" entailed an asymptomatic case entering the country of Uganda undetected among the numerous refugees then coming from the DRC.[94] On 20 September, Uganda indicated it was ready for immediate vaccination, should the Ebola virus be detected in any individual.[95][96]

On 21 September, officials of the DRC indicated a confirmed case of EVD at Lake Albert, an entry point into Uganda, though no cases were then confirmed within Ugandan territory.[97][98]

On 2 November, it was reported that the Ugandan government would start vaccinating health workers along the border with the DRC as a proactive measure against the virus.[99]Vaccinations started on 7 November, and by 13 June 2019, 4,699 health workers at 165 sites had been vaccinated.[93] Proactive vaccination was also carried out in South Sudan, with 1,471 health workers vaccinated by 7 May 2019.[100]

On 2 January 2019, it was reported that refugee movement from the DRC to Uganda had increased after the presidential elections.[101]On 12 February, it was reported that 13 individuals had been isolated due to their contact with a suspected Ebola case in Uganda;[102]laboratory results came back negative several hours later.[103]

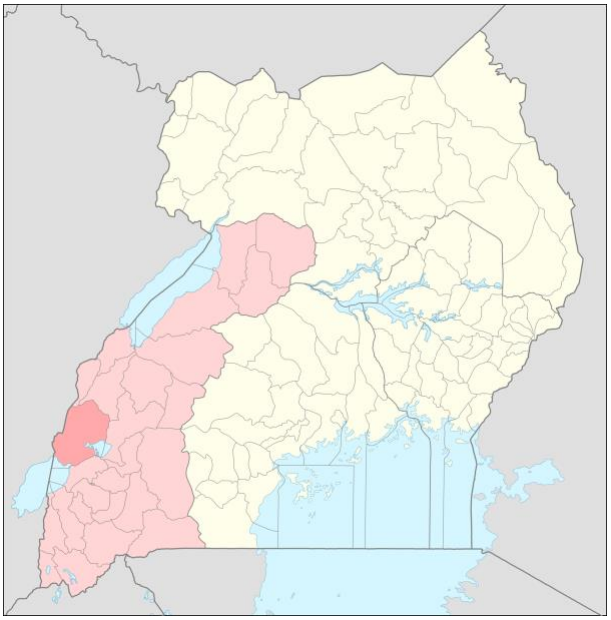


**Figure 5** | Map of Uganda; District Kasese in Western Region
*Gregor Rom, CC-BY-SA 4.0*

On 11 June 2019, the WHO reported that the virus had spread to Uganda. A 5-year-old Congolese boy entered Uganda on the previous Sunday with his family to seek medical care. On 12 June, the WHO reported that the 5-year-old had died, while two more cases of Ebola infection within the same family were confirmed.[15][104] On 14 June it was reported that there were 112 contacts since EVD was first detected in Uganda.[105] Ring vaccination of Ugandan contacts was scheduled to start on 15 June.[23] By 18 June 2019, 275 contacts had been vaccinated per the Uganda Ministry of Health.[106]

On 14 July, an individual entered the country of Uganda from DRC while symptomatic for EVD; a search for contacts in Mpondwe followed.[107] On 24 July, Uganda marked the needed *42 day period* without any EVD cases to be declared Ebola-free.[108] On 29 August, a 9-year-old Congolese girl became the fourth individual in Uganda to test positive for EVD when she crossed from the DRC into the district of Kasese, noted on **Figure 5** map.[109]

## Tanzania

Regarding possible EVD cases in Tanzania, **Figure 6** map, the WHO stated on 21 September 2019 that "to date, the clinical details and the results of the investigation, including laboratory tests performed for differential diagnosis of these patients, have not been shared with WHO. The insufficient information received by WHO does not allow for a formulation of a hypotheses regarding the possible cause of the illness".[110][111][112] On 27 September, the CDC and U.S. State Department alerted potential travellers to the possibility of unreported EVD cases within Tanzania.[113]

The Tanzanian Health Minister Ummy Mwalimu stated on 3 October 2019 that there was no Ebola outbreak in Tanzania.[114] The WHO were provided with a preparedness update on 18 October which outlined a range of actions, and included commentary that since the outbreak commenced, there had been "29 alerts of Ebola suspect cases reported, and 17 samples tested which were negative for Ebola (including 2 in September 2019)".[115]

**Figure 6** | Map of United Republic of Tanzania
*semhur, CC-BY-SA 4.0*

## Countries with medically evacuated individuals

On 29 December, an American physician who was exposed to the Ebola virus (and who was non-symptomatic) was evacuated, and taken to the University of Nebraska Medical Center.[116][117] On 12 January, the individual was released after 21 days without symptoms.[118] The table which follows indicates *confirmed*, *probable* and *suspected* cases, as well as *deaths*; the table also indicates the countries where these cases took place.

## Outbreak and military conflict

At the time of the epidemic, there were approximately 70 armed military groups, among them the Alliance of Patriots for a Free and Sovereign Congo and the Mai-Mayi Nduma défense du Congo-Rénové, in North Kivu, **Figure 7** shows Goma, the capital of said province. The armed fighting displaced thousands of individuals[229] and seriously affected the response to the outbreak.[230][231] According to the WHO, health care workers are to be accompanied by military personnel for protection and ring vaccination may not be possible.[232] On 11 August 2018, it was reported that seven individuals were killed in Mayi-Moya by a militant group, approximately 24 miles from the city of Beni where there were several EVD cases.[233][234][235]

**Figure 7** | Goma, the capital of North Kivu province
*MONUSCO, CC-BY-SA 4.0*

On 24 August 2018, it was reported that a physician infected with Ebola had been in contact with some 97 individuals in an inaccessible military area, who hence could not be diagnosed.[236][237] In September, it was reported that two peacekeepers were attacked and wounded by rebel groups in Beni,[238] and 14 individuals were killed in a military attack.[239] In September 2018, the WHO's Deputy Director-General for Emergency Preparedness and Response described the combination of military conflict and civilian distress as a potential "perfect storm" that could lead to a rapid worsening of the outbreak.[16][17]

On 20 October 2018, an armed rebel group in the DRC killed 13 civilians and took 12 children as hostages in Beni, which was then experiencing one of the worst outbreaks.[240][241] On 11 November, six people were killed in an attack by an armed rebel group in Beni; as a consequence vaccinations were suspended there.[242][243] Yet another attack reported on 17

November, in Beni by an armed rebel group forced the cessation of EVD containment efforts and WHO staff to evacuate to another DRC city for the time being.[244] Beni continues to be the site of attacks by militant groups as 18 civilians were

**Table 1**

| Date | Cases [a] | | | | Deaths | CFR [b] | Contacts | Sources |
|---|---|---|---|---|---|---|---|---|
| | Confirmed | Probable | Suspected | Totals | | | | |
| 2018-08-01[c] ***DRC*** | 4 | 22 | 0 | **26** | **20** | - | - | [119] |
| 2018-08-03 | 13 | 30 | 33 | **76** | **33** | 76.7% | 879 | [120][121] |
| 2018-08-05 | 16 | 27 | 31 | **74** | **34** | 79% | 966 | [122][123] |
| 2018-08-10 | 25 | 27 | 48 | **100** | **39** | 75% | 953 | [124] |
| 2018-08-12 | 30 | 27 | 58 | **115** | **41** | - | 997 | [125] |
| 2018-08-17 | 64 | 27 | 12 | **103** | **50** | 55.6% | 1,609 | [55] |
| 2018-08-20 | 75 | 27 | 9 | **111** | **59** | - | 2,408 | [126] |
| 2018-08-24 | 83 | 28 | 6 | **117** | **72** | 65% | 3,421 | [127] |
| 2018-08-26 | 83 | 28 | 10 | **121** | **75** | 67.6% | 2,445 | [128] |
| 2018-08-31 | 90 | 30 | 8 | **128** | **78** | 65% | 2,462 | [129] |
| 2018-09-02 | 91 | 31 | 9 | **131** | **82** | - | 2,512 | [130] |
| 2018-09-07 | 100 | 31 | 14 | **145** | **89** | 68% | 2,426 | [131] |
| 2018-09-09 | 101 | 31 | 9 | **141** | **91** | - | 2,265 | [132][133] |
| 2018-09-14 | 106 | 31 | 17 | **154** | **92** | 67.2% | 1,751 | [134] |
| 2018-09-16 | 111 | 31 | 7 | **149** | **97** | - | 2,173 | [135][136] |
| 2018-09-21 | 116 | 31 | n/a | **147** | **99** | 67.3% | 1,641 | [137] |
| 2018-09-23 | 119 | 31 | 9 | **159** | **100** | 67% | 1,836 | [138] |
| 2018-09-28 | 126 | 31 | 23 | **180** | **102** | 65% | 1,410 | [139] |
| 2018-10-02 | 130 | 32 | 17 | **179** | **106** | 65.4% | 1,463 | [140] |
| 2018-10-05 | 142 | 35 | 11 | **188** | **113** | 63.8% | 2,045 | [141] |
| 2018-10-07 | 146 | 35 | 21 | **202** | **115** | 63.5% | 2,115 | [142] |
| 2018-10-12 | 176 | 35 | 32 | **243** | **135** | 64% | 2,663 | [143] |
| 2018-10-15 | 181 | 35 | 32 | **248** | **139** | 64% | 4,707 | [144] |
| 2018-10-19 | 202 | 35 | 33 | **270** | **153** | 65% | 5,518 | [145] |
| 2018-10-21 | 203 | 35 | 14 | **252** | **155** | 65% | 5,341 | [146] |
| 2018-10-26 | 232 | 35 | 43 | **310** | **170** | 64% | 6,026 | [60] |
| 2018-10-28 | 239 | 35 | 32 | **306** | **174** | 63.5% | 5,991 | [147] |
| 2018-11-02 | 263 | 35 | 70 | **368** | **186** | 62.4% | 5,036 | [148] |

## Table 1 Continued

| Date | Cases [a] | | | | Deaths | CFR [b] | Contacts | Sources |
|---|---|---|---|---|---|---|---|---|
| | Confirmed | Probable | Suspected | Totals | | | | |
| 2018-11-04 | 265 | 35 | 61 | **361** | **186** | 62% | 4,971 | [149] |
| 2018-11-09 | 294 | 35 | 60 | **389** | **205** | 62% | 4,779 | [150] |
| 2018-11-11 | 295 | 38 | n/a | **333** | **209** | - | 4,803 | [151] |
| 2018-11-16 | 319 | 47 | 49 | **415** | **214** | 59% | 4,430 | [152] |
| 2018-11-21 | 326 | 47 | 90 | **463** | **217** | - | 4,668 | [153] |
| 2018-11-23 | 365 | 47 | 45 | **457** | **236** | 57% | 4,354 | [154] |
| 2018-11-26 | 374 | 47 | 74 | **495** | **241** | 57% | 4,767 | [155] |
| 2018-11-30 | 392 | 48 | 63 | **503** | **255** | 58% | 4,820 | [156] |
| 2018-12-03 | 405 | 48 | 79 | **532** | **268** | 59% | 5,335 | [157] |
| 2018-12-07 | 446 | 48 | 95 | **589** | **283** | 57% | 6,417 | [158] |
| 2018-12-10 | 452 | 48 | n/a | **500** | **289** | 58% | 6,509 | [159] |
| 2018-12-14 | 483 | 48 | 111 | **642** | **313** | 59% | 6,695 | [160] |
| 2018-12-21 | 526 | 48 | 118 | **692** | **347** | 60% | 8,422 | [161] |
| 2018-12-28 | 548 | 48 | 52 | **648** | **361** | 61% | 7,007 | [162] |
| 2019-01-04 | 575 | 48 | 118 | **741** | **374** | 60% | 5,047 | [163] |
| 2019-01-11 | 595 | 49 | n/a | **644** | **390** | 61% | 4,937 | [164] |
| 2019-01-18 | 636 | 49 | 209 | **894** | **416** | 61% | 4,971 | [165][166] |
| 2019-01-25 | 679 | 54 | 204 | **937** | **459** | 63% | 6,241 | [167][168] |
| 2019-02-01 | 720 | 54 | 168 | **942** | **481** | 62% | >7,000 | [169][170] |
| 2019-02-10 | 750 | 61 | 148 | **959** | **510** | 63% | 7,846 | [171][172] |
| 2019-02-18 | 773 | 65 | 135 | **973** | **534** | 64% | 6,772 | [173][174] |
| 2019-02-24 | 804 | 65 | 219 | **1,088** | **546** | 63% | 5,739 | [175][176] |
| 2019-03-03 | 830 | 65 | 182 | **1,077** | **561** | 63% | 5,613 | [177][178] |
| 2019-03-10 | 856 | 65 | 191 | **1,112** | **582** | 63% | 4,830 | [179][180] |
| 2019-03-17 | 886 | 65 | 231 | **1,182** | **598** | 63% | 4,158 | [181][182] |
| 2019-03-25 | 944 | 65 | 226 | **1,235** | **629** | 62% | 4,132 | [183][184] |
| 2019-03-31 | 1,016 | 66 | 279 | **1,361** | **676** | 62% | 6,989 | [67][185] |
| 2019-04-07 | 1,080 | 66 | 282 | **1,428** | **721** | 63% | 7,099 | [186] |

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## Table 1 Continued

| Date | Cases [a] | | | | Deaths | CFR [b] | Contacts | Sources |
|---|---|---|---|---|---|---|---|---|
| | Confirmed | Probable | Suspected | Totals | | | | |
| 2019-04-14 | 1,185 | 66 | 269 | **1,520** | **803** | 64% | 10,461 | [187] |
| 2019-04-21 | 1,270 | 66 | 92 | **1,428** | **870** | 65% | 5,183 | [188] |
| 2019-04-28 | 1,373 | 66 | 176 | **1,615** | **930** | 65% | 11,841 | [189] |
| 2019-05-05 | 1,488 | 66 | 205 | **1,759** | **1,028** | 66% | 12,969 | [190] |
| 2019-05-12 | 1,592 | 88 | 534 | **2,214** | **1,117** | 67% | 13,174 | [76] |
| 2019-05-19 | 1,728 | 88 | 278 | **2,094** | **1,209** | 67% | 12,608 | [191] |
| 2019-05-26 | 1,818 | 94 | 277 | **2,189** | **1,277** | 67% | 20,415 | [192] |
| 2019-06-02 | 1,900 | 94 | 316 | **2,310** | **1,339** | 67% | 19,465 | [193] |
| 2019-06-09 | 1,962 | 94 | 271 | **2,327** | **1,384** | 67% | 15,045 | [194] |
| 2019-06-16 ***DRC*** & ***Uganda*** | 2,051 / 3 | 94 / 0 | 319 / 1 | **2,468** | **1,440** | 67% /100% | 15,992 / 90 | [195][note 2] |
| 2019-06-23 | 2,145 / 3 | 94 / 0 | 276 / 0 | **2,515** | **1,506** | 67% /100% | 15,903 / 110 | [197] |
| 2019-06-30 | 2,231 / 3 | 94 / 0 | 309 / 0 | **2,634** | **1,563** | 67% /100% | 18,088 / 108 | [198][199] |
| 2019-07-07 | 2,314 / 3 | 94 / 0 | 323 / 0 | **2,731** | **1,625** | 68% /100% | 19,227 / 0 | [200][201] |
| 2019-07-14 | 2,407 / 3 | 94 / 0 | 335 / 0 | **2,836** | **1,665** | 67% /100% | 19,118 / 0 | [202][201] |
| 2019-07-21 | 2,484 / 3 | 94 / 0 | 361 / 0 | **2,939** | **1,737** | 67% /100% | 20,505 / 19 | [203][204] |
| 2019-07-28 ***DRC*** | 2,565 | 94 | 358 | **3,017** | **1,782** | 67% | 20,072 | [205] |
| 2019-08-04 | 2,659 | 94 | 397 | **3,150** | **1,843** | 67% | 19,156 | [206] |
| 2019-08-11 | 2,722 | 94 | 326 | **3,142** | **1,888** | 67% | 15,988 | [207] |
| 2019-08-19 | 2,783 | 94 | 387 | **3,264** | **1,934** | 67% | 15,817 | [208] |
| 2019-08-25 | 2,863 | 105 | 396 | **3,364** | **1,986** | 67% | 17,293 | [209] |
| 2019-09-01 | 2,926 | 105 | 365 | **3,396** | **2,031** | 67% | 16,370 | [210] |
| 2019-09-08 | 2,968 | 111 | 403 | **3,486** | **2,064** | 67% | 14,737 | [211] |
| 2019-09-15 | 3,005 | 111 | 497 | **3,613** | **2,090** | 67% | 13,294 | [27] |
| 2019-09-22 | 3,053 | 111 | 415 | **3,583** | **2,115** | 67% | 11,335 | [212] |
| 2019-09-29 | 3,074 | 114 | 426 | **3,618** | **2,133** | 67% | 7,775 | [213] |
| 2019-10-06 | 3,090 | 114 | 414 | **3,622** | **2,146** | 67% | 7,807 | [214] |
| 2019-10-13 | 3,104 | 114 | 429 | **3,647** | **2,150** | 67% | 5,622 | [215] |
| 2019-10-20 | 3,123 | 116 | 420 | **3,659** | **2,169** | 67% | 5,570 | [216] |

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## Table 1 Continued

| Date | Cases [a] | | | | Deaths | CFR [b] | Contacts | Sources |
|---|---|---|---|---|---|---|---|---|
| | Confirmed | Probable | Suspected | Totals | | | | |
| 2019-10-28 | 3,146 | 117 | 357 | **3,624** | **2,180** | 67% | 4,437 | [217] |
| 2019-11-03 | 3,157 | 117 | 513 | **3,787** | **2,185** | 67% | 6,078 | [218] |
| 2019-11-10 | 3,169 | 118 | 482 | **3,769** | **2,193** | 67% | 6,137 | [219] |
| 2019-11-17 | 3,174 | 118 | 422 | **3,714** | **2,195** | 67% | 4,857 | [220] |
| 2019-11-24 | 3,183 | 118 | 349 | **3,650** | **2,198** | 67% | 3,371 | [221] |
| 2019-12-08 | 3,202 | 118 | 391 | **3,711** | **2,209** | 67% | 2,955 | [222] |
| 2019-12-22 | 3,240 | 118 | 446 | **3,804** | **2,224** | 66% | 5,137 | [223] |
| 2020-01-05 | 3,270 | 118 | 464 | **3,852** | **2,233** | 66% | 4,133 | [224] |
| 2020-01-19 | 3,293 | 119 | 438 | **3,854** | **2,241** | 66% | 5,018 | [225] |
| 2020-02-02 | 3,305 | 123 | 447 | **3,879** | **2,250** | 66% | 2,374 | [226] |
| 2020-02-16 | 3,309 | 123 | 504 | **3,936** | **2,253** | 66% | 1,972 | [227] |
| 2020-03-29 | 3,310 | 143 | 232 | **3,685** | **2,273** | 66% | - | [228] |
| 2020-06-25[d] | 3,313 | 153 | 0 | **3,470** | **2,280** | 66% | - | [7][a] |

a. These figures may increase when new cases are discovered, and fall consequently, when tests show cases were not Ebola-related.
b. indicates *suspected cases* were not counted towards CFR
c. DRC Ministry of Public Health
d. indicates 42 days have passed since the last case and outbreak is declared over

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killed on 6 December.[245] On 22 December it was reported that elections for the President of the DRC would go forward despite the EVD outbreak, including in the Ebola-stricken area of Beni.[246] Four days later, on 26 December, the DRC government reversed itself to indicate those Ebola-stricken areas, such as Beni, would not vote for several months;[247] consequently, election protesters ransacked an Ebola assessment center in Beni.[248][249][250]Post election tensions continued when it was reported that the DRC government had cut off internet connectivity for the population, as the vote results were yet to be released.[251]

On 29 December 2018, Oxfam said it would suspend its work due to the ongoing violence in the DRC;[252] on the same day, the International Rescue Committee suspended their Ebola support efforts as well.[253] On 18 January, the African Union indicated that presidential election results announcements should be suspended in the DRC.[254]

## Virology

The outbreak was caused by the *Zaire ebolavirus* species. This is the same strain that was involved in the early 2018 outbreak in western DRC.[259]

**Figure 8** | Fruit bats (group of *Rousettus aegyptiacus*)
*Ismail Ali Gago, CC-BY-SA 4.0*

*Zaire ebolavirus* strain is the most lethal of the six known strains (including the newly discovered *Bombali* strain);[260] it is fatal in up to 90% of cases.[261] Both Ebola and Marburg virus are part of the *Filoviridae* family.[262]

The filovirus genome contains seven genes, including VP40.[263] The natural reservoir of the virus is thought to be the African fruit bat shown in **Figure 8**,[264] though the reservoir is not the vector[265].

### Viral mechanism

A significant part of the EVD infection is based on immune suppression along with systemic inflammation, leading to multiple organ failure.[266] Systemic inflammation and fever may damage many types of body tissues but the consequences are especially profound in the liver, where Ebola wipes out cells required to produce coagulationfactors. In the gastrointestinal tract damaged cells lead to diarrhea putting people at risk of dehydration. And in the adrenal gland the virus harming the cells that make steroids which regulates blood pressure, resulting in circulatory failure.[267]

### Genetic epidemiology

This is a medical field which tries to understand how genetic factors and the environment interact in this case while the outbreak was going through the population of the Democratic Republic of the Congo and the neighboring country of Uganda.[268][100]. The WHO declared a Public Health Emergency of International Concern when the virus reached Goma with its first case[269]. Genomic surveillance and Ebola virus evolution have been facilitated due to Ebola virus disease genetic epidemiology.[270]**Figure 9** is an indication of the *genetic epidemiology* of the virus until October 2019, when the outbreak decline began.

## Transmission

Ebola virus is found in a variety of bodily fluids including: blood, saliva, stool, semen, and breast milk. The virus is extremely infectious following contact with any of these bodily fluids. Some potential routes of transmission include:[271][272]

- Bodily fluids: The most common way of transmitting in humans is through contact with infected bodily fluids.
- Droplets: Droplet transmission occurs when contact is made with virus-containing droplets.
- Fomites: Occurs when an individual comes in contact with a pathogen-contaminated surface.

Those infected by EVD generally gain immunity, although it is possible that such immunity is only temporary.[273] In October 2019, a survivor who had been assisting at a treatment center in Beni was reinfected with EVD and died; which was unprecedented.[274]

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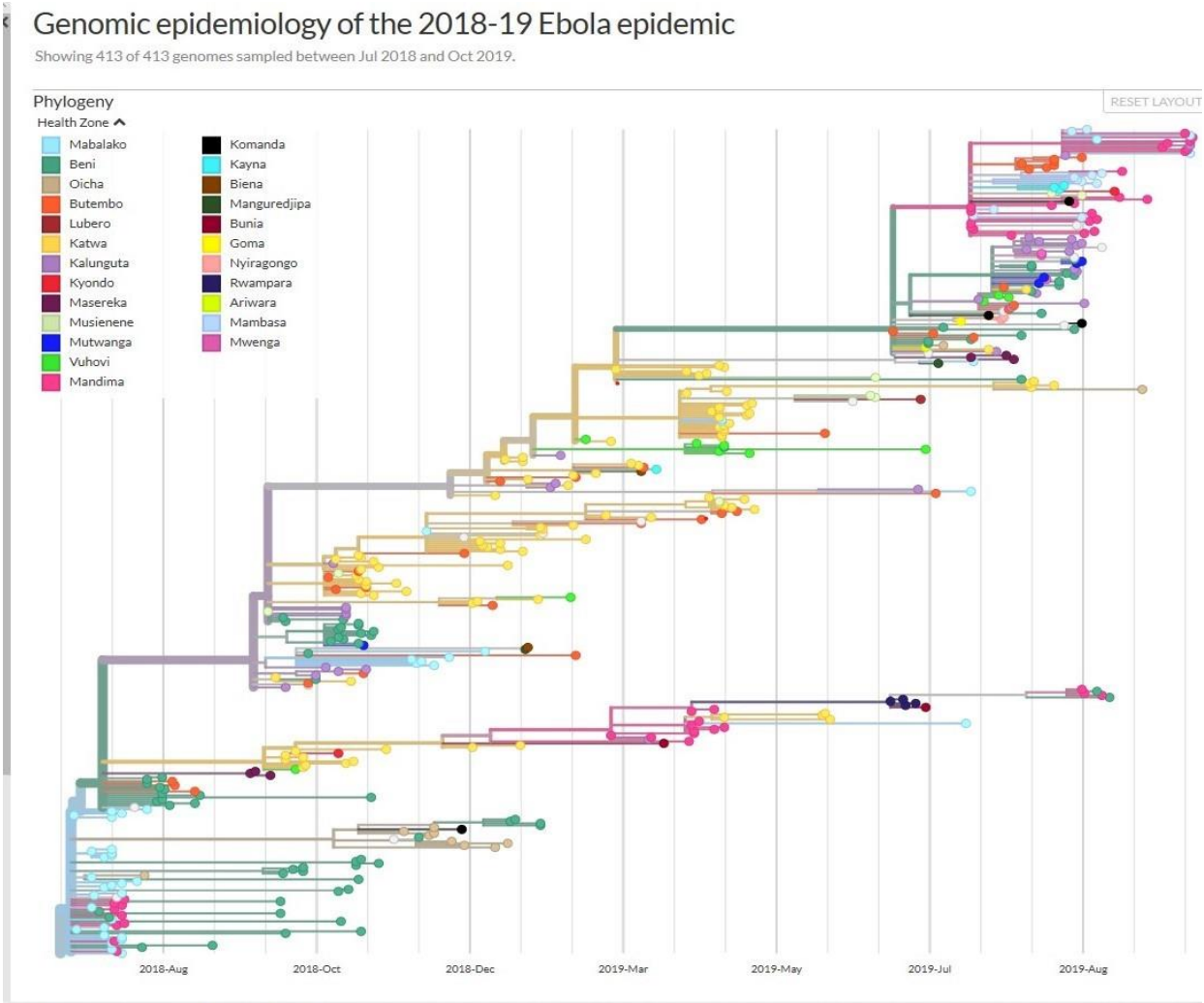


**Figure 9**| Genomic epidemiology from July 2018 to Oct. 2019 of the Kivu Ebola epidemic.[255] (One of the first *sequence*:[256] BEN164, health zone: **Mabalako**, divergence: 5.285e-5, date: 10/08/18, no nucleotide mutations, to its spread to **Goma**, *sequence*: GOM1887, health zone: [aforementioned] Goma, divergence: 2.062e-3, date: 7/13/19, nucleotide mutations: A3376G T3378C C3380A T3386A G3388C G3389T T3391C G3398A C3399A, AA mutations: VP35 V87A Q88K L901 to the more recent *sequence*: MAN9501, health zone: **Mandima**, divergence: 1.4803-4, date: 10/10/19, no nucleotide mutations[257] This does not reflect the possible final *sequence* or information, however as of Oct. 2019 the outbreak was slowing down[258].) *Nextstrain.org, CC-BY-SA 4.0*

## Containment and Control

Even with the advances made in vaccine technology and treatment options during previous Ebola outbreaks, effective control of the North Kivu Epidemic continued to rely heavily on traditional public health efforts including the timely identification and isolation of cases, control measures in hospital settings, identification and follow-up of contacts, community engagement, and safe burials. Data from the West African Ebola Outbreak showed that response strategies which achieved 60% efficacy for sanitary burial, case isolation, and contact-tracing combined, could have greatly reduced the daily number of Ebola cases and ended the outbreak after only 6 months;[275] therefore, the most effective outbreak response should include non-pharmaceutical containment and control strategies in addition to new preventive and therapeutic measures.

### Surveillance and contact tracing

Contact tracing is defined as the identification and follow-up of persons who may have been in contact with a person infected with Ebola. All close contacts should be monitored for 21 days following their last

known exposure to the case and be isolated if they become ill. The volume of contacts and the duration of monitoring presented challenges in Ebola surveillance as it requires careful record-keeping by properly trained and equipped staff.[276] To strengthen surveillance activities, the DRC Ministry of Health began disseminating standardized Ebola case definitions, developed reporting tools, and communication strategies, and began distribution of daily situation reports.[256] Rapid response teams were deployed to affected health zones to strengthen Ebola case management and infection prevention and control in health care facilities and treatment centers.[256] Similar to the West African Ebola Outbreak, less than 10% of cases presented with bleeding.[277]

Disease surveillance in North Kivu and Ituri was complicated by two major obstacles: 1) the outbreaks of sporadic violence against those responding and the affected communities; and 2) suspicion of the response in parts of some affected communities. Poor record keeping by local health facilities also made it difficult or impossible to identify and trace contacts that might have been exposed to the disease while they were undergoing treatment for other illness at health centers. Additionally, the high degree of mobility of affected populations, combined with occasional mistrust of the response has meant that contacts that had been identified sometimes were lost to follow-up for extended periods.[278] Initially, it was estimated that 30-50% of contacts may not have originally been registered by contact tracing teams;[279] improvements to the security situation and improved acceptance by affected communities had led to improvement in most surveillance metrics which was central to controlling the outbreak.

## Community engagement and awareness

Surveys among the affected population in North Kivu and Ituri showed both general mistrust with the Ebola response, partly related to years of mistrust of any governmental or external action, and specific opposition to the response because of conflicts with local cultural practices.[280] Some of the cultural practices which complicated the response included regular gatherings at family or village events, and traditional funeral practices, which were events that were particularly high risk for transmission.[280] Additionally, people from the affected region reported that their perception of security and trust in the government, as well as humanitarian workers, declined over the course of the outbreak, complicating an already complex response.[281]

### Misinformation

Combating misinformation was a key element in overcoming Ebola in North Kivu. One study using surveys found that low institutional trust coupled with a belief in misinformation about Ebola were inversely associated with preventive behaviors in individuals, including Ebola vaccine acceptance.[282] Belief in misinformation regarding Ebola was widespread, with 25% of respondents reporting that they did not believe the Ebola outbreak was real. Some of the rumors that were being circulated included statements that the outbreak did not exist, it was fabricated by the authorities for financial gains, or was fabricated to destabilize the region.[282] Approximately 68% of respondents reported that they did not trust the local authorities to represent their interest, and community trust in the Ebola response was often further undermined by misinformation spread by local politicians.[282]

Aside from politics, and according to one reputable source some individuals in the Democratic Republic of the Congo believed that: "Ebola wasn't a real illness, it was brought in by white people", this in part, led individuals to distrust medical workers. Spreading of harmful rumors had led to more than 130 attacks on healthcare facilities, with dozens of individuals killed.[283] One of the methods used to combat misinformation was for communications experts to rebut them with correct information via social media. Additionally, support from Ebola survivors also helped as some became volunteers at treatment centers for the virus.[284]

### Delay in seeking treatment

Early in the epidemic there were several delays in people seeking care for Ebola because the initial cases were misdiagnosed. Ebola symptoms were similar to symptoms of more common infectious diseases such as malaria, flu, and typhoid fever so people would wait until their situation deteriorated, usually after failure to respond to anti-malarial or antibiotic regimens, before going to the hospitals;[285]during this delay in care seeking, the relatives and close contacts of were being exposed.

## Burials

The IFRC has called funerals "super-spreading events" as burial traditions include kissing and generally touching bodies. Safe burial teams formed by health workers were subject to suspicion.[286]

### Travel restrictions and border closings

On 26 July 2019, Saudi Arabia stopped providing visas to people from the DRC after the WHO declared it an international emergency due to EVD.[287] On 1 August 2019, Rwanda closed its border with the DRC after multiple cases in the city of Goma, which borders the country in the upper Northwestern region.[288]

To minimize the risk of the spread to neighboring countries, screening points which consisted of temperature and symptom monitoring were established at many border crossings. Over 2 million screenings were undertaken during the outbreak which is believed to have contributed to the containment of the epidemic within DRC.[289]

## Treatment

In August 2018, the WHO evaluated the benefits and risks of several medications, including remdesivir, ZMapp, REGN-EB3(REGN3470-3471-3479), mAb114 and favipiravir.[290] The mAb114 (which is a monoclonal antibody) was deployed for the first time to treat individuals during this EVD outbreak.[291]

In November 2018, the DRC gave approval to start randomized clinical trials for EVD treatment.[292] On 12 August 2019, two medications were found to improve the rate of survival: REGN-EB3, a cocktail of three monoclonal Ebola antibodies, and mAb114. When used shortly after infection they were found to have a 90% survival rate. ZMapp and remdesivir were subsequently discontinued.[293][294][295][296]

In October 2020, the U.S. Food and Drug Administration (FDA) approved w:atoltivimab/maftivimab/odesivimab (Inmazeb, formerly REGN-EB3) with an indication for the treatment of infection caused by *Zaire ebolavirus*.[297]

### Vaccination

#### Vaccine distribution DRC

On 8 August 2018, the process of vaccination began with rVSV-ZEBOV Ebola vaccine, **Figure 10**.[299] While several studies have shown the vaccine to be safe and protective against the virus, additional research was needed before it could be licensed. Consequently, the WHO reported that it was being used under a ring vaccination strategy under "compassionate use" to protect persons at highest risk of Ebola, i.e. contacts of those infected, contacts of those contacts, and front-line medical personnel.[300]The DRC Ministry of Public Health reported on 16 August 2018 that 316 individuals had been vaccinated.[301] On 24 August, the DRC indicated it had vaccinated 2,957 individuals, including 1,422 in Mabalako against the Ebola virus.[302] By late October, more than 20,000 individuals had been vaccinated.[303] In December, Peter Salama, who is Deputy Director-General of Emergency Preparedness and Response for WHO, reported that the current 300,000 vaccine stockpile might not be enough to contain the EVD outbreak, especially since it takes several months to make more of the Zaire EVD vaccine (rVSV-ZEBOV).[304][305] On 11 December, Beni only had 4,290 doses of vaccine in stock.[160] Yet, by 31 January 2019, over 70,000 individuals had been vaccinated in the DRC.[306] As of August 2019, Merck & Co., the producers of the vaccine in use, reported a stockpile sufficient for 500,000 individuals, with more in production,[307]and as of 15 September, almost a quarter of a million individuals had been vaccinated in the outbreak.[27]

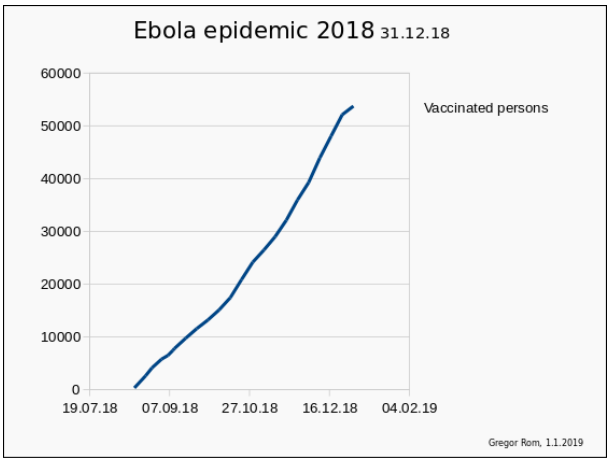


**Figure 10** | Number of vaccinated people in the epidemic area DRC[298]
*Gregor Rom, CC-BY-SA 4.0*

On 20 September 2019 a second vaccine by Johnson & Johnson was introduced in the EVD epidemic in the DRC.[308]In November 2019, the World Health Organization prequalified an Ebola vaccine, rVSV-ZEBOV, for the first time.[309] As of 22 February 2020, a total of 297,275 people had been vaccinated since the start of the outbreak.[310]Vaccinations helped to contain the epidemic, though military attacks and community resistance complicated distribution.[311]

#### Vaccine distribution Uganda

On 7 November, 2018 vaccination began in Uganda to some 2,100 individuals (health workers).[312] By April 2019, the Ministry of Health of Uganda had vaccinated 4,419 frontline health workers, plus another 800 people who had come in contact with infected individuals.[313][314]

### Vaccine effectiveness

In April 2019, the WHO published the preliminary results, in association with the DRC's Institut National pour la Recherche Biomedicale, into the effectiveness of the ring vaccination program, including data from 93,965 at-risk people who had been vaccinated. WHO stated that the rVSV-ZEBOV-GP vaccine had been 97.5% effective (or estimated efficacy rate[315]) at stopping Ebola transmission.[316][317] The vaccine had also reduced mortality among those who were infected after vaccination. The ring vaccination strategy was effective at reducing EVD in contacts of contacts (tertiary cases), with only two such cases being reported.[317]

### Vaccine safety

Based on a lack of evidence about the safety of the vaccine during pregnancy, the DRC ministry of health and the WHO decided to cease vaccinating women who are pregnant or breastfeeding. Some authorities criticized this decision as "utterly indefensible" from an ethical perspective. They note that as caregivers of the sick, pregnant and breastfeeding women are more likely to contract Ebola. They also note that since it is known that almost 100% of pregnant women who contract Ebola will die, a lack of safety data in this population should not be a deciding factor.[318] As of June 2019, pregnant and breastfeeding women were also being vaccinated.[319]

## Treatment centres

In August 2018, the Mangina Ebola Treatment Center was reported to be operational.[320][321] A fourth Ebola Treatment Center (after those in Mangina, Beni and Butembo) was inaugurated in September in Makeke in the Mandima Health Zone of Ituri Province.[322]Makeke is less than five kilometers from Mangina along a well-traveled local road; the site had been proposed in August when it appeared that a second Ebola Treatment Center would be needed in the area, and space was insufficient in Mangina itself to accommodate one.[323] By mid-September, however, there had been only two additional cases in the Mandima Health Zone, and only sporadic cases were being reported in the Mabalako Health Zone.[324]

In February 2019, attacks at treatment centers had been carried out in Butembo and Katwa. The motives behind the attacks were unclear. Due to the violence, international aid organizations stopped their work in the two communities.[325][326] In April, an epidemiologist from WHO was killed and two health workers injured in a militia attack on Butembo University Hospital in Katwa.[327] In May, WHO's health emergencies chief said insecurity had become a "major impediment" to controlling the outbreak. He reported that since January there had been 42 attacks on health facilities and 85 health workers had been wounded or killed. "Every time we have managed to regain control over the virus and contain its spread, we have suffered major, major security events. We are anticipating a scenario of continued intense transmission".[18]

### Healthcare workers

Health workers must wear personal protection equipment during treatment of those affected by the virus.[328] On 3 September 2018, WHO stated that 16 health workers had contracted the virus.[130] On 10 December, the WHO reported that the current DRC outbreak had led to 49 healthcare workers contracting the Ebola virus, and 15 had died.[159] As of 30 April 2019, there have been 92 health care workers in the DRC infected with EVD, of which 33 had died.[329] With false rumors being spread by word-of-mouth and social media, residents remain mistrustful and fearful of health care workers. In January 2020, it was reported that there had been nearly 400 attacks on medical workers since the outbreak began in 2018.[330]

# Post-Ebola virus syndrome

In terms of prognosis, aside from the possible effects of post-Ebola syndrome,[331] there was also the reality of survivors returning to communities where they might be shunned due to the fear many have towards the Ebola virus,[332][333] hence psychosocial assistance was often needed.[334] Many survivors of EVD face serious side effects, including but not limited to:[335][336]

- Joint pain
- Muscle pain
- Chest pain
- Hearing loss
- Hair loss
- Memory problems
- Anxiety attacks
- Vision loss

# History

The Ebola virus disease outbreak in Zaire (Yambuku) started in late 1976, and was the second outbreak ever after the earlier one in Sudan the same year.[337][338] On 1 August 2018, the tenth Ebola outbreak was declared in the DRC, only a few days after a prior outbreak in the same country had been declared over on 24 July (**Table 2**).[42][43]

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**Table 2**

| Date | Country | Major location | Outbreak information | | | | Source |
|---|---|---|---|---|---|---|---|
| | | | Strain | Cases | Deaths | CFR | |
| Aug 1976 | Zaire | Yambuku | EBOV | 318 | 280 | **88%** | [342] |
| Jun 1977 | Zaire | Tandala | EBOV | 1 | 1 | **100%** | [74][343] |
| May–Jul 1995 | Zaire | Kikwit | EBOV | 315 | 254 | **81%** | [344] |
| Aug–Nov 2007 | Democratic Republic of the Congo | Kasai-Occidental | EBOV | 264 | 187 | **71%** | [345] |
| Dec 2008–Feb 2009 | Democratic Republic of the Congo | Kasai-Occidental | EBOV | 32 | 14 | **45%** | [346] |
| Jun–Nov 2012 | Democratic Republic of the Congo | Orientale | BDBV | 77 | 36 | **47%** | [74] |
| Aug–Nov 2014 | Democratic Republic of the Congo | Tshuapa | EBOV | 66 | 49 | **74%** | [347] |
| May–Jul 2017 | Democratic Republic of the Congo | Likati | EBOV | 8 | 4 | **50%** | [348] |
| Apr–Jul 2018 | Democratic Republic of the Congo | Équateur Province | EBOV | 54 | 33 | **61%** | [349] |
| Aug 2018–June 2020 | Democratic Republic of the Congo | Kivu | EBOV | 3,470 | 2,280 | **66%** | [350] |

**Table 2 |** Timeline of Ebola outbreaks in the Democratic Republic of the Congo (formerly Zaire) since 1976

WHO chief Tedros Adhanom Ghebreyesu indicated on 15 August that the outbreak then in the DRC might be worse than the West African outbreak of 2013–2016,[339] with the IRC connecting this to the ongoing Kivu conflict.[340] The Kivu outbreak was the biggest of the ten recorded outbreaks recorded in the DRC of the viral hemorrhagic fever, **Figure 11**.[341]

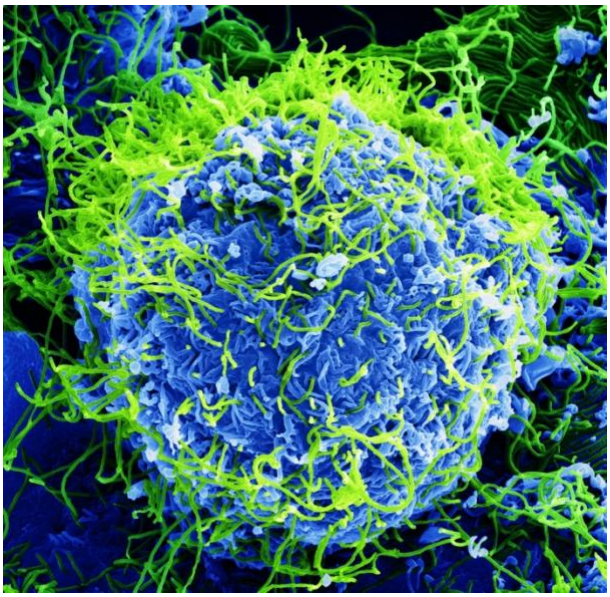

**Figure 11** | Colorized scanning electron micrograph of Ebola virus particles (green)
*BernbaumJG, CC-BY-SA 4.0*

Learning from other responses (**Figure 12**), such as in the 2000 outbreak in Uganda, the WHO established its Global Outbreak Alert and Response Network, and other public health measures were instituted in areas at high risk. Field laboratories were established to confirm cases, instead of shipping samples to South Africa.[352] Additionally, the outbreak was closely monitored by the CDC Special Pathogens Branch.[353]

## Statistical measures

One way to measure the outbreak is via the basic reproduction number, $R_0$, a statistical measure of the average number of people expected to be infected by one person with a disease. If the basic reproduction number is less than 1, the infection dies out; if it is greater than 1, the infection continues to spread—with exponential growth in the number of cases.[355] A March 2019 paper by Tariq *et al.* suggested that $R_0$ was oscillating around 0.9.[356]

## Response

During the Ebola outbreak in Democratic Republic of the Congo, a number of organizations helped in different capacities: CARITASDRC, CARE International, Cooperazione Internationale (COOPE), Catholic Organization for Relief and Development Aid (CORDAID/PAP-DRC), International Rescue Committee (IRC), Médecins Sans Frontières (MSF), Oxfam, International Federation of Red Cross and Red Crescent Societies (IFRC), International Committee of the Red Cross (ICRC), and Samaritan's Purse.[132]

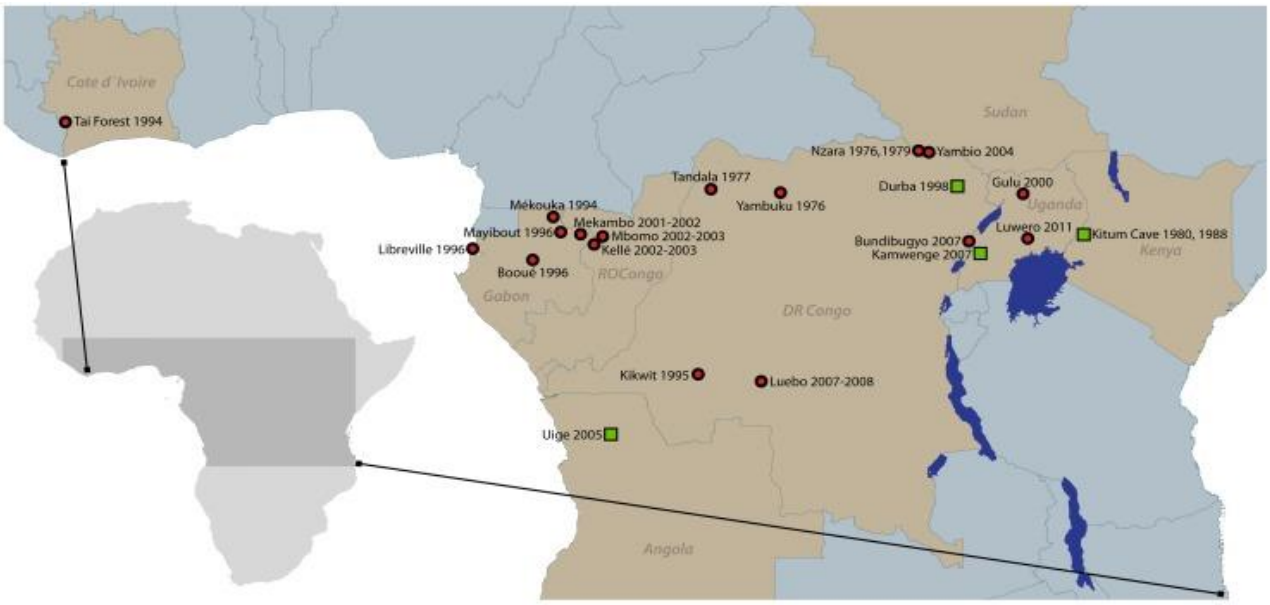


**Figure 12** | Ebola (and Marburg virus depicted as green squares) outbreaks on the African continent, both from the *Filoviridae* family[11][354]
*McNeil A., Rollin P., CC-BY-SA 4.0*

### WHO

On 12 April 2019, the WHO Emergency Committee was reconvened by the WHO Director-General after an increase in the rate of new cases, and determined that the outbreak still failed to meet the criteria for a Public Health Emergency of International Concern (PHEIC).[357][358]

Following the confirmation of Ebola crossing into Uganda, a third review by the WHO on 14 June 2019[22] concluded that while the outbreak was a health emergency in the DRC and the region, it did not meet all three criteria required for a PHEIC.[23] Following a case in Goma, the reconvening of a fourth review was announced on 15 July 2019.[25] The WHO officially declared the situation a PHEIC on 17 July 2019,[26] and as of 12 February 2020, it continues to be a PHEIC,[359] one of only six declared in its history.[360]

### World Bank

The World Bank was criticised when its Pandemic Emergency Financing Facility, intended to support countries affected by pandemic diseases, had only paid out $31 million of a potential total of $425 million by August 2019 while generating substantial returns for investors. The conditions used to decide when the fund should pay out to disease-affected countries were criticised as too stringent.[361]

### International governments

Financial support has been contributed by the governments of the US and the UK, among others. The UK DfID minister, Rory Stewart, visited the area in July 2019, and called for other western countries, including Canada, France and Germany, to donate more financial aid. He identified a funding deficit of $100–300 million to continue responding to the outbreak until December. He urged WHO to classify the situation as a PHEIC, to facilitate the release of international aid.[362][363]

## 2020 Équateur Province outbreak and other regional health issues

On 1 June 2020, the Congolese health ministry announced a new DRC outbreak of Ebola in Mbandaka, Équateur Province, a region along the Congo River. Genome sequencing suggests that this outbreak, the 11th outbreak since the virus was first discovered in the country in 1976, is unrelated to the one in North Kivu Province or the previous outbreak in the same area in 2018. It was reported that six cases had been identified with four fatalities. It is expected that more people will be identified as surveillance activities increase.[364]

The Équateur Province was the site of a small Ebola outbreak in 2018, which infected 53 people and resulted in 29 deaths. That outbreak was quickly brought under control with the use of the Ebola vaccine. The WHO is assisting with the response to this outbreak in part using the structures put in place for the 2018 outbreak. Testing and contact tracing is underway and additional medical staff has been sent in.[365] Médecins Sans Frontières was also present to give assistance if needed. The outbreak adds to an already difficult time for the Congo due to both COVID-19 cases (whose worldwide total at the time was over 75 million cases[366]) and a large measles outbreak that had caused almost 7000 deaths since 2019.[33]

By 8 June, a total of 12 cases had been identified in and around Mbandaka and six deaths due to the virus. The WHO said 300 people in Mbandaka and the surrounding Équateur province had been vaccinated.[367] By 15 June the case count had increased to 17 with 11 deaths, with more than 2,500 people having been vaccinated.[368] On 17 October, it had increased to 128 cases and 53 deaths, despite an effective vaccine being available.[369] By November 18, the World Health Organization has had no reported cases of Ebola in Équateur province for 42 days; therefore the outbreak was declared over.[370] In the end there were 130 cases and 55 dead due to the virus.[371]

## Additional Information

**Acknowledgements**

Would like to acknowledge all who contributed to this paper

**Conflict of interest**

There are no conflicts of interest

**Ethics statement**

No ethics issues exist that the author(s) are aware of.

## Notes

1. Ituri province was added to N. Kivu province, in terms of viral infection, when the first case of EVD was confirmed on 13 August.[1]
2. in the Congolese statistics cases of Mabalako. Uganda's index case and 7 other family members were classified in Mabalako, the health zone where they started to develop symptoms. Of these 8 confirmed cases of the same family, 5 remained in the DRC and 3 had crossed the border. [...] The 2 deaths of Bwera are the 5-year-old boy and the 50-year-old grandmother who were classified...[196] As of 25 June 2020

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