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Population movements from Bunia, Mongbwalu and Rwampara based on privacy-secure analysis of mobile operator data from Vodacom Congo

Supporting surveillance and response priorities for the 2026 DRC Ebola Bundibugyo outbreak

Reporting period: 24 April – 23 May 2026

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Executive summary

This report uses anonymised mobile operator data from Vodacom Congo to map population movements out of the three health zones — Bunia, Mongbwalu and Rwampara — that account for the vast majority of confirmed and suspected cases in the 2026 DRC Ebola Bundibugyo outbreak. The aim of the study is to identify which areas across the country face the greatest risk of importation and inform decision making in relation to where surveillance outside the three main affected health zones should be prioritised.

An anonymised study cohort of subscribers present in the three origin health zones during the period 3–23 April 2026, was followed between 24 April and 23 May 2026. Their subsequent movements provide a very recent estimate of how the population in the three main outbreak areas has spread across DRC.

The largest travel flows remain inside Ituri, with the top five recipient health zones being Lita, Nizi, Bambu, Kilo and Nyankunde. Lita alone has received 22% of the studied cohort — orders of magnitude more than other zones in the province. This points to very large differences in importation risk even within Ituri. Outside Ituri, there are clear flows south to Beni and Butembo in Nord-Kivu (~1% of the cohort), to Watsa in Haut-Uele (0.7%), Makiso Kisangani in Tshopo (0.35%), and smaller but notable flows to Kinshasa (Nsele and Gombe), Sud-Kivu, Maniema, Tanganyika, Mongala, Equateur, Kasai Central and Kongo Central, as well as along the Congo River corridor and the Kinshasa–Kikwit–Kananga axis.

Mobility patterns align with the observed case distribution: three of the top five recipient zones and eight out of ten health zones with confirmed cases outside the three main affected health zones fall within the top 30 destinations. Four important exceptions

stand out. Lita, the largest recipient, has no confirmed or suspected cases to date. This warrants a review of surveillance quality in this health zone. Bambu, the third largest recipient, has no confirmed cases, but does have both suspected cases and suspected deaths.

Conversely, confirmed cases in Goma and Miti Murhesa sit well outside the top 30 (ranks 45 and 126 respectively), a reminder that lower-ranked zones cannot be discounted.

The report recommends that highly ranked health zones, which are not seen as currently affected, be given particular attention in surveillance planning. Important caveats apply: mobility is a key but not sole predictor of spread (contact patterns ultimately determine transmission), and the data reflect Vodacom subscribers only, though Vodacom is the market leader in Ituri. Further analyses covering additional origin areas, individual health-zone breakdowns, and extended time periods are planned.

Privacy note

The analysis runs on anonymised Call Detail Records (CDRs), records of mobile activity that the operator generates automatically for billing, held inside Vodacom Congo's secure environment. No individual-level data leaves Vodacom's premises. All published results are aggregated to health zone level and to cohort percentages. Subscribers are not identified. The cohort is defined only by presence in the three outbreak health zones during 3–23 April 2026; no other personal attributes are used.

Population mobility in relation to the outbreak

Overview

This report provides data on travel patterns out of Bunia, Mongbwalu and Rwampara health zones. These health zones have seen the vast majority of confirmed and suspected cases and therefore currently confer the largest known exportation risk to other health zones. Additional analyses and data releases are planned.

The data is based on anonymised data on movements of hundreds of thousands of subscribers on the Vodacom Congo network in Ituri. Further details on methods and analytical choices are provided in the method section.

We follow the movements of all anonymised subscribers who were registered at least once in any of the three health zones of Bunia, Mongbwalu and Rwampara during the three weeks immediately preceding the death of the presumed index case on 24 April 2026. We then follow their movements out of the three health zones.

The analysis computes, at successive days from the end of the reference period at 23 April (+1 day, +2 days, +7 days, etc.), how many cohort members have been observed in each health zone, capturing the progressive spread of the study cohort day by day (Fig. 1 and Table 1). Each subscriber is counted in a health zone from the first day they are observed there, regardless of how many times they appear subsequently in that health zone. A subscriber observed in multiple health zones is counted in each of those health zones.

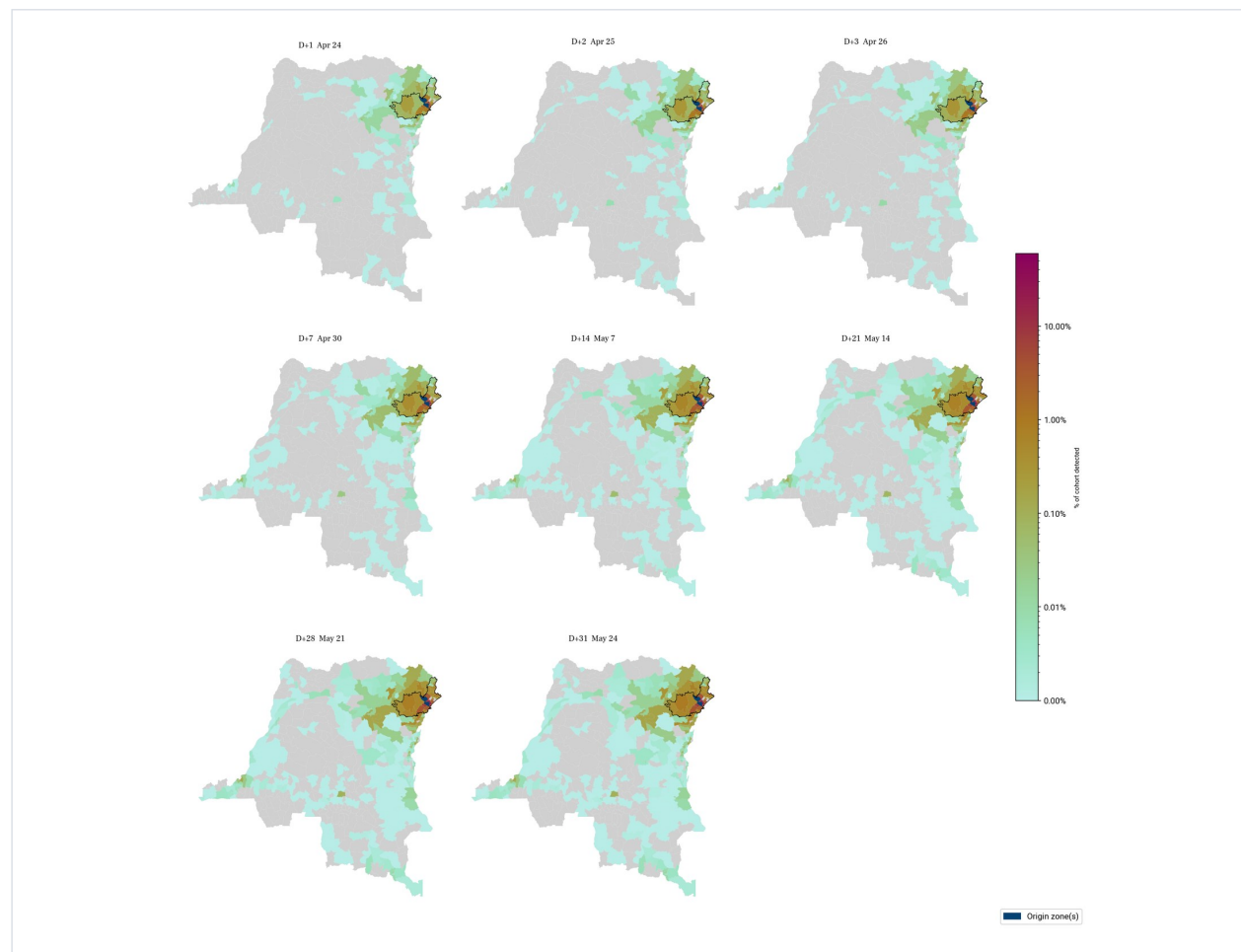


Figure 1. Diffusion of subscribers across DRC from 24 April and onwards (among those present in Bunia, Mongbwalu and Rwampara at least once during 3-23 April). Each panel shows the percentage of the subscriber group detected at least once in each health zone by that day (colour log scale; darker shades indicate a higher proportion). Health zones with no recorded travellers are grey. Sixty three out of five hundred and nineteen health zones are excluded due to data quality reasons and are also grey. See table in Annex B for health zones excluded from the study.

Overview (continued)

Large travel flows are directed to areas inside and close to Ituri. The 14 largest recipient zones are all within Ituri. The top five recipient health zones are Lita, Nizi, Bambu, Kilo and Nyankunde.

There are however very large differences in the sizes of flows to different parts of Ituri away from the three main outbreak areas. The largest recipient health zone is Lita, which has seen 22% of all anonymised subscribers studied (Table 1), Other health zones in Ituri, for example Adja and Adi have seen only a fraction of that flow (less than a hundredth of Lita's flow). This indicates very large differences in risk for new outbreaks across Ituri.

Outside Ituri there are large differences in flows across the country. There is a clear flow of subscribers down towards Beni and Butembo in North Kivu. These health zones have seen approximately 1% of the study group on 24 May. In Haut-Uele, Watsa has received the most travelers (0.7%). In Tshopo, Makiso Kisangani is the top recipient health zone (0.35%). In Kinshasa, Nsele and Gombe have both received 0.13% (ranked 50 and 51 respectively). In Sud-Kivu, Katana is the top recipient, ranking 69 (0.06%). In Maniema, Lubutu ranks 97 (0.02%). In Tanganyika, Nyemba (rank 105, 0.02%) is the top recipient, in Mongala, Yamaluka ranks 124 (0.01%), in Equateur, Mbandaka ranks 138 (0.01%), in Kasai Central, Lukonga ranks 141 (0.01%) and in Kongo Central, Massa (rank 122, 0.01%) is the top recipient. Several other areas relatively far from the outbreak area have received travelers. These include along the Congo river extending as an arc across the north of DRC and the East-West travel corridor between Kinshasa, Kikwit and Kananga, south of the central rainforest (Fig. 1).

Comparing the travel data with what is known about the distribution of confirmed cases, there is a high concurrence between the mobility data and the case data. Three out of the five top recipient health zones have confirmed cases. Bambu, the third highest ranked in terms of receiving travels, has both suspected cases and suspected deaths. Eight out of ten health zones with confirmed cases outside the three main outbreak areas are situated within the top 30 health zones in terms of travel from the three main outbreak health zones.

There are noteworthy exceptions to call attention to. Lita has received the most travelers from the outbreak areas but has, as far as we know, no confirmed or suspected cases. This could be due to travelers here coming from the areas with no transmission within the three main outbreak areas. However, responders should review how well surveillance works in the Lita health zone. Bambu ranks third in receiving travelers but has no confirmed case. However it has both suspected cases and suspected deaths. The cases in Goma and Miti Murhesa lie in health zones outside the top 30 ranking (rank 45 and 126 respectively). This is a good reminder of the randomness and multifactorial nature of spread and that also areas outside the top ranked health zones should be considered at risk.

We recommend health zones which are not seen to be affected but rank highly in Table 1 to be especially considered regarding surveillance activities.

Caveats

Sixty three out of five hundred and nineteen health zones are excluded from the study due to data quality reasons. See the table in Annex B for a list of these health zones.

Ebola spreads across the geography through travel. However, contact patterns between infectious and susceptible individuals determine if new individuals become infected

This means that the movements of people as estimated in this report are an important but far from the only predictor of the spatial spread of the epidemic.

While Flowminder's monthly population mobility reports for DRC estimate population movement through integration of survey data to adjust for biases in phone ownership, local market shares and other factors (methods here), these estimates provide data only on Vodacom's subscribers. Vodacom is the market leader in Ituri.

Table 1 — Top destination health zones

Table 1. Proportion of subscribers (out of those seen at least once in Bunia, Mongbwalu or Rwampara 3-23 April) who were seen in health zones across DRC at different times. Each row corresponds to a health zone with at least one recorded cohort member, ranked by the percentage of the cohort detected at the end of the period (24 May). Health zones with no recorded cohort presence are excluded. Health zones highlighted in red had at least one confirmed case as of 27 May.

Rank	Province	Health Zone	D+7	D+14	D+21	D+28	D+31
			30 Apr	7 May	14 May	21 May	24 May
1	Ituri	Lita	11	15.1	18.2	20.6	21.6
2	Ituri	Nizi	10	12.6	14.4	15.8	16.3
3	Ituri	Bambu	6.4	8.4	10	11.1	12
4	Ituri	Kilo	3.9	5.4	6.4	7.1	7.3
5	Ituri	Nyankunde	3.4	4.9	5.8	6.5	6.8
6	Ituri	Tchomia	4.6	5.4	5.9	6.4	6.6
7	Ituri	Komanda	1.8	2.5	3	3.5	3.6
8	Ituri	Damas	1.9	2.6	2.9	3.2	3.3
9	Ituri	Drodro	1.3	2	2.4	2.8	2.9
10	Ituri	Gety	1.6	2.2	2.4	2.7	2.8
11	Ituri	Fataki	0.5	0.8	1.1	1.3	1.4
12	Ituri	Logo	0.5	0.7	0.9	1.1	1.2
13	Ituri	Rimba	0.4	0.6	0.8	0.9	1
14	Ituri	Mahagi	0.5	0.6	0.8	0.9	1
15	Nord-Kivu	Beni	0.3	0.5	0.7	0.9	1
16	Nord-Kivu	Katwa	0.4	0.6	0.7	0.9	1
17	Ituri	Mambasa	0.4	0.6	0.7	0.8	0.9
18	Nord-Kivu	Butembo	0.3	0.5	0.6	0.8	0.8
19	Nord-Kivu	Oicha	0.2	0.4	0.6	0.7	0.8
20	Haut-Uele	Watsa	0.3	0.4	0.5	0.6	0.7
21	Ituri	Boga	0.2	0.5	0.6	0.6	0.7
22	Ituri	Aru	0.2	0.4	0.5	0.6	0.6
23	Ituri	Mandima	0.3	0.4	0.5	0.6	0.6
24	Ituri	Lolwa	0.2	0.4	0.5	0.6	0.6
25	Nord-Kivu	Kalunguta	0.2	0.3	0.4	0.5	0.5
26	Ituri	Kambala	0.1	0.3	0.4	0.5	0.5
27	Ituri	Nyarambe	0.2	0.3	0.4	0.5	0.5
28	Ituri	Biringi	0.2	0.3	0.4	0.4	0.5
29	Nord-Kivu	Musienene	0.1	0.3	0.3	0.4	0.5
30	Ituri	Nia Nia	0.2	0.2	0.3	0.4	0.4

Partnership between Vodacom and Flowminder

Since 2018, Vodacom Congo and the Flowminder Foundation have been collaborating to put anonymised mobile data at the service of development and humanitarian action in the Democratic Republic of Congo. This partnership combines operator metadata (CDRs) provided by Vodacom Congo with Flowminder's analytical expertise in big data, in strict compliance with subscriber privacy. Together, the two organisations have produced mobility indicators to support the government's response to COVID-19, estimate population displacement following the eruption of Mount Nyiragongo in 2021, and strengthen routine immunisation planning for the Expanded Programme on Immunization (EPI). This collaboration illustrates how the Congolese private sector, national health authorities, and technical partners can combine their strengths to produce timely, evidence-based insights for the benefit of the people of the DRC. The analyses are carried out on de-identified mobile data. No individual-level data leaves Vodacom's secure premises.

Future analyses

We will provide further analyses of the travel patterns, including additional areas of departures, separate analysis per health zone and cover additional time periods. We welcome requests and discussion with responders to best serve the community.

Data underlying our regular monthly reports across the whole of the DRC are available on HDX [here](#).

Citation

Please use this citation when referring to this report:

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Flowminder's reports are accessible at: <https://www.flowminder.org/resources/publications-reports/drc-reports-publications>

For enquiries please contact info@flowminder.org

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Methods and data

Input data

The analysis uses three types of daily level Call Detail Records (CDRs) files provided by Vodacom: voice calls, SMS, and mobile data sessions (MDS). CDRs are transactional records generated automatically by a mobile network operator for each communication event — voice call, SMS, or mobile data session — made or received by a subscriber. Each record contains a timestamp, an anonymised subscriber identifier, and the identifier of the cell tower that handled the event, which provides an approximate geographic location. CDRs do not capture the content of communications.

The geographic reference unit throughout is the health zone (“zone de santé”).

Methods for cohort and period selection

Step 1 — Cohort identification

Reference period: 3–23 April 2026 (20 days)

The cohort consists of all subscribers who were active in either of the three origin health zones — Bunia, Mongbwalu or Rwampara — during the three weeks immediately preceding the first death of the outbreak on 24 April 2026. These zones were selected as the presumed geographic source of the outbreak; the reference period was set to capture the general population present in those zones in the weeks before the epidemic became known. A longer period, including March, would have captured travel during a time when there were fewer infectious cases in these areas. A shorter period in April would have provided scope for more randomness in small trajectories.

For each origin zone, CDR files across all three event types dated within the reference period were scanned, and anonymised subscribers recorded within those zones were tagged. Subscribers observed in a zone — or multiple — during the reference period were pooled and deduplicated, so that each subscriber is counted only once regardless of how many zones or days they appear in.

Step 2 — CDR extraction for the analysis period

Analysis period: 24 April – 23 May 2026 (30 days)

All CDR files dated within the analysis period are scanned across all three event types. From each file, only records belonging to cohort members were retained, along with the hashed subscriber identifier, cell tower identifier, and timestamp. This produces a cohort-filtered set of daily CDR files covering the full 30-day analysis window.

More information on analysis of CDR data can be found at www.flowgeek.org.

Mobile operator data for prediction of spatial spread of infectious diseases

The first validation study of using mobile operator data for predicting infectious disease outbreaks was provided for the cholera epidemic in Haiti (Bengtsson et al. Sci Rep. 2015). The same results have been shown for multiple agents, e.g. dengue (Wesolowski. PNAS. 2015) and COVID-19 (Chang et al. Nature. 2021).

Annex A — Full ranked list of destination health zones

Full table: Proportion of subscribers (out of those seen at least once in Bunia, Mongbwalu or Rwampara 3-23 April) who were seen in health zones across DRC at different times. Health zones with no recorded cohort presence are excluded. Health zones highlighted in red had at least one confirmed case as of 27 May. Continued on the following pages.

Rank	Province	Health Zone	D+7	D+14	D+21	D+28	D+31
			30 Apr	7 May	14 May	21 May	24 May
1	Ituri	Lita	11	15.11	18.21	20.6	21.55
2	Ituri	Nizi	9.97	12.62	14.45	15.83	16.33
3	Ituri	Bambu	6.45	8.39	9.99	11.15	11.98
4	Ituri	Kilo	3.9	5.43	6.37	7.11	7.35
5	Ituri	Nyankunde	3.45	4.89	5.8	6.48	6.8
6	Ituri	Tchomia	4.57	5.38	5.89	6.39	6.55
7	Ituri	Komanda	1.76	2.55	3.03	3.46	3.64
8	Ituri	Damas	1.87	2.6	2.91	3.2	3.32
9	Ituri	Drodoro	1.32	1.97	2.4	2.76	2.89
10	Ituri	Gety	1.61	2.18	2.45	2.69	2.77
11	Ituri	Fataki	0.51	0.82	1.06	1.27	1.35
12	Ituri	Logo	0.48	0.71	0.92	1.1	1.17
13	Ituri	Rimba	0.36	0.58	0.77	0.93	1
14	Ituri	Mahagi	0.46	0.63	0.79	0.92	0.97
15	Nord-Kivu	Beni	0.34	0.53	0.71	0.89	0.96
16	Nord-Kivu	Katwa	0.41	0.57	0.73	0.89	0.96
17	Ituri	Mambasa	0.44	0.58	0.69	0.81	0.86
18	Nord-Kivu	Butembo	0.35	0.5	0.64	0.79	0.84
19	Nord-Kivu	Oicha	0.25	0.43	0.58	0.74	0.8
20	Haut-Uele	Watsa	0.27	0.4	0.49	0.62	0.67
21	Ituri	Boga	0.22	0.54	0.59	0.64	0.66
22	Ituri	Aru	0.24	0.37	0.48	0.58	0.61
23	Ituri	Mandima	0.25	0.37	0.45	0.56	0.6
24	Ituri	Lolwa	0.23	0.36	0.46	0.55	0.59
25	Nord-Kivu	Kalunguta	0.15	0.28	0.38	0.51	0.55
26	Ituri	Kambala	0.15	0.26	0.38	0.48	0.53
27	Ituri	Nyarambe	0.21	0.3	0.38	0.46	0.49
28	Ituri	Biringi	0.17	0.27	0.36	0.43	0.46
29	Nord-Kivu	Musienene	0.14	0.27	0.34	0.42	0.45
30	Ituri	Nia Nia	0.15	0.25	0.31	0.37	0.42
31	Tshopo	Makiso Kisangani	0.17	0.24	0.29	0.34	0.35
32	Ituri	Aungba	0.1	0.17	0.25	0.31	0.34
33	Haut-Uele	Isiro	0.09	0.2	0.24	0.29	0.32
34	Ituri	Ariwara	0.13	0.2	0.24	0.3	0.31
35	Haut-Uele	Gombari	0.13	0.2	0.24	0.29	0.31
36	Haut-Uele	Makoro	0.09	0.17	0.23	0.27	0.3

Rank	Province	Health Zone	D+7	D+14	D+21	D+28	D+31
			30 Apr	7 May	14 May	21 May	24 May
37	Ituri	Angumu	0.13	0.18	0.23	0.26	0.28
38	Nord-Kivu	Kyondo	0.07	0.12	0.17	0.22	0.25
39	Ituri	Rethy	0.09	0.13	0.16	0.21	0.23
40	Tshopo	Kabondo	0.1	0.14	0.18	0.21	0.22
41	Nord-Kivu	Masereka	0.04	0.08	0.11	0.15	0.17
42	Tshopo	Bafwasende	0.05	0.09	0.12	0.15	0.16
43	Tshopo	Wanierukula	0.05	0.09	0.12	0.15	0.16
44	Nord-Kivu	Mutwanga	0.04	0.08	0.11	0.14	0.15
45	Nord-Kivu	Goma	0.06	0.08	0.11	0.13	0.14
46	Nord-Kivu	Mabalako	0.05	0.08	0.1	0.13	0.14
47	Haut-Uele	Wamba	0.05	0.08	0.1	0.13	0.14
48	Haut-Uele	Dungu	0.05	0.08	0.1	0.12	0.14
49	Nord-Kivu	Karisimbi	0.05	0.08	0.1	0.13	0.13
50	Kinshasa	Nsele	0.04	0.08	0.1	0.13	0.13
51	Kinshasa	Gombe	0.07	0.09	0.11	0.12	0.13
52	Nord-Kivu	Nyiragongo	0.04	0.06	0.09	0.11	0.12
53	Tshopo	Tshopo	0.05	0.07	0.09	0.11	0.12
54	Kinshasa	Limete	0.04	0.07	0.08	0.1	0.1
55	Nord-Kivu	Lubero	0.03	0.05	0.07	0.09	0.1
56	Nord-Kivu	Kayna	0.03	0.05	0.07	0.09	0.1
57	Tshopo	Mangobo	0.04	0.06	0.07	0.09	0.09
58	Kinshasa	Lingwala	0.04	0.06	0.07	0.09	0.09
59	Tshopo	Lubunga	0.03	0.05	0.07	0.09	0.09
60	Kinshasa	Binza Ozone	0.05	0.07	0.08	0.09	0.09
61	Kinshasa	Kokolo	0.04	0.06	0.07	0.08	0.09
62	Kinshasa	Kasa Vubu	0.04	0.05	0.07	0.08	0.08
63	Kinshasa	Kinshasa	0.03	0.05	0.07	0.08	0.08
64	Kinshasa	Kalamu 1	0.03	0.05	0.06	0.08	0.08
65	Kinshasa	Kintambo	0.03	0.05	0.06	0.07	0.07
66	Kinshasa	Lemba	0.02	0.04	0.06	0.07	0.07
67	Kinshasa	Masina 1	0.02	0.04	0.05	0.07	0.07
68	Nord-Kivu	Rutshuru	0.01	0.03	0.04	0.06	0.07
69	Sud-Kivu	Katana	0.02	0.03	0.04	0.06	0.06
70	Kinshasa	Bandalungwa	0.02	0.04	0.05	0.06	0.06
71	Ituri	Laybo	0.02	0.03	0.04	0.05	0.06
72	Kinshasa	Masina 2	0.01	0.03	0.04	0.05	0.06
73	Kinshasa	Kikimi	0.01	0.03	0.04	0.05	0.05
74	Sud-Kivu	Ibanda	0.02	0.03	0.04	0.05	0.05

Rank	Province	Health Zone	D+7	D+14	D+21	D+28	D+31
			30 Apr	7 May	14 May	21 May	24 May
75	Kinshasa	Barumbu	0.02	0.03	0.04	0.05	0.05
76	Kinshasa	Matete	0.02	0.03	0.04	0.05	0.05
77	Ituri	Adi	0.02	0.03	0.03	0.04	0.05
78	Kinshasa	Binza Meteo	0.02	0.03	0.04	0.04	0.05
79	Kinshasa	Ndjili	0.01	0.02	0.03	0.04	0.04
80	Kinshasa	Selembao	0.01	0.03	0.03	0.04	0.04
81	Sud-Kivu	Kadutu	0.01	0.02	0.03	0.04	0.04
82	Kinshasa	Kingabwa	0.01	0.02	0.03	0.04	0.04
83	Kinshasa	Ngiri Ngiri	0.01	0.02	0.03	0.04	0.04
84	Kinshasa	Mont Ngafula 1	0.02	0.03	0.03	0.04	0.04
85	Haut-Uele	Pawa	0.01	0.02	0.03	0.04	0.04
86	Kinshasa	Mont Ngafula 2	0.02	0.02	0.03	0.04	0.04
87	Sud-Kivu	Minova	0	0.01	0.02	0.03	0.04
88	Kinshasa	Police	0.01	0.02	0.02	0.03	0.04
89	Kinshasa	Kingasani	0.01	0.02	0.02	0.03	0.03
90	Sud-Kivu	Bagira	0.01	0.01	0.02	0.03	0.03
91	Haut-Uele	Rungu	0.01	0.02	0.02	0.03	0.03
92	Sud-Kivu	Kabare	0.01	0.01	0.02	0.03	0.03
93	Kinshasa	Maluku 1	0.01	0.01	0.02	0.03	0.03
94	Nord-Kivu	Alimbongo	0.01	0.01	0.02	0.03	0.03
95	Haut-Uele	Faradje	0.01	0.01	0.02	0.02	0.03
96	Nord-Kivu	Walikale	0.01	0.01	0.02	0.02	0.02
97	Maniema	Lubutu	0.01	0.01	0.02	0.02	0.02
98	Haut-Uele	Aba	0.01	0.02	0.02	0.02	0.02
99	Kinshasa	Kalamu 2	0.01	0.01	0.01	0.02	0.02
100	Kinshasa	Makala	0	0.01	0.01	0.02	0.02
101	Haut-Katanga	Lubumbashi	0.01	0.01	0.01	0.02	0.02
102	Bas-Uele	Buta	0.01	0.02	0.02	0.02	0.02
103	Tshopo	Bafwagbogbo	0.01	0.01	0.01	0.02	0.02
104	Tshopo	Banalia	0	0.01	0.01	0.02	0.02
105	Tanganyika	Nyemba	0.01	0.01	0.01	0.02	0.02
106	Haut-Uele	Niangara	0.01	0.01	0.01	0.01	0.02
107	Kinshasa	Ngaba	0	0.01	0.01	0.01	0.01
108	Haut-Katanga	Mumbunda	0	0.01	0.01	0.01	0.01
109	Kinshasa	Bumbu	0	0.01	0.01	0.01	0.01
110	Nord-Kivu	Kamango	0.01	0.01	0.01	0.01	0.01
111	Nord-Kivu	Kirotshe	0	0.01	0.01	0.01	0.01
112	Haut-Katanga	Tshamilemba	0	0.01	0.01	0.01	0.01

Rank	Province	Health Zone	D+7	D+14	D+21	D+28	D+31
			30 Apr	7 May	14 May	21 May	24 May
113	Kinshasa	Kisenso	0	0.01	0.01	0.01	0.01
114	Sud-Kivu	Uvira	0	0.01	0.01	0.01	0.01
115	Maniema	Kindu	0	0.01	0.01	0.01	0.01
116	Tshopo	Isangi	0	0.01	0.01	0.01	0.01
117	Nord-Kivu	Manguredjipa	0	0	0.01	0.01	0.01
118	Tanganyika	Kalemie	0	0	0.01	0.01	0.01
119	Tshopo	Basoko	0	0	0.01	0.01	0.01
120	Nord-Kivu	Biena	0	0	0.01	0.01	0.01
121	Sud-Kivu	Kalehe	0	0	0	0	0.01
122	Kongo Central	Massa	0	0	0.01	0.01	0.01
123	Haut-Katanga	Kipushi	0	0	0.01	0.01	0.01
124	Mongala	Yamaluka	0	0.01	0.01	0.01	0.01
125	Ituri	Adja	0	0.01	0.01	0.01	0.01
126	Sud-Kivu	Miti Murhesa	0	0	0.01	0.01	0.01
127	Kinshasa	Kimbanseke	0	0	0	0.01	0.01
128	Nord-Kivu	Bambo	0	0	0.01	0.01	0.01
129	Kinshasa	Maluku 2	0	0	0	0.01	0.01
130	Kinshasa	Biyela	0	0	0	0.01	0.01
131	Tshopo	Yakusu	0	0	0	0.01	0.01
132	Sud-Kivu	Mwana	0	0	0	0	0.01
133	Sud-Kivu	Ruzizi	0	0	0	0	0.01
134	Tshopo	Bengamisa	0	0	0	0.01	0.01
135	Bas-Uele	Poko	0	0	0	0.01	0.01
136	Sud-Kivu	Nyantende	0	0	0	0.01	0.01
137	Lualaba	Manika	0	0	0	0.01	0.01
138	Equateur	Mbandaka	0	0	0.01	0.01	0.01
139	Sud-Kivu	Walungu	0	0	0	0	0.01
140	Mongala	Lisala	0	0	0	0.01	0.01
141	Kasai Central	Lukonga	0	0	0	0	0.01
142	Kongo Central	Kisantu	0	0	0	0	0.01

Annex B — Health zones excluded from the study

List of DRC health zones not included in the study (63 out of 519 health zones across DRC) due to data quality reasons. These health zones did not just not receive any travellers from the three main outbreak health zones; they are fully excluded from the study.

Province	Health Zone	Province	Health Zone	Province	Health Zone
Equateur	Ntondo	Kasaï Central	Kalomba	Nord-Kivu	Rwanguba
Equateur	Iboko	Kasaï Oriental	Mukumbi	Nord-Kivu	Vuhovi
Haut-Katanga	Kowe	Kasaï Oriental	Cilundu	Nord-Ubangi	Businga
Haut-Katanga	Vangu	Kasaï Oriental	Mpokolo	Nord-Ubangi	Bili
Haut-Katanga	Mufunga Sampwe	Kongo Central	Mangembo	Nord-Ubangi	Abuzi
Haut-Lomami	Butumba	Kongo Central	Kimvula	Nord-Ubangi	Wasolo
Haut-Lomami	Lwamba	Kwilu	Moanza	Sankuru	Tshudi Loto
Ituri	Jiba	Kwilu	Kimputu	Sankuru	Omendjadi
Ituri	Mangala	Kwilu	Mungindu	Sud-Kivu	Minembwe
Ituri	Linga	Lomami	Tshofa	Sud-Kivu	Mwenga
Kasaï	Kitangwa	Lomami	Lubao	Sud-Kivu	Idjwi
Kasaï	Bulape	Lomami	Ludimbi Lukula	Sud-Ubangi	Mawuya
Kasaï	Ndjoko Mpunda	Lomami	Kamiji	Sud-Ubangi	Mbaya
Kasaï Central	Yangala	Lomami	NGandajika	Sud-Ubangi	Bominenge
Kasaï Central	Mutoto	Lualaba	Lualaba	Tshopo	Lowa
Kasaï Central	Dibaya	Maindombe	Pendjwa	Tshopo	Basali
Kasaï Central	Masuika	Maindombe	Mimia	Tshuapa	Bokungu
Kasaï Central	Lubondaie	Mongala	Bumba	Tshuapa	Yalifafu
Kasaï Central	Tshibala	Mongala	Bongandanga	Tshuapa	Mompono
Kasaï Central	Bilomba	Mongala	Yambuku		
Kasaï Central	Bobozo	Mongala	Yamongili		