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

Population movements to and from affected health zones, based on privacy-secure analysis of mobile operator data from Vodacom Congo (DRC)

Analysis period: Daily mobility through 8 June 2026
Publication date: 29 June 2026

1. Executive Summary

1.1 Key Findings

This report uses anonymised mobile operator data from Vodacom Congo (DRC) to map population movements out of the most affected health zones in the 2026 Ebola Bundibugyo outbreak, and to identify which areas across the country face the greatest risk of importation of infectious persons, to inform surveillance prioritisation. It updates and extends our 4 June 2026 Rapid Update, using a more recent reference period (4 May 2026–17 May 2026) and an improved methodology.

We provide data on movements away from two groups of health zones. The first, in Ituri, consists of Bunia, Mongbwalu, Nyankunde and Rwampara, which account for the vast majority of confirmed and suspected cases in DRC (Nyankunde has been added since the previous report). The second, in Nord-Kivu, consists of Beni, Butembo and Katwa. For each group we follow an anonymised cohort of subscribers present in the origin zones during 4 May 2026–17 May 2026, and measure their average subscriber-days per cohort member in every health zone over the follow-up period (18 May 2026–8 June 2026), a metric capturing both how many cohort members reached a zone and how long they stayed.

For the Ituri cohort, the nine highest-ranked recipient zones are all within the province: Lita, Nizi, Bambu, Tchomia, Kilo, Gety, Damas, Komanda and Drodro, led by Lita at 1.09 subscriber-days per cohort member; the first zone outside Ituri is Katwa (Nord-Kivu, rank 10), followed by Butembo (15), Beni (17), Watsa (Haut-Uele, 18) and Makiso Kisangani (Tshopo, 22). For the Nord-Kivu cohort, the top five recipients are all within Nord-Kivu: Musienene (1.64), Kalunguta, Oicha, Kyondo and Mabalako, with the main destinations beyond the two provinces being Watsa (rank 15) and Makiso Kisangani (rank 17).

Mobility patterns align closely with the observed case distribution: for the Ituri cohort, all ten top-ranked destination zones have at least one confirmed case as of 25 Jun 2026[1,2,3], and 21 of the top 30 do (70%); confirmed cases are far less common further down the ranking, with only 6 of zones ranked 31–60 affected (20%). For the Nord-Kivu cohort, 14 of the top 30 destinations have confirmed cases (47%)[1,2,3], including all five of the top five.

The exportation risk from the Nord-Kivu cluster is considerably more uncertain than from the Ituri cluster. For Nord-Kivu, case counts remain low and likely underestimate the true burden given detection and testing constraints in the northeast[1,2,3], so exportation from this cluster cannot be reliably estimated from the data presented here; we therefore present these flows as a separate, interim analysis. Recent spatial spread nonetheless suggests some exportation beyond the main Ituri outbreak, which may reflect the importance of this group. Responders should evaluate the data through their knowledge of the local context in Nord-Kivu, rather than reading the rankings as a direct measure of risk; the Nord-Kivu cohort also shows substantially stronger urban connectivity: roughly six times the Ituri cohort's exposure to Goma (NK rank 22), five times to Bukavu (NK rank 36) and nearly twice to Lubumbashi (NK rank 78), which would become particularly important should this cluster grow.

We recommend that highly ranked health zones without confirmed cases receive particular attention in surveillance planning. If the three Nord-Kivu origin zones do contribute sizeable exportation, several zones ranking highly for Nord-Kivu but not Ituri warrant attention: Mandima (Nord-Kivu rank 6, Ituri rank 24), Mutwanga (Nord-Kivu rank 8) and Lubero (Nord-Kivu rank 12), together with Makiso Kisangani, which faces compound exposure from both clusters yet has no confirmed cases to date. Ten health zones rank in the top 30 of both cohorts, facing possible compound importation pressure not visible in either ranking alone.

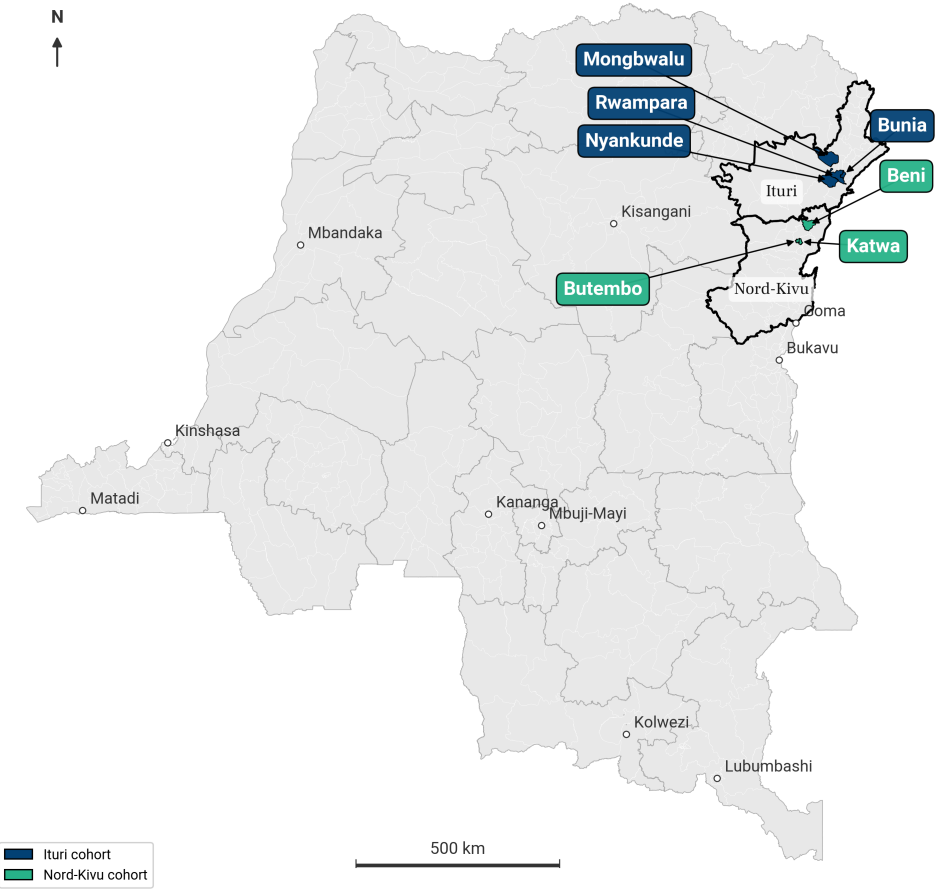

Figure 1. Location of the two study cohorts within the Democratic Republic of Congo. *The Ituri cohort origin zones (Bunia, Mongbwalu, Nyankunde and Rwampara) are shown in blue; the Nord-Kivu cohort origin zones (Beni, Butembo and Katwa) in green. Provinces of interest are outlined in black. Inset: northeast DRC.*

Privacy note

The analysis runs on anonymised Call Detail Records (CDR), metadata records of mobile phone activity held inside Vodacom Congo (DRC)'s secure environment. No individual-level data leaves Vodacom Congo (DRC)'s premises. All results are aggregated to health-zone level. The cohort is defined only by presence in the origin health zones during 4 May 2026–17 May 2026; no other personal attributes are used.

2. Population Mobility

2.1 Approach and Rationale

The analysis draws on data from hundreds of thousands of anonymised subscribers on the Vodacom Congo (DRC) network. Further details on methods and analytical choices are provided in the methods section.

We provide data on movements away from two separate groups (or clusters) of health zones: one in Ituri, consisting of Bunia, Mongbwalu, Nyankunde and Rwampara (which account for the vast majority of confirmed and suspected cases in DRC; compared with the previous report, we have added Nyankunde to this group), and one in Nord-Kivu, consisting of Beni, Butembo and Katwa (Figure 1).

In the weeks preceding this report (May–June 2026), confirmed cases in Nord-Kivu, especially in Beni, Butembo and Katwa, have been rising. Given this case data and the spatial development of the epidemic in Nord-Kivu, which does not seem fully explainable by movements from the four main areas in Ituri, it is possible that this spread is more driven by movements from Nord-Kivu health zones. As an interim solution, while we are seeking resources to provide mobility data between all health zones at high risk, we therefore show, as a separate analysis, movements away from this second group of most affected health zones in Nord-Kivu.

We follow the movements of all anonymised subscribers who were registered on at least 2 separate days during the 4 May 2026–17 May 2026 reference period in either of the four Ituri health zones (Ituri cohort) or in the three Nord-Kivu health zones (Nord-Kivu cohort).

For each cohort, we compute average subscriber-days per cohort member spent in each health zone during the follow-up period (18 May 2026–8 June 2026). This metric captures both the share of cohort members present in a zone and the duration of their stay, providing an estimate of exposure intensity. Figures 2 and 3 map this metric for the Ituri and Nord-Kivu cohorts respectively; Tables 1 and 2 provide ranked values. Summary maps comparing where the respective cohorts spent time before the reference period and afterwards, and the relative change between the periods are in Annexes A and B. Full methodological details are in Section 3.

2.2 Ituri Cohort

As seen in the previous report, there is a very strong correlation between the mobility of the Ituri cohort and the distribution of confirmed cases: all ten of the top-ranked health zones in the Ituri cohort in this most recent analysis have at least one confirmed case as of 25 Jun 2026[1,2,3], and 21 of the top 30 do (70%). Correspondingly, confirmed cases are far less frequent among lower-ranked zones: only 6 of the zones ranked 31–60 have seen confirmed cases (20%).

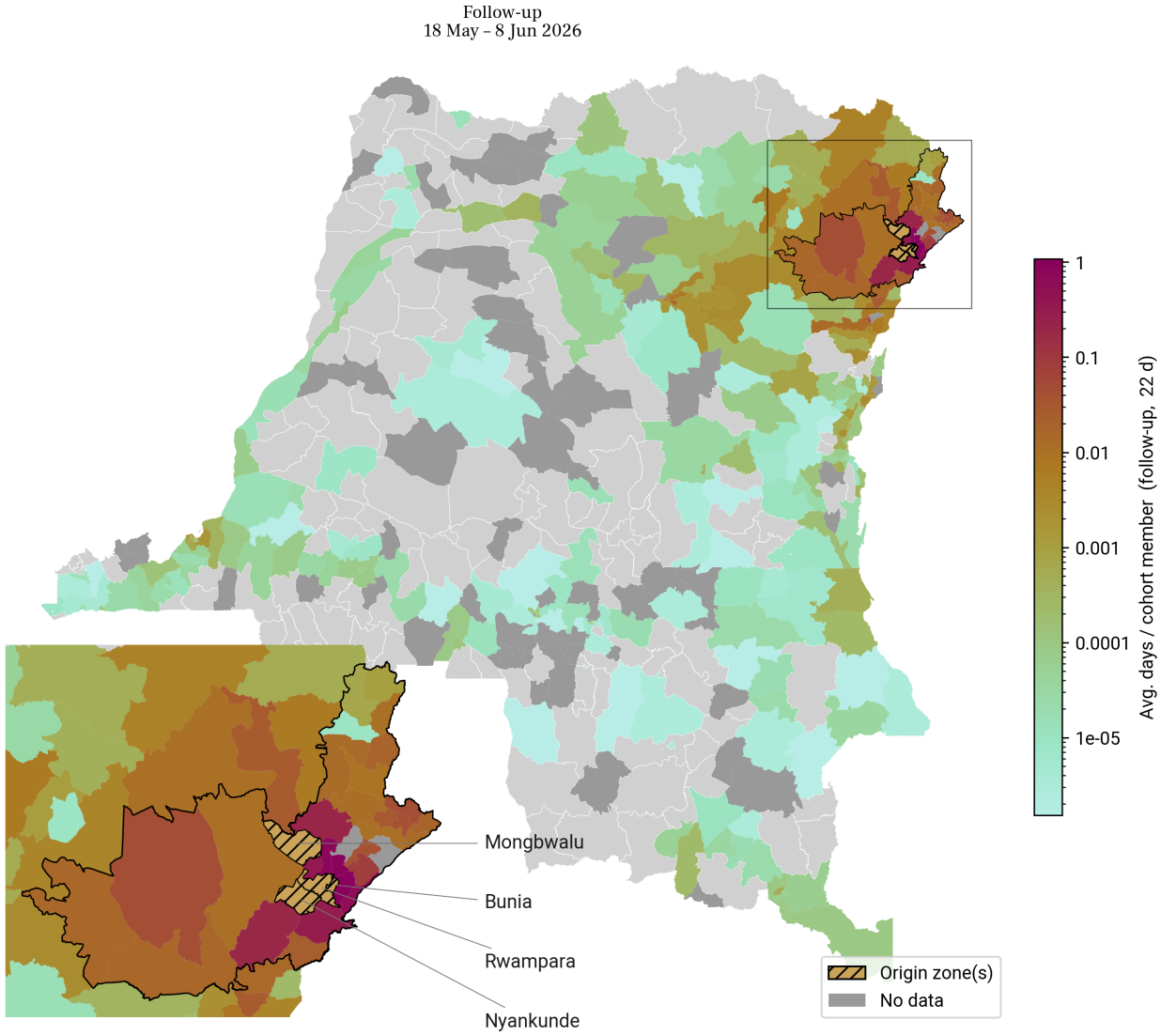

Figure 2. Subscriber-day presence during the follow-up period: Ituri cohort. *Average subscriber-days per cohort member in each health zone during 18 May 2026–8 June 2026, among subscribers present in Bunia, Mongbwalu, Nyankunde, Rwampara during 4 May 2026–17 May 2026 (colour log scale; darker shades indicate higher presence intensity). The metric captures overall intensity of presence: a zone visited briefly by many cohort members scores similarly to one where fewer members spent more time. Health zones with no recorded presence are light grey; zones excluded for data-quality reasons are dark grey. Hatching identifies origin health zones. Inset: northeast DRC. Table 1 lists the ranked values.*

Table 1 — Top 90 Recipient Health Zones (Ituri Cohort)

Average subscriber-days per cohort member in each health zone during the follow-up period (18 May 2026–8 June 2026), among subscribers present in Bunia, Mongbwalu, Nyankunde, Rwampara during 4 May 2026–17 May 2026. Each row is a health zone with at least one recorded cohort member during the follow-up period, ranked highest to lowest. Origin zones and health zones excluded for data-quality reasons are not shown (see Section 4). Values are the same as those mapped in Figure 2. **Red highlight covering the full row:** at least one confirmed case as of 25 Jun 2026[1,2,3]. Health zones in the same province have the same colour shading.

Rank	Province	Health Zone	Avg. days / cohort member (follow-up, 18 May–8 Jun 2026)
1	Ituri	Lita	1.09e+00
2	Ituri	Nizi	9.32e-01
3	Ituri	Bambu	8.12e-01
4	Ituri	Tchomia	5.51e-01
5	Ituri	Kilo	3.59e-01
6	Ituri	Gety	2.99e-01
7	Ituri	Damas	1.97e-01
8	Ituri	Komanda	1.87e-01
9	Ituri	Drodro	8.59e-02
10	Nord-Kivu	Katwa	5.02e-02
11	Ituri	Mambasa	4.49e-02
12	Ituri	Mahagi	4.37e-02
13	Ituri	Logo	4.26e-02
14	Ituri	Fataki	3.74e-02
15	Nord-Kivu	Butembo	3.06e-02
16	Ituri	Rimba	2.85e-02
17	Nord-Kivu	Beni	2.62e-02
18	Haut-Uele	Watsa	2.60e-02
19	Ituri	Boga	2.42e-02
20	Ituri	Nyarambe	1.86e-02
21	Ituri	Aru	1.86e-02
22	Tshopo	Makiso Kisangan	1.82e-02
23	Ituri	Nia Nia	1.56e-02
24	Ituri	Mandima	1.54e-02
25	Nord-Kivu	Oicha	1.48e-02
26	Ituri	Biringi	1.36e-02
27	Nord-Kivu	Musienene	1.31e-02
28	Ituri	Angumu	1.24e-02
29	Ituri	Kambala	1.15e-02
30	Ituri	Lolwa	1.11e-02
31	Ituri	Ariwara	1.07e-02
32	Haut-Uele	Gombari	1.07e-02
33	Ituri	Rethy	1.06e-02
34	Ituri	Aungba	8.90e-03
35	Nord-Kivu	Kalunguta	8.10e-03
36	Tshopo	Kabondo	7.31e-03
37	Nord-Kivu	Kyondo	6.67e-03
38	Haut-Uele	Isiro	6.48e-03
39	Haut-Uele	Makoro	6.24e-03
40	Nord-Kivu	Goma	4.88e-03
41	Kinshasa	Gombe	4.74e-03
42	Haut-Uele	Dungu	4.67e-03
43	Nord-Kivu	Karisimbi	4.17e-03
44	Nord-Kivu	Mutwanga	4.05e-03
45	Haut-Uele	Wamba	3.97e-03
46	Tshopo	Tshopo	3.51e-03
47	Nord-Kivu	Masereka	3.19e-03
48	Kinshasa	Binza Ozone	3.00e-03
49	Tshopo	Mangobo	2.98e-03
50	Nord-Kivu	Nyiragongo	2.98e-03
51	Tshopo	Bafwasende	2.77e-03
52	Nord-Kivu	Kayna	2.74e-03
53	Kinshasa	Limete	2.67e-03
54	Sud-Kivu	Katana	2.50e-03
55	Sud-Kivu	Ibanda	2.42e-03
56	Kinshasa	Lingwala	2.24e-03
57	Nord-Kivu	Mabalako	2.22e-03
58	Kinshasa	Kokolo	2.14e-03
59	Tshopo	Wanierukula	2.08e-03
60	Nord-Kivu	Lubero	1.91e-03
61	Kinshasa	Nsele	1.84e-03
62	Kinshasa	Lemba	1.68e-03
63	Tshopo	Lubunga	1.65e-03
64	Kinshasa	Kintambo	1.61e-03
65	Kinshasa	Kasa Vubu	1.61e-03
66	Sud-Kivu	Kadutu	1.59e-03
67	Kinshasa	Kinshasa	1.39e-03
68	Nord-Kivu	Rutshuru	1.36e-03
69	Kinshasa	Kalamu 1	1.34e-03
70	Sud-Kivu	Minova	1.23e-03
71	Kinshasa	Binza Meteo	1.13e-03
72	Haut-Uele	Pawa	1.07e-03
73	Ituri	Adi	1.03e-03
74	Kinshasa	Bandalungwa	9.97e-04
75	Kinshasa	Matete	9.48e-04
76	Kinshasa	Masina 1	8.66e-04
77	Sud-Kivu	Bagira	8.18e-04
78	Nord-Kivu	Walikale	8.13e-04
79	Haut-Katanga	Lubumbashi	7.82e-04
80	Ituri	Laybo	7.14e-04
81	Kinshasa	Barumbu	7.01e-04
82	Kinshasa	Mont Ngafula 1	6.82e-04
83	Kinshasa	Mont Ngafula 2	6.74e-04
84	Kinshasa	Selembao	6.73e-04
85	Kinshasa	Kingabwa	5.93e-04
86	Tshopo	Bafwagbogbo	5.46e-04
87	Sud-Kivu	Kalehe	5.36e-04
88	Haut-Uele	Faradje	5.28e-04
89	Kinshasa	Masina 2	5.17e-04
90	Haut-Uele	Aba	5.13e-04

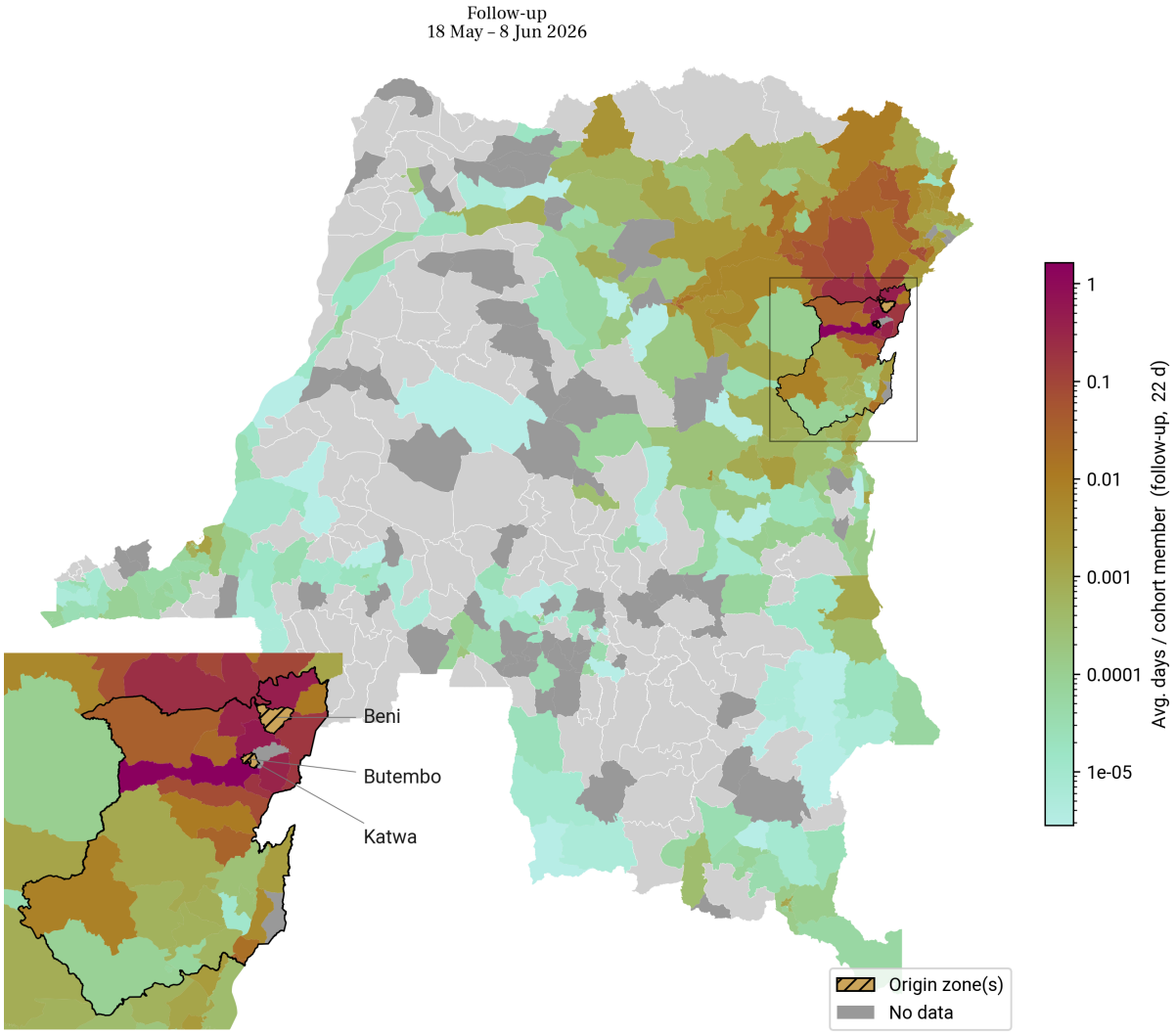

Figure 3. Subscriber-day presence during the follow-up period: Nord-Kivu cohort. *Average subscriber-days per cohort member in each health zone during 18 May 2026–8 June 2026, among subscribers present in Beni, Butembo, Katwa during 4 May 2026–17 May 2026 (colour log scale; darker shades indicate higher presence intensity). The metric captures overall intensity of presence: a zone visited briefly by many cohort members scores similarly to one where fewer members spent more time. Health zones with no recorded presence are light grey; zones excluded for data-quality reasons are dark grey. Hatching identifies origin health zones. Inset: northeast DRC. Table 2 lists the ranked values.*

2.2 Ituri Cohort (Continued)

The rankings are broadly consistent with our previous report (4 June 2026), despite changes in the analytical approach and study period. The broad geographic picture is unchanged: Ituri zones continue to dominate, and the three leading destinations (Lita, Nizi and Bambu) are identical. Among notable changes, Katwa rises from rank 16 to 10; Kalunguta drops from rank 25 to 36, leaving the top 30; and Makiso Kisangani rises markedly from rank 31 to 22. We recommend using these rankings instead of the earlier ones, as they use an improved methodology and a more recent reference period.

The largest flows remain concentrated in Ituri. The top nine recipient zones by average subscriber-days per cohort member are all within the province: **Lita, Nizi, Bambu, Tchomia, Kilo, Gety, Damas, Komanda** and **Drodro**. There are very large differences in intensity even within Ituri: Lita leads with 1.09 subscriber-days per cohort member, substantially higher than most other zones in the province. The first zone outside Ituri is Katwa (Nord-Kivu) at rank 10, followed by Butembo (rank 15), Beni (rank 17), Watsa (Haut-Uele, rank 18) and Makiso Kisangani (Tshopo, rank 22). Flows to Kinshasa and other western provinces are small but present. As of 25 Jun 2026, all ten of the top ten destination zones have at least one confirmed case[1,2,3]. Notably, Goma (Nord-Kivu, rank 40) and Miti Murhesa (Sud-Kivu, rank 122) have confirmed cases despite ranking well outside the top 30, a reminder of the randomness and multifactorial nature of Ebola spread, and that lower-ranked zones should not be overlooked.

2.3 Nord-Kivu Cohort

The top five recipient health zones of the Nord-Kivu cohort are all within Nord-Kivu: **Musienene** leads with 1.64 subscriber-days per cohort member, followed by **Kalunguta, Oicha, Kyondo** and **Mabalako**, all with at least one confirmed case as of 25 Jun 2026[1,2,3]. Across the full ranking, 14 of the top 30 destinations have confirmed cases (47%), declining to 8 of 30 (27%) for ranks 31–60. Outside the two provinces, the main destinations are Watsa (Haut-Uele, rank 15) and Makiso Kisangani (Tshopo, rank 17). Goma (Nord-Kivu) appears at rank 22.

All else being equal, exportation risk from an area is driven by both the number of people leaving the area and the number of infectious persons in the area. For the Ituri cohort, the studied areas clearly contribute a large risk of exportation, based on available data on the high number of cases in those health zones and the empirical evidence from recent spatial spread. When interpreting the flow data provided for the Nord-Kivu health zones, the situation is more complex.

Case counts in Nord-Kivu destinations remain low but likely underestimate the true burden, given detection and testing constraints in the northeast[1,2,3]. Recent spatial spread also seems to indicate exportation from areas beyond the main Ituri outbreak, possibly reflecting the importance of this group of health zones. Responders should evaluate the data provided here through their knowledge of the local context in Nord-Kivu.

Assuming the three health zones of Beni, Butembo and Katwa contribute to sizeable exportation, health zones without confirmed cases ranking highly in this list but not highly in the Ituri cohort list, notably **Mandima** in Ituri, with rank 6 here (rank 24 in the Ituri list), **Mutwanga** in Nord-Kivu,

Table 2 — Top 90 Recipient Health Zones (Nord-Kivu Cohort)

Average subscriber-days per cohort member in each health zone during the follow-up period (18 May 2026–8 June 2026), among subscribers present in Beni, Butembo, Katwa during 4 May 2026–17 May 2026. Each row is a health zone with at least one recorded cohort member during the follow-up period, ranked highest to lowest. Origin zones and health zones excluded for data-quality reasons are not shown (see Section 4). Values are the same as those mapped in Figure 3. **Red highlight covering the full row:** at least one confirmed case as of 25 Jun 2026[1,2,3]. Health zones in the same province have the same colour shading.

Rank	Province	Health Zone	Avg. days / cohort member (follow-up, 18 May-8 Jun 2026)
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2	Nord-Kivu	Kalunguta	5.23e-01
3	Nord-Kivu	Oicha	4.43e-01
4	Nord-Kivu	Kyondo	3.32e-01
5	Nord-Kivu	Mabalako	3.06e-01
6	Ituri	Mandima	2.19e-01
7	Nord-Kivu	Masereka	1.85e-01
8	Nord-Kivu	Mutwanga	1.65e-01
9	Ituri	Komanda	9.08e-02
10	Ituri	Mambasa	8.71e-02
11	Ituri	Bunia	8.42e-02
12	Nord-Kivu	Lubero	7.36e-02
13	Ituri	Rwampara	7.16e-02
14	Ituri	Nia Nia	6.21e-02
15	Haut-Uele	Watsa	4.71e-02
16	Ituri	Mongbwalu	3.86e-02
17	Tshopo	Makiso Kisangan	3.53e-02
18	Nord-Kivu	Manguredjipa	3.44e-02
19	Nord-Kivu	Kayna	3.00e-02
20	Nord-Kivu	Karisimbi	2.80e-02
21	Haut-Uele	Wamba	2.75e-02
22	Nord-Kivu	Goma	2.73e-02
23	Haut-Uele	Gombari	2.50e-02
24	Nord-Kivu	Biena	2.32e-02
25	Nord-Kivu	Nyiragongo	1.77e-02
26	Ituri	Lita	1.74e-02
27	Haut-Uele	Isiro	1.74e-02
28	Tshopo	Kabondo	1.65e-02
29	Ituri	Lolwa	1.32e-02
30	Nord-Kivu	Kamango	1.24e-02
31	Nord-Kivu	Alimbongo	1.06e-02
32	Sud-Kivu	Ibanda	1.03e-02
33	Ituri	Nyankunde	9.53e-03
34	Haut-Uele	Dungu	9.38e-03
35	Nord-Kivu	Walikale	7.99e-03
36	Sud-Kivu	Kadutu	7.89e-03
37	Haut-Uele	Makoro	7.65e-03
38	Tshopo	Bafwagbogbo	5.99e-03
39	Tshopo	Bafwasende	5.61e-03
40	Ituri	Aru	5.55e-03
41	Tshopo	Mangobo	5.21e-03
42	Ituri	Ariwara	5.16e-03
43	Maniema	Kindu	5.10e-03
44	Kinshasa	Gombe	4.94e-03
45	Nord-Kivu	Rutshuru	4.90e-03
46	Tshopo	Tshopo	4.86e-03
47	Haut-Uele	Pawa	4.07e-03
48	Ituri	Nizi	4.01e-03
49	Ituri	Biringi	3.44e-03
50	Kinshasa	Binza Ozone	3.39e-03
51	Tshopo	Wanierukula	3.32e-03
52	Ituri	Tchomia	3.25e-03
53	Ituri	Bambu	3.19e-03
54	Bas-Uele	Bondo	2.97e-03
55	Ituri	Aungba	2.86e-03
56	Ituri	Gety	2.64e-03
57	Ituri	Kilo	2.61e-03
58	Tshopo	Lubunga	2.34e-03
59	Kinshasa	Limete	2.30e-03
60	Kinshasa	Lingwala	2.27e-03
61	Tshopo	Banalia	2.25e-03
62	Sud-Kivu	Katana	2.21e-03
63	Kinshasa	Kinshasa	2.18e-03
64	Ituri	Rimba	2.06e-03
65	Sud-Kivu	Minova	2.01e-03
66	Kinshasa	Kokolo	1.93e-03
67	Sud-Kivu	Shabunda	1.87e-03
68	Ituri	Mahagi	1.87e-03
69	Nord-Kivu	Binza	1.87e-03
70	Ituri	Drodro	1.84e-03
71	Ituri	Logo	1.81e-03
72	Ituri	Fataki	1.75e-03
73	Ituri	Damas	1.71e-03
74	Sud-Kivu	Bagira	1.71e-03
75	Kinshasa	Kintambo	1.70e-03
76	Kinshasa	Nsele	1.58e-03
77	Kinshasa	Lemba	1.42e-03
78	Haut-Katanga	Lubumbashi	1.34e-03
79	Kinshasa	Barumbu	1.33e-03
80	Maniema	Lubutu	1.31e-03
81	Sud-Kivu	Kabare	1.31e-03
82	Sud-Kivu	Uvira	1.29e-03
83	Ituri	Kambala	1.28e-03
84	Bas-Uele	Buta	1.27e-03
85	Ituri	Boga	1.24e-03
86	Kinshasa	Kasa Vubu	1.24e-03
87	Haut-Katanga	Mumbunda	1.23e-03
88	Sud-Kivu	Kalehe	1.22e-03
89	Kinshasa	Kalamu 1	1.18e-03
90	Kinshasa	Binza Meteo	1.10e-03

2.3 Nord-Kivu Cohort (Continued)

with rank 8 here (rank 44 in the Ituri cohort list) and **Lubero** in Nord-Kivu with rank 12 here (rank 60 in the Ituri list) should be especially considered as priority surveillance areas.

A structurally important feature of the Nord-Kivu rankings is the prominence of Ituri zones: nine of the top 30 and ten of the 31–60 range are in Ituri, and every confirmed zone in the 31–60 band is in Ituri. This reflects intense mobility between these two areas; the rankings capture routine movement between two areas now both affected, with the Ituri outbreak starting earlier than the Nord-Kivu cluster.

2.4 Cross-Cohort Comparison

Comparing overall mobility patterns, the Nord-Kivu cohort shows stronger connections to important urban centres beyond the outbreak area. For example, the average Nord-Kivu cohort member contributes about six times as much exposure as the average Ituri cohort member to Goma (Goma health zone, NK rank 22), about five times to Bukavu (Kadutu health zone, NK rank 36), and nearly twice to Lubumbashi (Lubumbashi health zone, NK rank 78). This broader geographic connectivity becomes particularly important should the epidemic in the three Nord-Kivu health zones grow.

Ten health zones rank among the top 30 destinations of both cohorts: **Komanda** (Ituri rank 8, NK rank 9), **Mambasa** (rank 11, rank 10), **Mandima** (rank 24, rank 6), **Nia Nia** (rank 23, rank 14), **Watsa** (rank 18, rank 15), **Makiso Kisangani** (rank 22, rank 17), **Oicha** (rank 25, rank 3), **Musienene** (rank 27, rank 1), **Lita** (rank 1, rank 26) and **Lolwa** (rank 30, rank 29). These zones receive simultaneous exportation pressure from two geographically distinct outbreak clusters, a potential compound importation risk not visible in either table alone, in the event of sizeable case numbers in the three Nord-Kivu health zones.

For eight of these ten zones, the average Nord-Kivu cohort member contributes more subscriber-days than the average Ituri cohort member: Mandima receives 0.22 subscriber-days per Nord-Kivu cohort member versus 0.015 from the Ituri cohort; Oicha 0.44 versus 0.015. Komanda and Lita are the exceptions, both within Ituri province.

Cross-cluster connectivity is also bidirectional. Among the top 20 destinations of the Nord-Kivu cohort sit **Bunia** (rank 11), **Rwampara** (rank 13) and **Mongbwalu** (rank 16), all Ituri origin zones, indicating that Nord-Kivu subscribers are routinely travelling toward the Ituri epicentre. The two clusters are not independent outbreak foci generating separate exportation streams: they are connected by ongoing bidirectional mobility, and this connectivity may sustain transmission risk in both directions, assuming there is a sizeable number of cases in the Nord-Kivu cluster.

Partnership — Vodacom & Flowminder

Since 2018, Vodacom Congo (DRC) 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.

3. Methods

3.1 Input Data

The analysis uses three types of daily-level Call Detail Records (CDR) 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 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 is the health zone (*zone de santé*). Data on confirmed cases used to contextualise the mobility rankings derive from WHO DON608 and the INRB-UMIE epidemic dashboard[1,2,3].

3.2 Methods for Cohort and Analysis

Step 1 — Cohort Selection

Reference period: 4 May 2026 – 17 May 2026 · Minimum active days: 2

This analysis builds on the 4 June 2026 rapid report, which studied movements from an Ituri cohort using an April reference period. The present version advances the reference period to May, adds Nyankunde to the Ituri origin cluster, and introduces a second cohort covering the Nord-Kivu cluster.

Two cohorts are defined, each anchored in the health zones identified as the presumed geographic epicentre of active transmission during the reference period. The **Ituri cohort** comprises all subscribers active on at least 2 distinct days in any of the four origin health zones (Bunia, Mongbwalu, Nyankunde and Rwampara) during the reference period. The **Nord-Kivu cohort** is defined analogously for Beni, Butembo and Katwa. CDR files across all three event types were scanned for each origin zone; subscribers recorded there were tagged and pooled across zones and CDR types to form a single cohort per cluster, with deduplication applied across all origin zones.

Step 2 — CDR Extraction

Look-back: 12 Apr 2026 – 3 May 2026 · Follow-up: 18 May 2026 – 8 June 2026

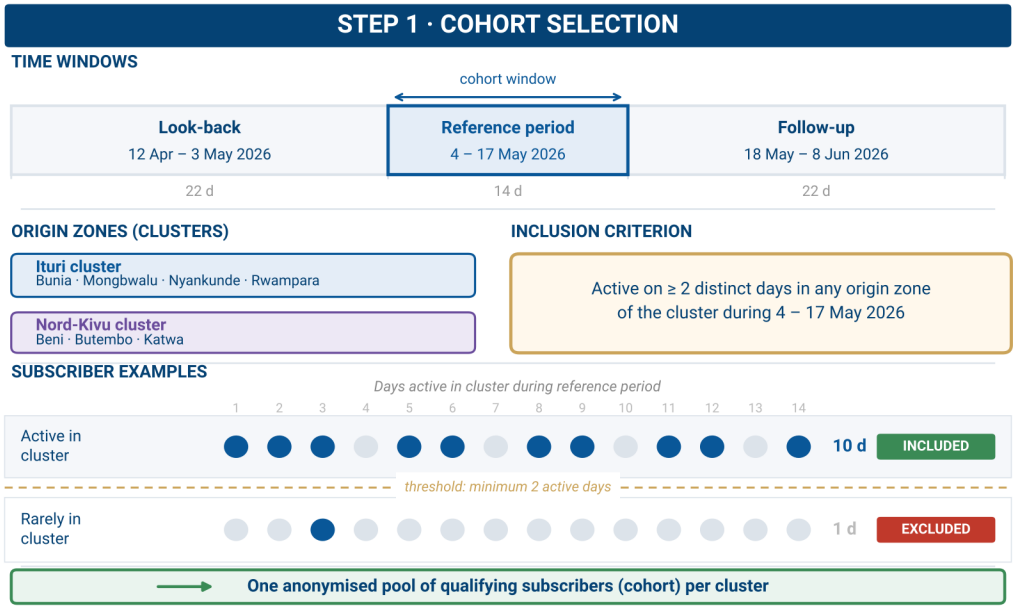
Two analysis windows are extracted for each cohort: a **look-back** window (12 Apr 2026–3 May 2026), showing where the cohort spent time before the reference period, and a **follow-up** window (18 May 2026–8 June 2026), showing presence afterwards. All CDR files within each window were scanned across all three event types; only records belonging to cohort members were retained, preserving the hashed subscriber identifier, cell tower identifier, and timestamp.

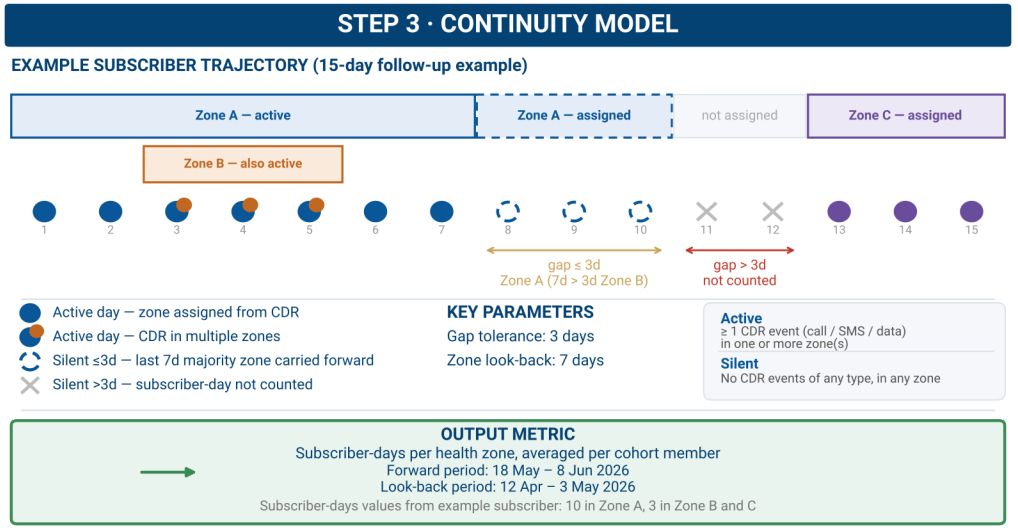
Step 3 — Continuity Model

Gap tolerance: 3 days · Location look-back: 7 days

While CDRs frequently capture multiple events per day for active subscribers, some users experience periods of reduced or absent activity (whether temporarily or persistently), leaving gaps in their location record. A continuity model is applied to estimate presence during these unobserved days. If a subscriber was last detected in health zone Z, they are credited as present in zone Z for each subsequent unobserved day, up to a maximum of 3 consecutive undetected days. Beyond this threshold, no further credit is assigned until the next detection.

More information on CDR analysis methods: www.flowgeek.org





4. Caveats

4.1 Limitations

Sixty-six out of five hundred and nineteen health zones are excluded from the study for data-quality reasons. No reliable data is available for these zones: they are entirely absent from all rankings, not merely low-ranking. Some of these lie in or near the origin health zones of the two cohorts. They should not be overlooked when using this data to guide surveillance prioritisation.

Ebola spreads across the geography through travel. However, contact patterns between infectious and susceptible individuals determine whether 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, these estimates are based only on Vodacom's subscribers. Vodacom is the market leader in Ituri and a leading operator in Nord-Kivu.

Areas outside the top-ranked health zones should also be considered at risk. The randomness and multifactorial nature of infectious disease spread means that lower-ranked zones cannot be discounted.

Due to resource and technical constraints, data after 8 June 2026 has not been fully quality assured; 8 June 2026 is therefore the end date of the analysis period covered by this report.

Beyond the aggregate analysis provided here, regular or daily data releases would enable finer tracking of how travel patterns evolve over the course of the epidemic. Should dedicated resources become available, we aim to provide such releases to directly inform evolving surveillance priorities.

4.2 Mobile Data and Infectious Disease Spread

The first validation study using mobile operator data to predict infectious disease spread was conducted for the cholera epidemic in Haiti[4]. The approach has since been validated for multiple pathogens, including dengue[5] and COVID-19[6].

4.3 Health Zones Excluded from the Study

Health zones excluded from all rankings due to insufficient data quality. These zones are data-absent, not zero-flow — no reliable data is available for them, and they receive no rank in either cohort's analysis. They should not be overlooked in surveillance planning.

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

5. Citations

[1] Institut National de Santé Publique (INSP-RDC). *Rapport de Situation de la 17ème Épidémie de la Maladie à Virus Ebola/RDC. SitRep N°042/MVB_25/06/2026.* 26 juin 2026. Available at: insp.cd/sitrep-n042-mvb_25-06-2026

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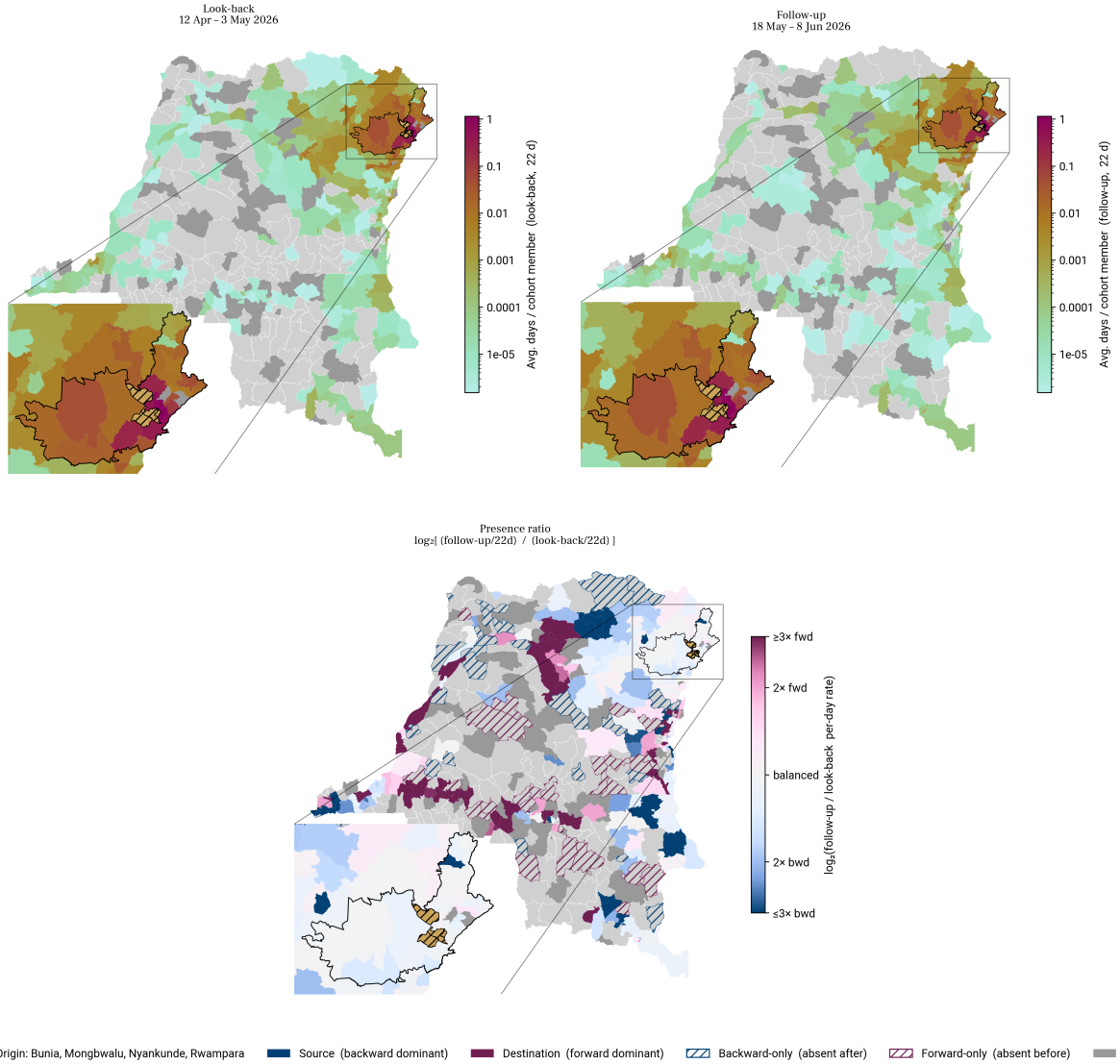
Annexes

The following two annexes provide three-panel summary maps for each study cohort: a look-back window (12 Apr 2026–3 May 2026), showing where the cohort spent time before the reference period; a follow-up window (18 May 2026–8 June 2026), showing presence afterwards; and the relative change between the two. Annex A covers the Ituri cohort (Bunia, Mongbwalu, Nyankunde and Rwampara); Annex B covers the Nord-Kivu cohort (Beni, Butembo and Katwa).

The top-left panel (look-back) shows the intensity of cohort member presence across health zones before the cohort selection period, providing a baseline that can be compared directly with the top-right panel (follow-up) to assess whether presence patterns shifted between the two windows. This is useful for understanding the geographic reach of the cohort both before and after the reference period.

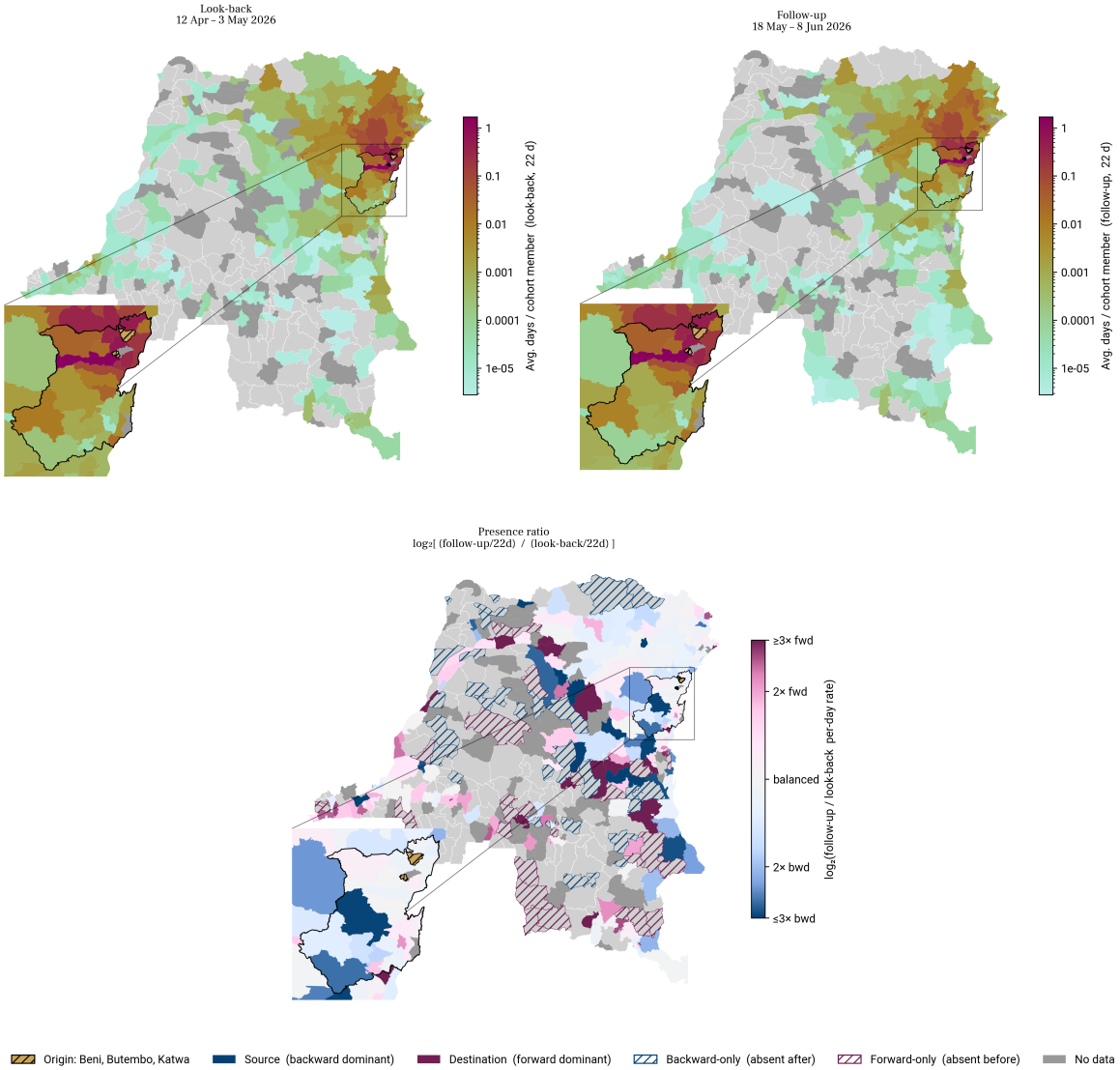
Under normal conditions, past and future presence intensity tend to be similar, since mobility is largely driven by stable factors: economic ties, family connections and established routes. The bottom panel (relative change, $\log_2$ ratio of follow-up to look-back presence) makes this comparison explicit: zones with markedly imbalanced ratios indicate a specific push or pull. Higher follow-up presence suggests the zone attracted more of the cohort during this period than usual, and vice versa. The causes of such imbalances can be many, including the current epidemic, although a direct causal link cannot be established from mobility data alone. Where the two panels are broadly similar, this indicates that the cohort's presence patterns were at least consistent across the two periods.

Annex A — Ituri Cohort: Three-Panel Summary Map



Annex A. Subscriber-day presence across DRC for the Ituri cohort: look-back, follow-up and relative-change panels. *Among subscribers present in Bunia, Mongbwalu, Nyankunde, Rwampara during 4 May 2026–17 May 2026.* ***(Top left)*** *Average subscriber-days per cohort member during the look-back period (12 Apr 2026–3 May 2026).* ***(Top right)*** *Average subscriber-days per cohort member during the follow-up period (18 May 2026–8 June 2026). Both panels use a log colour scale; health zones with no recorded presence are light grey, and zones excluded for data-quality reasons are dark grey. The metric captures overall intensity of presence: a zone visited briefly by many cohort members scores similarly to one where fewer members spent more time. Days between detections are estimated using a continuity model (see Section 3).* ***(Bottom)*** *Presence ratio: $\log_2$(follow-up rate / look-back rate), where rate is average subscriber-days per cohort member per day. Purple tones indicate zones with higher relative presence during follow-up; blue tones indicate zones more heavily present during look-back. Values are clipped at $\pm\log_2(3)$. Hatching: origin health zones (gold); zones present only during look-back (blue); zones present only during follow-up (red). Insets: northeast DRC.*

Annex B — Nord-Kivu Cohort: Three-Panel Summary Map



Annex B. Subscriber-day presence across DRC for the Nord-Kivu cohort: look-back, follow-up and relative-change panels. *Among subscribers present in Beni, Butembo, Katwa during 4 May 2026–17 May 2026.* ***(Top left)*** *Average subscriber-days per cohort member during the look-back period (12 Apr 2026–3 May 2026).* ***(Top right)*** *Average subscriber-days per cohort member during the follow-up period (18 May 2026–8 June 2026). Both panels use a log colour scale; health zones with no recorded presence are light grey, and zones excluded for data-quality reasons are dark grey. The metric captures overall intensity of presence: a zone visited briefly by many cohort members scores similarly to one where fewer members spent more time. Days between detections are estimated using a continuity model (see Section 3).* ***(Bottom)*** *Presence ratio: $\log_2$(follow-up rate / look-back rate), where rate is average subscriber-days per cohort member per day. Purple tones indicate zones with higher relative presence during follow-up; blue tones indicate zones more heavily present during look-back. Values are clipped at $\pm\log_2(3)$. Hatching: origin health zones (gold); zones present only during look-back (blue); zones present only during follow-up (red). Insets: northeast DRC.*

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Authors

This report was produced by the **Flowminder Foundation**, a non-profit organisation specialising in the analysis of mobile phone, geospatial and survey data for humanitarian and development purposes.

This report was written by Romain Goldenberg and Linus Bengtsson, with contributions from Daniel Power, Joachim Jellinek, Chris Brooks and Apphia Yuma.

Romain Goldenberg led and produced the analysis, created the charts and co-authored the report. Linus Bengtsson interpreted the charts and mobility statistics, and co-authored the report. Daniel Power co-authored the report. Joachim Jellinek and Chris Brooks produced the aggregates derived from pseudonymised call detail records. Apphia Yuma provided support and oversight for the analysis and the project.

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