

Detected case growth and outcome heterogeneity during the 2026 Bundibugyo virus disease outbreak in the Democratic Republic of the Congo and Uganda

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Abstract

Background

The 2026 Bundibugyo virus disease outbreak in the Democratic Republic of the Congo (DRC), with cross-border cases in Uganda, evolved amid mobility, insecurity, delayed detection, laboratory constraints, and pressure on case management. We assessed how source-traced official aggregate data could support real-time interpretation of detected case growth, outcome heterogeneity, and response bottlenecks.

Methods

We conducted a retrospective aggregate time-series and subnational ecological analysis of official situation reports and public health updates. The DRC analysis used national, provincial, and health-zone data from Situation Report 001 through Situation Report 028; Uganda was analysed separately as a companion series. Outcomes included epidemic trajectory, detected case-growth signals, crude observed case fatality ratios (CFR), and selected operational indicators. Growth estimates were interpreted as detected case-growth signals, not direct estimates of true transmission intensity.

Results

Between 14 May and 11 June 2026, DRC recorded 689 laboratory-confirmed cases and 139 confirmed deaths across 29 health zones, corresponding to a crude observed CFR of 20.2% (95% CI 17.2–23.4%). Ituri accounted for 646 confirmed cases (93.8%). Uganda separately recorded 19 confirmed cases and two confirmed deaths. Interpretable seven-day phases yielded similar doubling times of 10.5 days for 21–27 May and 10.3 days for 4–10 June. The shorter apparent doubling time during 28 May–3 June likely reflected geographic expansion, retrospective ascertainment, and data harmonisation rather than sustained transmission acceleration. Crude observed CFR was higher in North Kivu (60.0%, 95% CI 43.3–75.1%) than in Ituri (17.6%, 95% CI 14.8–20.8%). Contact follow-up improved but remained incomplete in complete reports. High and variable Ituri test positivity, reaching 48.6% at the study cut-off, was consistent with selective testing and possible under-detection.

Conclusions

Source-traced official aggregate outbreak data can provide actionable operational evidence when interpreted with explicit data-quality safeguards. The main signals were continued detected case growth, outcome heterogeneity, and response bottlenecks affecting contact follow-up, laboratory testing, and case management. These findings should be interpreted as surveillance and operational signals, not causal estimates or final epidemic parameters.

Background

Bundibugyo virus disease (BVD) is an Ebola disease caused by Bundibugyo virus, a virus within the species *Orthoebolavirus bundibugyoense* and genus *Orthoebolavirus* [1, 2]. The virus was first recognised during the 2007 outbreak in Bundibugyo District, Uganda, and was subsequently associated with a second outbreak in the Democratic Republic of the Congo (DRC) in 2012 [3–5]. Compared with the more frequently reported Ebola virus species historically responsible for large outbreaks in DRC and West Africa, BVD has been less commonly observed, leaving relatively limited species-specific evidence on clinical course, transmission dynamics, countermeasures, and operational control in large outbreaks [4–7].

The 2026 outbreak was officially declared by the Government of DRC on 15 May 2026 after laboratory confirmation of Bundibugyo virus in samples analysed by the Institut National de Recherche Biomédicale (INRB) [8]. The World Health Organization (WHO) reported that previous BVD outbreaks had case fatality ratios (CFRs) in the range of 30% to 50% and noted the absence of a licensed vaccine or specific therapeutic against Bundibugyo virus, while emphasising the importance of early supportive care and standard Ebola control measures [6]. Uganda confirmed imported BVD linked to DRC on the same date [9].

The outbreak developed in a setting where operational interpretation of surveillance data is particularly challenging. The initial affected areas in Ituri Province were characterised by mining-linked mobility, cross-border movement, insecurity, health-facility exposure risks, and community mistrust [10, 11]. A high-level ministerial meeting in Kampala highlighted the need for cross-border coordination among DRC, Uganda, South Sudan, the Africa Centres for Disease Control and Prevention (CDC), and WHO [12]. Public statements from response partners also documented disruptions to care and threats to health facilities during the early response, including an incident in Rwampara in which treatment tents were set on fire [13].

Several early analyses have already addressed possible under-ascertainment and outbreak size. For example, an Imperial College London analysis used exported cases and back-calculation from suspected deaths to estimate the possible magnitude of the outbreak in DRC during the early phase [14]. Such work is valuable, but it answers a different question from the one most relevant to daily field operations: what do official situation reports reveal about detected case growth, geographic expansion, observed outcome heterogeneity, and response bottlenecks as the outbreak unfolds? Official aggregate situation reports are imperfect but important. They are produced under operational pressure, often while surveillance intensity, laboratory capacity, contact follow-up, and case-management capacity are changing. Cumulative values may be revised after harmonisation, daily increments may include retroactive ascertainment, and denominators for operational indicators may be missing or incomplete. These limitations can be viewed not only as obstacles to analysis but also as part of the operational signal: they describe the information environment in which outbreak decisions are made. This study therefore takes a complementary operational epidemiology approach. It does not aim to estimate the

true final size of the outbreak, validate prior scenario projections, or infer individual-level risk. Instead, it uses source-traced official aggregate data to describe detected case growth, observed case fatality heterogeneity, and response-system bottlenecks in DRC, with Uganda included as a separate cross-border companion series. The purpose is to provide a scientifically cautious and operationally relevant analysis of what official outbreak data can and cannot support during an active BVD response.

Methods

Study design and reporting approach

We conducted a retrospective, aggregate, observational time-series and subnational ecological analysis of official outbreak situation reports and public health updates. Because the study used aggregate public data, all analyses were interpreted at the population, province, health-zone, or reporting-period level; no individual-level inference was made.

Setting

The primary setting was the 2026 BVD outbreak in DRC, affecting Ituri, North Kivu, and South Kivu provinces. Uganda was included as a cross-border companion setting because official Uganda Ministry of Health (MOH) updates documented imported and locally detected confirmed cases linked to the outbreak. Uganda values were not pooled with DRC values for transmission or case fatality calculations.

Data sources

The primary data sources were official situation reports (sitreps) from DRC Centre des Opérations d'Urgence de Santé Publique and Institut National de Santé Publique (COUSP/INSP), from sitrep 001 through sitrep 028 [15]. The analysis cut-off for the DRC was situation report 028, with a reporting date of 11 June 2026 and publication date of 12 June 2026. The Uganda companion series was updated through 10 June 2026, using the latest Uganda MOH updates. The initial declaration of the outbreak [8], official Uganda MOH communications [9], WHO updates [6], Africa CDC communications [11], and partner statements were used for triangulation and contextual interpretation. Where source documents contained page-level or table-level values, extracted data retained the original reported value, harmonised analytic value, source document, reporting date, publication date, and extraction note. The INRB-UMIE public repository was used only for triangulation and data-definition checks, not as a replacement for original source extraction [16].

Study population and units of analysis

The study population comprised all aggregate surveillance and response events reported in official documents during the study period: laboratory-confirmed cases, confirmed deaths, recoveries,

suspected cases, contacts under active follow-up, contacts seen, alerts, samples tested, isolated or hospitalised patients, affected health zones, and aggregate Uganda cross-border indicators. Units of analysis varied by component: national reporting-date series for epidemic trajectory and growth analysis; province-date panels for subnational case fatality and operational indicators; health-zone distributions for descriptive endpoint analysis; and country-level Uganda data for the companion cross-border series. Key epidemiological and operational indicators were defined using official situation-report terminology and pre-specified analytic rules. Definitions included confirmed cases, confirmed deaths, crude observed case fatality ratio (CFR), resolved-outcome CFR, affected health zone, contact follow-up coverage, isolation or hospitalisation burden, and detected case-growth signal. Full operational definitions and analytic handling rules are provided in Supplementary Table S1.

Data extraction and quality assurance

Data extraction followed a source-register and decision-log workflow. Cumulative indicators were checked for consistency, and negative increments were classified as harmonisation events when supported by source evidence. Percentages were recalculated from available numerators and denominators. Values with internal inconsistencies, incomplete reporting, header-table discrepancies, or secondary-source-only support were retained with analytic flags rather than silently corrected. All official situation reports were treated as official source records. Analytic exclusions and sensitivity analyses were based only on substantive data issues, including multi-day increments, estimated or calculated-only rows, harmonisation events, denominator ambiguity, missing values, or unresolved source contradictions. The SitRep 028 endpoint was retained as the final source-supported cut-off; however, its 28.4% national contact follow-up value was flagged because follow-up data were missing for Rwampara and Bunia, two major high-contact health zones.

Statistical analysis

Outbreak trajectory

We described daily new confirmed cases, cumulative confirmed cases, cumulative confirmed deaths, recoveries, unresolved confirmed outcomes, isolation or hospitalisation burden, and the number of affected health zones over time. Daily new confirmed cases were taken directly from source reports where explicitly reported or calculated from consecutive source-verified cumulative totals where appropriate. When source-reported new cases differed from net cumulative change because of harmonisation, both values were retained and the difference was documented.

Detected case-growth signal

Detected case growth was characterised using exponential growth rates fitted to log-transformed cumulative confirmed cases. Doubling time was calculated as $\ln(2)$ divided by the estimated daily

growth rate. Estimates were interpreted as detected case-growth signals, not direct estimates of true transmission intensity. Estimated or interpolated rows were excluded from primary growth analysis. Multi-day increments were retained for cumulative trajectory description but excluded from daily-incidence windows requiring true 24-hour incidence. For visual analysis, growth was summarised across fixed 7-day epidemiological phases anchored to the first laboratory confirmation date: 14–20 May, 21–27 May, 28 May–3 June, 4–10 June, and 11–17 June 2026. A phase-specific growth line was fitted only when at least five usable source-supported observations were available. Sitrep 028 initiated the fifth phase; a phase-specific line was not fitted unless sufficient observations accrued. Approximate reproduction-number conversions, if reported, were treated as supplementary detected-transmission indices only, because reproduction-number estimation from reporting-date aggregate data is sensitive to reporting delay, ascertainment, serial interval assumptions, and surveillance changes [17–19].

Observed case fatality heterogeneity

Crude observed CFRs were calculated for the DRC overall and for provinces using confirmed deaths divided by confirmed cases, with exact binomial confidence intervals. Health-zone ratios were calculated only when source-verified case and death counts were available and denominators were adequate. Percentages were suppressed where confirmed cases were fewer than five, and values based on small denominators were interpreted cautiously. Differences between provinces were interpreted as possible surveillance sensitivity, care access, reporting delay, unresolved-outcome, or small-denominator signals; biological differences in virulence were not inferred from aggregate data.

Operational response indicators

Operational indicators were analysed descriptively. Contact follow-up coverage was used only when numerator and denominator were clear; values with incomplete follow-up reporting were flagged and excluded from primary lagged association analyses unless used in an explicitly labelled sensitivity analysis. Isolation or hospitalisation burden was described using total patients in facilities and confirmed/suspected disaggregation where source-reported. Laboratory throughput was described using samples tested, positives, positivity, and pending samples where available; high positivity was interpreted as a potential testing-selectivity or under-detection signal rather than a direct transmission measure.

Contact follow-up and subsequent detected cases

We pre-specified 5- and 7-day lags between contact follow-up coverage and subsequent new confirmed cases. Regression analysis was considered feasible only if at least 15 usable lagged pairs were available. Because this threshold was not met at either the 5-day or 7-day lag, the analysis was limited to descriptive overlays and Spearman rank correlations.

Ethics

This study used publicly available aggregate outbreak data and official response communications. No individual-level, identifiable, or patient-level data were used. The analysis did not involve direct contact with human participants, human tissue, or private medical records. Reporting followed STROBE guidelines [20] and the completed checklist is provided as S1 Checklist.

Results

Outbreak Trajectory and Cross-Border Evolution

1.1 Overview of the Study Period

Between 14 May 2026, when INRB reported the first eight laboratory-confirmed Bundibugyo ebolavirus cases in the DRC, and the study cut-off of 11 June 2026, a total of 689 laboratory-confirmed cases and 139 confirmed deaths were recorded across three provinces of eastern DRC, yielding a crude observed CFR of 20.2% (95% confidence interval (CI) 17.2–23.4%). Thirty-two confirmed patients had recovered by the cut-off date, leaving 518 confirmed cases (75.2%) with unresolved outcomes at the time of analysis. Endpoint indicators for DRC and the Uganda companion series are summarised in Table 1.

1.2 Temporal Evolution of Confirmed Cases and Deaths

Daily new confirmed cases fluctuated substantially across the study period. The highest interpretable 24-hour increment outside harmonisation-sensitive expansion events was 71 new confirmed cases on 4 June 2026. An earlier value of 84 new confirmed cases on 28 May coincided with a major geographic expansion event and was treated as harmonisation-sensitive. On 11 June, 17 new confirmed cases were reported, all from Ituri Province: Bunia (six), Rwampara (five), Mongbwalu (four), and Nizi (two). The daily and cumulative national trajectory is shown in Fig. 1. The crude observed CFR increased from 9.9% (95% CI 4.9–17.5%) on 23 May, when 101 confirmed cases and 10 confirmed deaths had been recorded, to 20.2% (95% CI 17.2–23.4%) at the study cut-off. Because many confirmed cases remained unresolved, these values should be interpreted as crude observed, time-point-specific proportions rather than final case fatality risk. The resolved-outcome CFR was 81.3% (139 deaths among 171 cases with known outcomes, including 32 recoveries; 95% CI 74.6–86.8%) at the study cut-off. This measure includes only confirmed cases that had either died or recovered by 11 June 2026 and excludes the 518 confirmed cases whose final outcomes were still unresolved. It is therefore presented only as a sensitivity indicator and should not be interpreted as the final case fatality risk.

1.3 Geographic Expansion

At surveillance activation on 13 May 2026, three health zones in Ituri Province were affected: Mongbwalu, Rwampara, and Bunia. The number of affected health zones increased gradually from three to thirteen between 13 and 27 May, then expanded more rapidly from fourteen to twenty-two during 28–29 May. By the study cut-off on 11 June 2026, 29 health zones across three provinces were affected: 19 of 36 in Ituri, 9 of 34 in North Kivu, and 1 of 34 in South Kivu. Ituri remained the epidemic epicentre

throughout, accounting for 646 of 689 confirmed cases (93.8%) at the study cut-off. The endpoint geographic distribution is summarised in Table 1.

1.4 Uganda Companion Cross-Border Series

The Uganda series increased from one confirmed imported case identified on 15 May 2026 to nine confirmed cases by 29 May and 19 confirmed cases by 7 June. At the latest database update on 10 June, Uganda had recorded 19 confirmed cases, two confirmed deaths, five recoveries, and 409 active contacts under follow-up (Table 1). Five of the 19 confirmed Uganda cases were healthcare workers (26.3%). Contact follow-up coverage was 91.0% at the 7 June update.

Table 1
Outbreak indicators at study cut-off (11 June 2026)

Province / Series	Confirmed cases	Confirmed deaths	Crude observed CFR % (95% CI)	Recoveries	Unresolved cases	Affected HZ
ITURI	646	114	17.6 (14.8–20.8)	—	—	19/36
NORTH KIVU	40	24	60.0 (43.3–75.1)	—	—	9/34
SOUTH KIVU	3	1	Suppressed ‡	—	—	1/34
DRC TOTAL	689	139	20.2 (17.2–23.4)	32	518 (75.2%)	29/104
UGANDA (confirmed only)	19	2	10.5 (1.3–33.1)	5	12	N/A
Note: 95% CIs calculated using the Clopper–Pearson exact method. CI = confidence interval; CFR = case fatality ratio; HZ = health zones. ‡ CFR percentage suppressed: confirmed cases below the pre-specified threshold of five for stable percentage reporting. Uganda values use confirmed-only denominators.						

2. Detected Case-Growth Signal

2.1 Analytic Approach and Phase Definitions

The time series included an official 17 May count of 13 confirmed cases, while no report was produced for 16 May. The 18 May cumulative total was retained for trajectory and growth analyses, but the corresponding increase was not interpreted as a single-day incidence value because it reflected accumulation over a multi-day reporting gap. The 22 May record was retained as an official source-supported observation.

2.2 Phase-Specific Growth Rates

Growth lines were fitted for Phases 2, 3, and 4, each of which had at least seven usable observations. Phase 1 had six observations but was not interpreted as an epidemiological signal because early identical cumulative totals and a multi-day reporting gap dominated the slope. It is shown as data points in Fig. 2, while its growth estimate is retained only for completeness. Phase 5 had one observation only, so no growth line was fitted. Phase-specific estimates are summarised in Table 2.

Among the interpretable phases, Phase 2 yielded a detected daily growth rate of 0.066 per day, corresponding to a doubling time of 10.5 days ($R^2 = 0.961$). Phase 3 yielded a higher apparent growth rate of 0.094 per day, corresponding to a doubling time of 7.4 days ($R^2 = 0.935$). Phase 4 yielded a growth rate of 0.067 per day and a doubling time of 10.3 days ($R^2 = 0.998$), closely approximating the Phase 2 estimate. Across the full study period, the detected growth rate was 0.150 per day, corresponding to a doubling time of 4.6 days ($R^2 = 0.906$). A sensitivity analysis excluding harmonisation-sensitive or retroactive records and the multi-day increment yielded a similar estimate of 0.154 per day, corresponding to a doubling time of 4.5 days ($R^2 = 0.911$). Approximate effective reproduction number values were calculated as supplementary detected-transmission indices only. For Phases 2 and 4, these values were approximately 2.3 to 2.4 depending on the approximation used.

Table 2
Detected case-growth rates and doubling times (exponential growth modelling)

Analysis specification	Date interval	Usable observations (n)	Growth rate r (per day)	Doubling time (days)	R ²	Notes
Phase 1: early outbreak	14–20 May 2026	6	0.387	1.8	0.930	Not interpreted as an epidemiological signal because the slope is dominated by early identical cumulative totals and a multi-day reporting gap; estimate shown for completeness only.
Phase 2: established transmission	21–27 May 2026	7	0.066	10.5	0.961	7 source-supported observations; 11–13 health zones affected; national contact follow-up approximately 20–21% where reported.
Phase 3: geographic expansion	28 May–3 Jun 2026	7	0.094	7.4	0.935	Includes geographic expansion, retrospective ascertainment, and harmonisation-sensitive records; elevated growth rate likely reflects step-changes in detected case reporting rather than sustained transmission acceleration.
Phase 4: sustained transmission	4–10 Jun 2026	7	0.067	10.3	0.998	Wider and more stable reporting period with 25–29 affected health zones; estimate closely matches Phase 2 outside expansion-dominated periods.
Note: r = daily exponential growth rate from ordinary least-squares regression of log-transformed cumulative confirmed cases on calendar day (day 0 = 14 May 2026). Doubling time = $\ln(2)/r$. R ² = coefficient of determination.						

Analysis specification	Date interval	Usable observations (n)	Growth rate r (per day)	Doubling time (days)	R ²	Notes
Phase 5: 11 Jun onward	11–17 Jun 2026	1	—	—	—	One observation at the study cut-off only; shown in Fig. 2 but not fitted because at least five observations were required.
Overall full study period	14 May–11 Jun 2026	28	0.150	4.6	0.906	Overall detected growth across the full study period; includes all official source-supported cumulative records except the zero-confirmed baseline.
Sensitivity clean records only	14 May–11 Jun 2026	23	0.154	4.5	0.911	Excludes multi-day, retroactive, and harmonisation-sensitive records; similar estimate supports robustness of the overall detected growth signal.
Note: r = daily exponential growth rate from ordinary least-squares regression of log-transformed cumulative confirmed cases on calendar day (day 0 = 14 May 2026). Doubling time = $\ln(2)/r$. R ² = coefficient of determination.						

3. Observed Case Fatality Ratio Heterogeneity

3.1 National case fatality ratio trend

The national DRC crude observed CFR increased from 9.9% (95% CI 4.9–17.5%) on 23 May 2026 to 20.2% (95% CI 17.2–23.4%) at the study cut-off, corresponding to 139 deaths among 689 confirmed cases. Because 75.2% of confirmed cases still had unresolved outcomes at the cut-off, these values should be interpreted as crude observed, time-point-specific proportions rather than final case fatality risk. National and provincial trends are shown in Fig. 3.

3.2 Provincial case fatality ratio heterogeneity

Crude observed CFR differed markedly between Ituri and North Kivu. At the study cut-off, Ituri reported 17.6% (114/646; 95% CI 14.8–20.8%), while North Kivu reported 60.0% (24/40; 95% CI 43.3–75.1%), a difference of 42.4 percentage points. This divergence was already apparent by 30 May and persisted through the remainder of the study period. Endpoint provincial values are summarised in Table 3. South Kivu reported three confirmed cases and one confirmed death. Its crude observed CFR percentage is

suppressed in primary outputs because the confirmed case count is below the pre-specified threshold of five for stable percentage reporting.

3.3 Health-Zone Case Fatality Ratio Heterogeneity within Ituri

Within Ituri, crude observed CFR varied substantially across the highest-burden health zones. At the study cut-off, Bunia reported 8.9% (17/191; 95% CI 5.3–13.9%), Rwampara 18.3% (26/142; 95% CI 12.3–25.7%), Mongbwalu 38.2% (52/136; 95% CI 30.0–47.0%), and Nyankunde 3.0% (1/33; 95% CI 0.1–15.8%). The lower observed values in Bunia and Nyankunde, which hosted treatment capacity, are consistent with differential access to care and earlier clinical management. Mongbwalu’s higher observed value may reflect delayed detection, community mortality, insecurity, and population mobility associated with artisanal mining. Selected health-zone estimates are presented in Table 3. Ninety-four confirmed Ituri cases (14.5%) remained unallocated to specific health zones at the database cut-off. These cases were included in provincial and national totals but excluded from health-zone-specific interpretation.

Table 3

Provincial and selected health-zone crude observed case fatality ratios at study cut-off (11 June 2026)

Province / Health zone	Confirmed cases	Confirmed deaths	Crude observed CFR % (95% CI)	Notes
ITURI	646	114	17.6 (14.8–20.8)	Primary epidemic epicentre; includes 94 cases not yet allocated to specific health zones.
Bunia	191	17	8.9 (5.3–13.9)	Highest health-zone case burden; observed CFR may reflect earlier detection and access to treatment capacity.
Rwampara	142	26	18.3 (12.3–25.7)	Early affected health zone with prolonged outbreak exposure and substantial contact burden.
Mongbwalu	136	52	38.2 (30.0–47.0)	High-burden mining area; elevated observed CFR may reflect delayed detection, mobility, insecurity, and access constraints.
Nyankunde	33	1	3.0 (0.1–15.8)	Moderate case burden with low observed CFR; estimate remains sensitive to small death counts.
Nizi	9	1	11.1 (0.3–48.2)	Small denominator; wide confidence interval.
Bambu	7	2	28.6 (3.7–71.0)	Small denominator; wide confidence interval.
Lita	6	0	0.0 (0.0–45.9)	Small denominator.
Unallocated (Autres zones de santé)	94	10	10.6 (5.2–18.7)	Cases pending health-zone attribution; included in Ituri and DRC totals but excluded from health-zone-specific interpretation.
Other Ituri health zones (12 zones)	28	5	Suppressed	Aggregated low-count health zones; individual CFR percentages suppressed where confirmed cases were fewer than five.
NORTH KIVU	40	24	60.0 (43.3–75.1)	Smaller case denominator with high observed CFR; interpretation limited by delayed
Note: 95% CIs calculated using the Clopper–Pearson exact method. CFR = crude observed case fatality ratio; CI = confidence interval. Percentages were suppressed where denominators were below the stability threshold or where low-count health zones were aggregated.				

Province / Health zone	Confirmed cases	Confirmed deaths	Crude observed CFR % (95% CI)	Notes
				detection, access constraints, and data harmonisation.
Katwa	16	9	56.3 (29.9–80.2)	Highest case burden in North Kivu; estimate remains imprecise because of small denominator.
Beni	9	5	55.6 (21.2–86.3)	Small denominator; wide confidence interval.
Butembo	7	5	71.4 (29.0–96.3)	High observed CFR with small denominator; interpretation limited by access and reporting constraints.
Other North Kivu health zones (6 zones)	8	5	Suppressed	Aggregated low-count health zones; individual CFR percentages suppressed where confirmed cases were fewer than five.
SOUTH KIVU	3	1	Suppressed	Three confirmed cases only; CFR percentage suppressed because the denominator was below the stability threshold.
DRC TOTAL	689	139	20.2 (17.2–23.4)	National crude observed CFR; not a final case fatality risk because most confirmed outcomes remained unresolved.
Note: 95% CIs calculated using the Clopper–Pearson exact method. CFR = crude observed case fatality ratio; CI = confidence interval. Percentages were suppressed where denominators were below the stability threshold or where low-count health zones were aggregated.				

4. Operational Response Indicators

4.1 Contact Follow-Up Coverage

Reported contact follow-up coverage was available for 15 time points, although one value was Ituri-specific and the endpoint value had incomplete follow-up reporting. Coverage was low early in the response, at 20–21% during 21–23 May, when 1,603–1,817 contacts were under follow-up. Early health-zone data showed marked heterogeneity, including zero contacts seen in Rwampara despite 621 contacts under follow-up. Coverage improved from 30 May onward, averaging 55.2% across reported values through 10 June and reaching 71.8% on 10 June. All complete reported values remained below the 80% performance benchmark. The 11 June national value of 28.4% (1,715/6,043) was excluded from primary interpretation because follow-up data were missing for Rwampara and Bunia, which together accounted for 2,659 of 4,782 active contacts in Ituri. This made the numerator incomplete and the

resulting coverage estimate difficult to compare with earlier complete values. Because Rwampara and Bunia follow-up data were missing, the 11 June provincial coverage values should be interpreted cautiously; among reporting areas, coverage was 17.4% in Ituri, 67.5% in North Kivu, and 82.6% in South Kivu.

4.2 Isolation and Hospitalisation Burden

The recorded isolation and hospitalisation burden increased from 104 patients on 31 May to 309 on 7 June and reached 315 on 11 June, the highest value in the study period. From 9 to 11 June, total isolation or hospitalisation ranged between 260 and 315 patients. At the study cut-off, 315 patients were in isolation or hospitalisation across response facilities, including 138 confirmed cases and 177 suspected cases. This corresponded to a bed occupancy rate of 69.7% based on 452 planned beds. Among confirmed patients in isolation or hospitalisation, 131 were in Ituri, six in North Kivu, and one in South Kivu.

4.3 Laboratory Throughput and Test Positivity

Source-verified laboratory throughput data were available for four Ituri time points. Test positivity was 32.6% on 4 June, 68.5% on 9 June, 26.6% on 10 June, and 48.6% on 11 June. Three of the four values exceeded 30%, supporting a potential testing-selectivity or under-detection signal. The sharp day-to-day variation suggests that positivity was influenced by changing sample-selection patterns rather than a sustained parallel change in transmission. During periods of high positivity and selective testing, confirmed case counts may under-ascertain infections; detected case-growth estimates should therefore be interpreted cautiously. At the study cut-off, 172 samples from North Kivu had been pending analysis for more than five days, indicating an important diagnostic bottleneck that may have contributed to delayed confirmation and the elevated observed case fatality ratio in that province.

5. Contact Follow-Up Coverage and Subsequent Detected Transmission

Formal regression modelling was not conducted because the number of usable lagged pairs was below the pre-specified feasibility threshold. Only 10 pairs were available at the five-day lag and 8 at the seven-day lag. The 11 June contact follow-up value was excluded because follow-up reporting was incomplete for major health zones. Descriptive lagged analyses showed no consistent inverse association between contact follow-up coverage and subsequent detected confirmed cases. Spearman correlations were weak and non-significant at both the five-day lag ($r_s = 0.091$; $p = 0.803$) and seven-day lag ($r_s = -0.214$; $p = 0.610$).

Discussion

Principal interpretation

This study provides a source-traced operational epidemiology analysis of the 2026 BVD outbreak in the DRC, with Uganda analysed separately as a companion cross-border series. Its central contribution is not a new forecast or a causal estimate of intervention effects, but a structured interpretation of official aggregate data generated during an active response. By analysing detected case growth, observed outcome heterogeneity, and selected response-system indicators within the same framework, the study shows how real-time situation reports can be used cautiously to describe the operational evolution of a rapidly changing outbreak.

The DRC trajectory showed continued detected case growth, but this should not be interpreted as a direct measure of true transmission intensity, because growth estimates derived from reporting-date aggregate data are sensitive to reporting delays, ascertainment changes, right truncation, and observation processes [17–19]. In the early phase of a viral haemorrhagic fever outbreak, confirmed case counts reflect overlapping processes, including ongoing transmission, delayed recognition of existing chains, expanded testing, geographic spread of detection, retrospective ascertainment, and data harmonization [17–19]. This is particularly important for BVD, where species-specific evidence remains limited and diagnostic or surveillance algorithms may be challenged when non-Zaire ebolaviruses are involved [3, 4, 6]. The phase-specific growth analysis supports this cautious interpretation. The most interpretable growth phases yielded similar doubling times during 21 to 27 May and 4 to 10 June, at 10.5 and 10.3 days, respectively. The shorter apparent doubling time during 28 May to 3 June coincided with geographic expansion, retrospective ascertainment, and harmonisation-sensitive records. The elevated growth estimate in this phase therefore likely reflects step-changes in detected case reporting rather than sustained transmission acceleration. In contrast, the sensitivity analysis produced a similar overall growth estimate after excluding multi-day, retroactive, and harmonisation-sensitive records, indicating that the full-period detected case-growth signal was not materially driven by flagged reporting events.

A second major finding is the marked heterogeneity in crude observed CFR. The national ratio should be interpreted as a time-point-specific measure because most confirmed cases still had unresolved outcomes at the study cut-off, and the resolved-outcome ratio is also not a final fatality estimate. During active outbreaks, crude fatality measures based on reporting-date aggregate data may be affected by delayed outcome ascertainment, preferential detection of severe cases, reporting delays, incomplete follow-up, and changing surveillance sensitivity [18, 19]. Higher observed ratios in North Kivu and Mongbwalu are therefore best interpreted as operational and surveillance signals, reflecting delayed detection, access constraints, differential ascertainment of severe cases, insecurity, mobility, small denominators, and unresolved outcomes [4, 5]. They should not be interpreted as evidence of biological differences in virulence between provinces or health zones.

Operational indicators showed that the epidemic trajectory was also shaped by response-system constraints. Contact follow-up improved but remained below the pre-specified 80% operational threshold in all complete reports, and the 11 June value was excluded from primary interpretation because major health-zone follow-up data were missing. Rising isolation and hospitalisation burden indicated sustained pressure on case management, while high and variable test positivity and delayed samples suggested

testing selectivity and diagnostic bottlenecks. Together, these indicators show that confirmed case trends reflected not only transmission, but also detection capacity, reporting completeness, diagnostic throughput, and access to care. The contact follow-up analysis did not show a consistent inverse association with subsequent detected confirmed cases at five- or seven-day lags. This should not be interpreted as evidence that contact tracing was ineffective. The analysis was constrained by sparse lagged observations, incomplete follow-up reporting from major health zones, geographic expansion, surveillance scale-up, harmonisation-sensitive reporting, and other reporting artefacts. These conditions make the aggregate situation-report data unsuitable for estimating the direction or magnitude of any contact-tracing effect from this analysis [18, 19].

Comparison with previous work

Previous work on the 2026 outbreak has focused on estimating under-ascertainment and possible epidemic size using exported cases, population movement, and death back-calculation [14]. The present study is complementary. It focuses on what official situation reports can reveal over time about detected case growth, observed outcome heterogeneity, and response-system constraints. This distinction matters because real-time outbreak decisions are often made from imperfect aggregate surveillance data before complete line lists, delay-adjusted outcomes, or final curated datasets are available. The approach also draws on broader lessons from epidemic estimation. Methods for estimating time-varying reproduction numbers are useful, but they are highly sensitive to reporting delays, right truncation, serial interval assumptions, and changes in ascertainment [17, 18]. Similarly, modelling work on Ebola has shown that fitting models to cumulative data without careful attention to observation processes can generate misleading confidence in transmission estimates [19]. For these reasons, this study prioritised growth rates and doubling times as detected case-growth signals and treated reproduction-number conversions only as supplementary indicators. This framing is especially important in an active outbreak where cumulative case counts may change because of retrospective harmonisation, new geographic detection, or delayed laboratory confirmation.

Operational implications

The main operational implication is that situation-report data should be interpreted through both epidemiological and response-system lenses. Geographic expansion, high observed CFR in specific provinces or health zones, incomplete contact follow-up reporting, increasing isolation burden, high test positivity, and laboratory backlogs are not isolated indicators. Taken together, they identify where the response system may be under pressure and where apparent epidemiological trends may be distorted by surveillance or access constraints.

Three practical messages follow from the analysis. First, trajectory assessment should distinguish source-reported incident values from net cumulative changes when harmonisation has occurred. Second, crude observed CFR should be accompanied by unresolved-outcome and denominator notes, especially during active outbreaks when outcomes remain incomplete and severe cases may be preferentially detected. Third, operational indicators should be interpreted only when reporting is source-

verified and geographically complete, because missing follow-up data or delayed laboratory results can distort performance measures. The findings also highlight the importance of complete subnational reporting. Health-zone-level contact follow-up, laboratory backlog, isolation status, and outcome resolution are essential for interpreting detected case growth and observed fatality patterns. When these indicators are incomplete, interpretation should remain descriptive and operational rather than inferential.

From a global health security perspective, these findings underscore that surveillance performance is not limited to case detection. It also depends on auditable data lineage, denominator completeness, rapid laboratory turnaround, cross-border data interoperability, and feedback loops between contact follow-up, laboratory confirmation, and case-management capacity. In mobile and conflict-affected settings, incomplete subnational data should trigger corrective operational action rather than silently entering dashboards, models, or policy briefings as complete evidence.

Strengths

This study has several strengths. It is based on official source documents, retains extraction and harmonisation notes, and separates DRC and Uganda denominators. It also avoids causal interpretation from ecological aggregate data, treating confirmed case growth as a detected surveillance signal rather than a direct measure of true transmission. A further strength is the integration of epidemiological and operational indicators. By considering case growth alongside case fatality, contact follow-up, isolation burden, laboratory positivity, and diagnostic backlog, the analysis reflects the realities of decision-making during an active outbreak and reduces the risk of overinterpreting confirmed case counts in isolation.

Limitations

This study has important limitations. It used aggregate reporting-date data rather than individual line-list data with dates of symptom onset, exposure, admission, isolation, recovery, death, and contact status. As a result, the analysis cannot estimate true transmission dynamics, delay-adjusted case fatality, individual risk factors, or intervention effectiveness. The analysis also depended on situation reports produced during an active response. These reports may include harmonisation changes, retrospective updates, reporting-date artefacts, incomplete follow-up reporting, and inconsistent laboratory denominators. In addition, most confirmed cases still had unresolved outcomes at the cut-off, limiting interpretation of both crude observed and resolved-outcome fatality measures. The contact follow-up analysis was particularly limited by the small number of usable lagged pairs and by confounding from calendar time, geographic expansion, surveillance scale-up, and reporting artefacts. It should therefore be interpreted only as a descriptive assessment, not as evidence for or against contact-tracing effectiveness. These limitations define the scope of inference. The study should be read as a source-traced operational interpretation of an active outbreak, not as an estimate of true transmission, final fatality risk, or causal response impact.

Conclusions

This study presents an operational epidemiology analysis of the 2026 BVD outbreak using official aggregate data from the DRC and Uganda. The findings show continued detected case growth, marked geographic and outcome heterogeneity, and important response-system constraints affecting contact follow-up, case management, and laboratory interpretation. These findings should be interpreted as source-traced surveillance and operational signals, not as causal estimates or final epidemic parameters. Transparent treatment of data harmonisation, incomplete follow-up reporting, unresolved outcomes, and subnational heterogeneity is essential for producing credible evidence during fast-moving outbreaks.

Abbreviations

BVD

Bundibugyo virus disease

CDC

Centers for Disease Control and Prevention

CFR

case fatality ratio

CI

confidence interval

COUSP

Centre des Opérations d'Urgence de Santé Publique

DRC

Democratic Republic of the Congo

HZ

health zone

INRB

Institut National de Recherche Biomédicale

INSP

Institut National de Santé Publique

MOH

Ministry of Health

STROBE

Strengthening the Reporting of Observational Studies in Epidemiology

WHO

World Health Organization.

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate were not required because this study used publicly available aggregate outbreak data and official public health communications. No individual-level, identifiable, or patient-level data were used.

Consent for publication

Not applicable. The manuscript does not contain individual person's data in any form.

Data availability

All data used in this study were extracted from publicly available outbreak situation reports, official public health statements, and public documents including INSP [15], Uganda Ministry of Health [9], WHO [6] and other supporting documents [8,10–13]. The curated analytic database used to generate the manuscript tables, figures, and endpoint estimates is provided as Supplementary File S1.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

TEA conceptualised the study, designed the analysis framework, led data extraction, analysis and interpretation, and manuscript drafting. ECB contributed to critical review and manuscript revision. All authors read and approved the final manuscript.

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Use of artificial intelligence tools

During manuscript preparation and revision, artificial intelligence tools were used for language refinement, formatting checks, and consistency review. The authors reviewed, verified, and take full responsibility for all manuscript content, analyses, interpretations, and submission materials.

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Figures

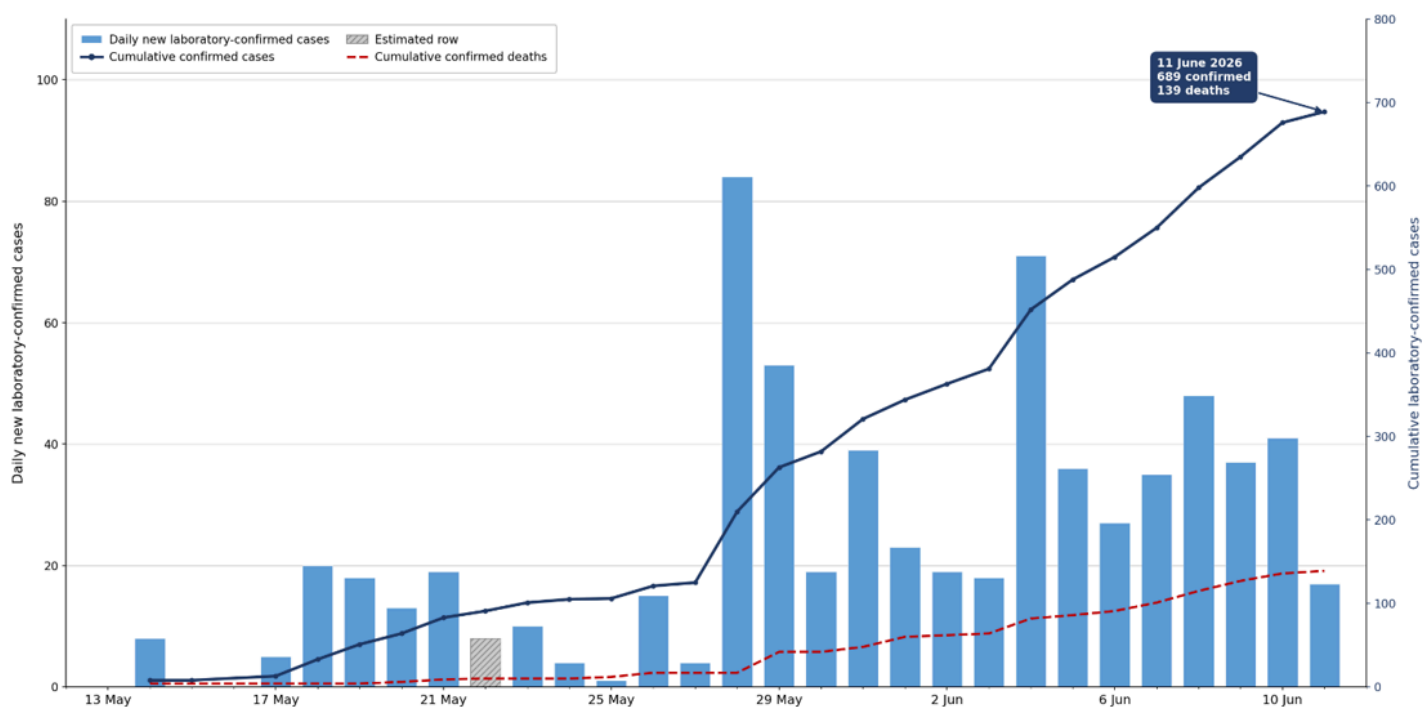


Figure 1

Confirmed Bundibugyo virus disease trajectory, Democratic Republic of the Congo, 2026. Bars show daily new laboratory-confirmed cases, and lines show cumulative confirmed cases and cumulative confirmed deaths. On 11 June, SitRep 028 reported 17 new confirmed cases while the cumulative total increased by 13 because of retrospective harmonisation of North Kivu totals.

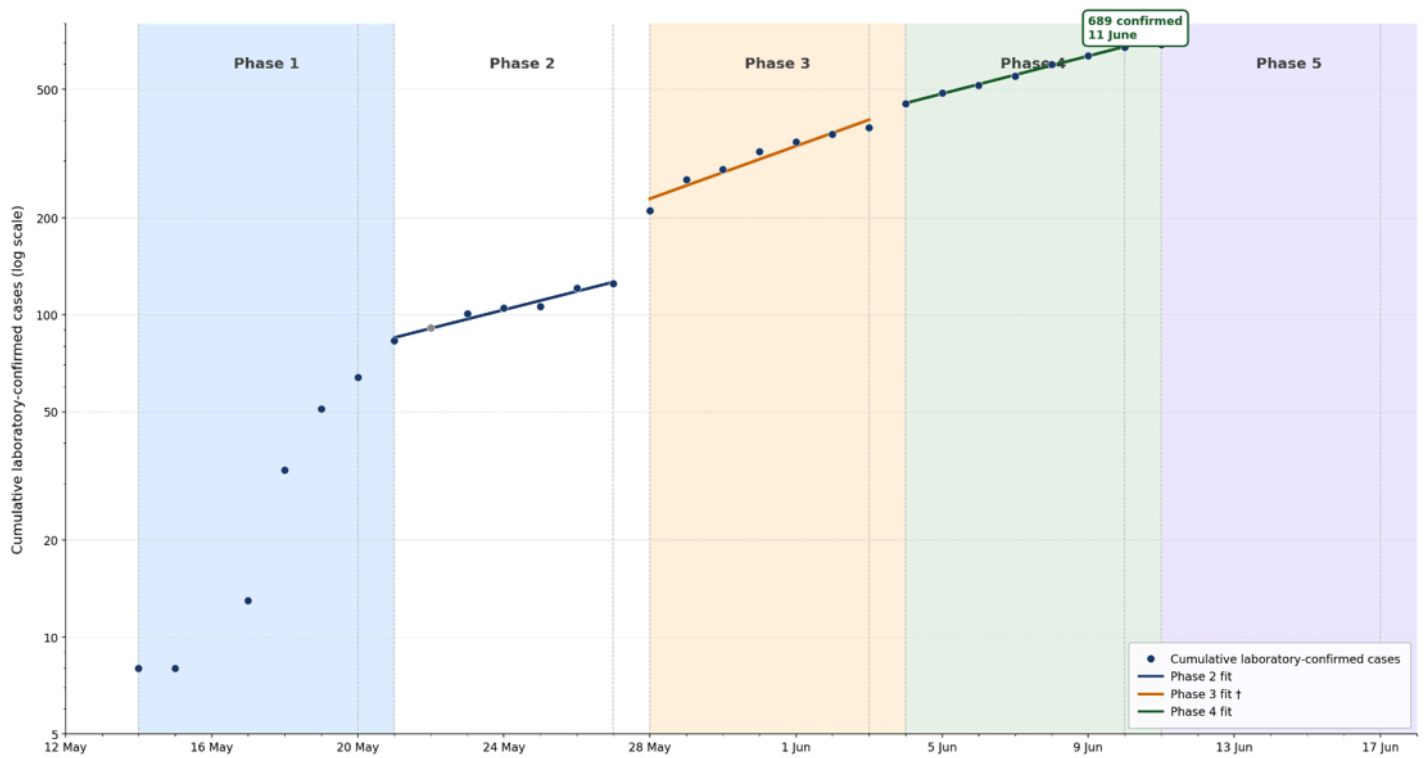


Figure 2

Detected case-growth phases, Democratic Republic of the Congo, 2026. Points show cumulative laboratory-confirmed cases on a logarithmic scale. Lines show phase-specific exponential fits for the three interpretable 7-day phases. Phase 1 (14–20 May) contains six observations including 17 May (13 confirmed) and 18 May (multi-day cumulative); the phase is shown as data points only because the slope is dominated by consecutive identical cumulative totals and a multi-day structural gap. Phase 5 begins on 11 June and had only one observation at the study cut-off. Phase 3 includes harmonisation-sensitive and retroactive ascertainment events. Growth rates represent detected case-growth signals, not direct estimates of true transmission intensity.

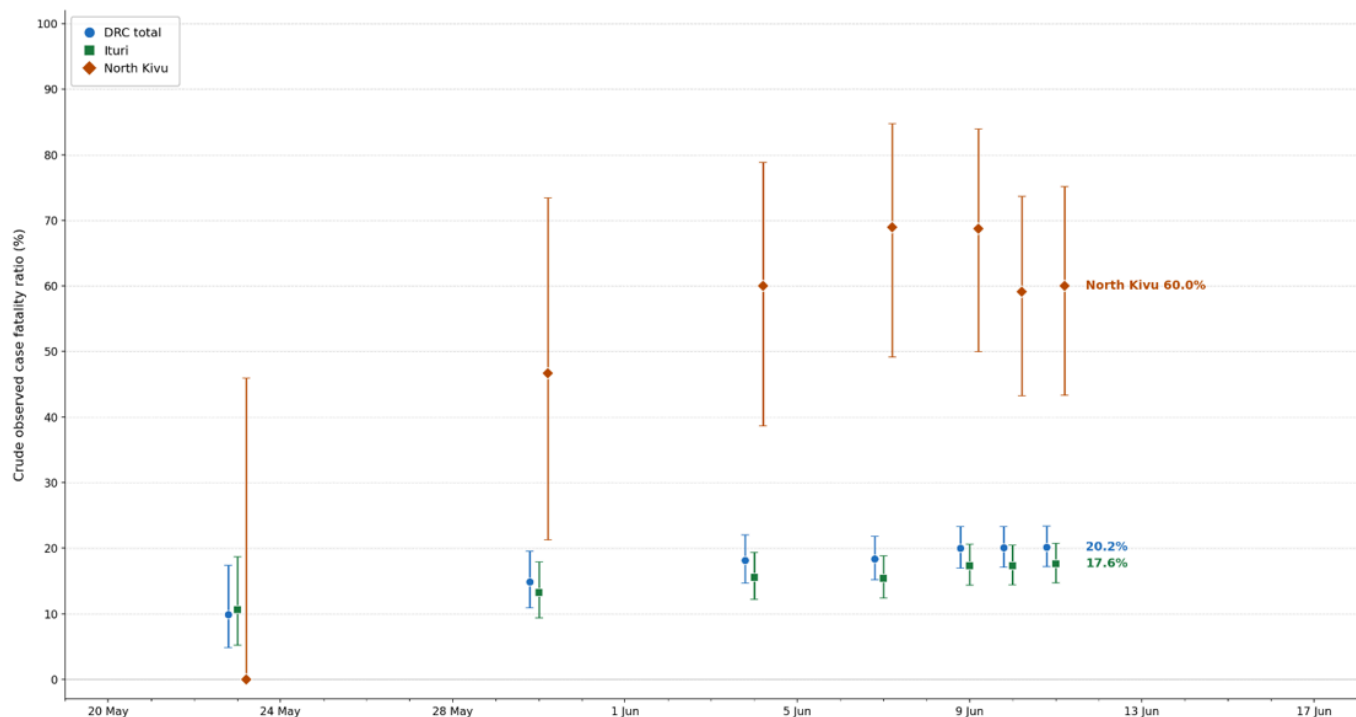


Figure 3

Provincial crude observed case fatality ratios, Democratic Republic of the Congo, 2026. Points show crude observed case fatality ratios for DRC overall, Ituri, and North Kivu over time. Confidence intervals are exact binomial intervals using the Clopper–Pearson method. South Kivu is not shown because it had three confirmed cases and one confirmed death at the study cut-off, below the pre-specified threshold of five for stable percentage reporting. Estimates are crude observed, time-point-specific proportions and should not be interpreted as final case fatality risk during an active outbreak.

Supplementary Files

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