

Lumpy Skin Disease (LSD) Global Trends, Dynamics, and WOAH Diagnostic Standards

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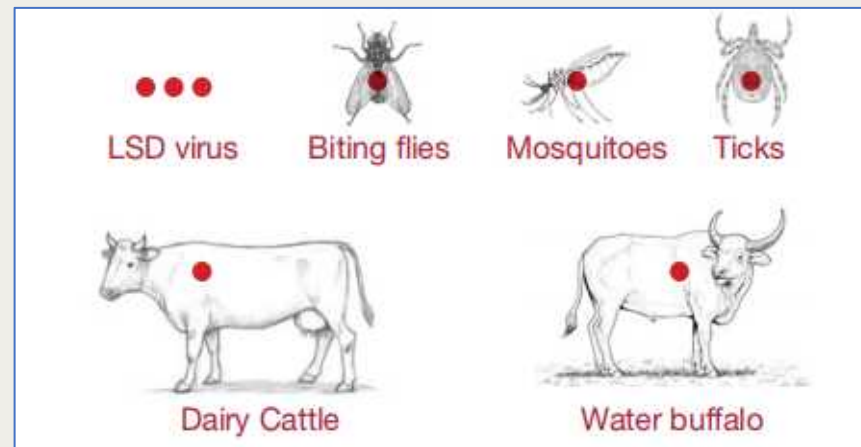
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Disease Control and Prevention in Asia and the Pacific
14-18 September 2026
Qingdao, China

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Lumpy skin disease (LSD)

- a poxviral disease of cattle: LSDV
- an acute to chronic viral disease
- characterized by skin nodules
- Major economic importance : due to loss of production
- The primary route of transmission is through biting insects like mosquitoes, stable flies, and ticks.
- The spread of the disease is often related to the movement of cattle.



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History of LSD

- 1929: Zambia(Southern and eastern Africa)
- 1960s: extended northwards through sub-Saharan West Africa
- 1990s: a resurgence of the disease in southern Africa
- LSD was confined to Africa, but later became established in the Middle East. endemic in most of Africa, parts of the Middle East and Turkey(2012)
- Since 2015(-2017): Central Asia and Russia,eastern and southern Europe
- 2019: Bangladesh, India, China
- 2020: Vietnam, Bhutan, Nepal, Sri Lanka, Myanmar
- 2021: Thailand, Mongolia, Cambodia

Data & Methods

- **Two complementary WOA–WAHIS extracts.**

Quantitative file (1,422 records): country/division-level cases, deaths, outbreaks, vaccination.

Disease-situation file (1,022 records): country presence/absence across all five continents each semester.

- **Period covered.**

2023, 2024 and 2025 are complete calendar years. 2026 is partial — only Jan–Jun plus a few Jul–Dec entries.

- **Processing.**

Symbol '—' treated as not-reported and excluded from sums; all records are uniformly LSD; no duplicate 'Middle East' region present in this extract.

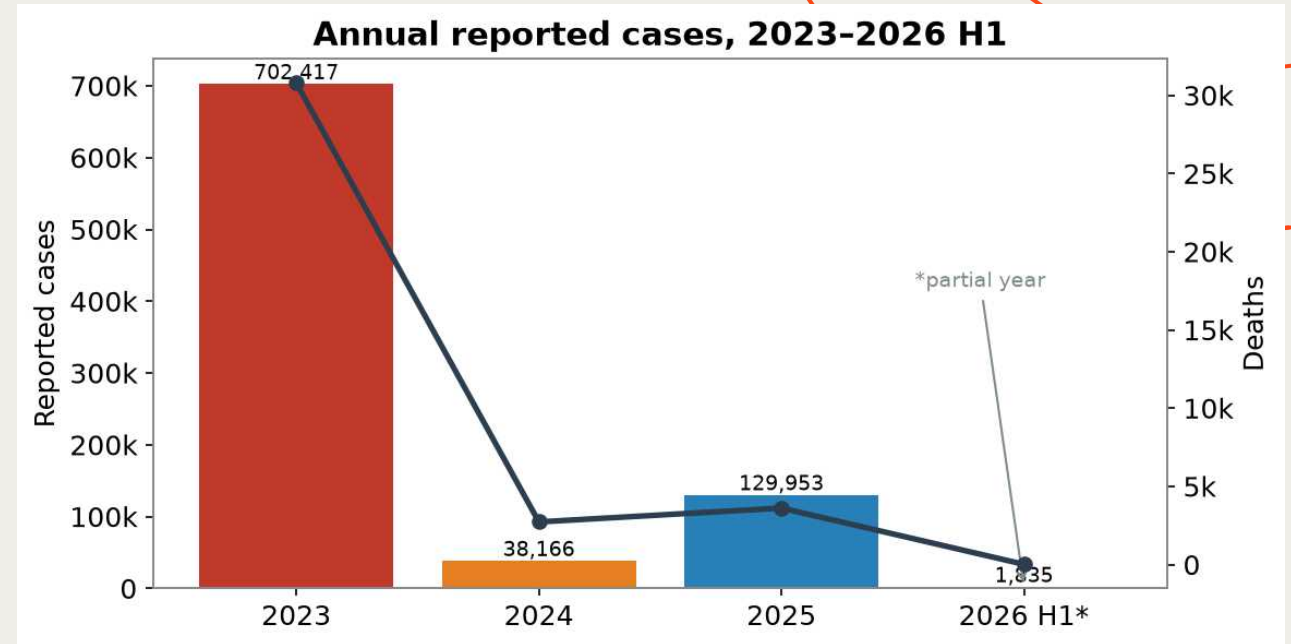
- **Critical caveat.**

Data retrieved 11 Sep 2026, so 2026 is incomplete. The fair comparison against prior years is 2026 H1 versus prior H1 — not full-year totals.

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Global Trends

- **2023 — record peak.**
702,417 cases and 30,788 deaths across 42 countries — the largest year on record.
- **2024 — sharp trough.**
Cases collapsed to 38,166 (5% of 2023), deaths 2,728.
- **2025 — strong rebound.**
129,953 cases (3.4× of 2024), deaths 3,613.
- **2026 H1 — partial.**
1,835 cases reported so far; not yet comparable to full years.

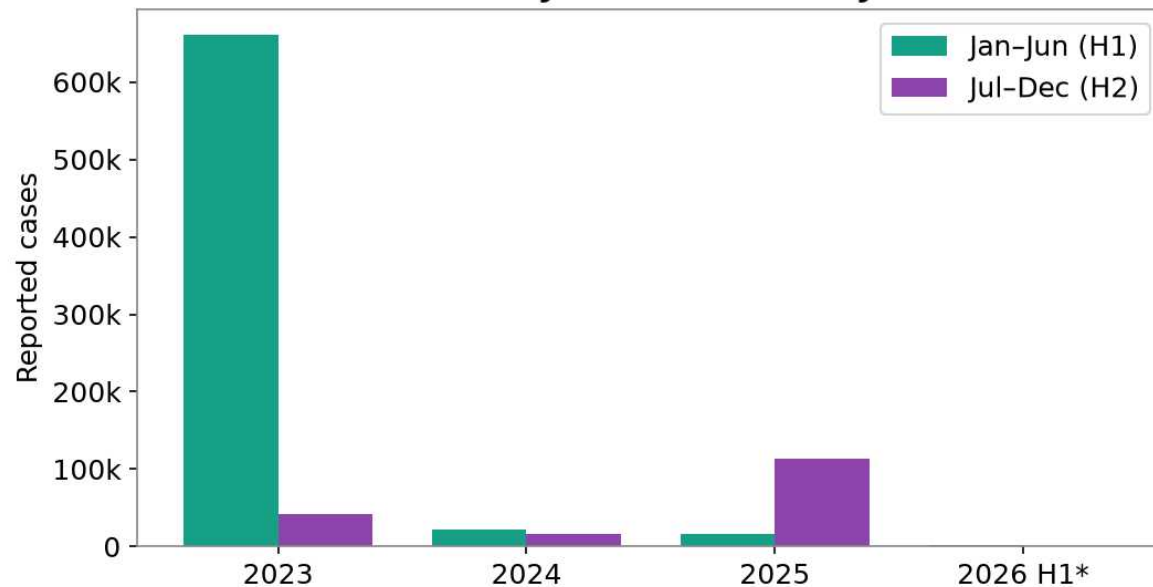


Year	Countries	Cases	Deaths	CFR	New outbreaks	Susceptible	Vacc. doses
2023	42	702,417	30,788	4.38%	14,320	17,994,828	32,850,231
2024	42	38,166	2,728	7.15%	3,796	32,172,240	47,069,317
2025	35	129,953	3,613	2.78%	4,831	45,108,705	40,271,853
2026 H1*	10	1,835	15	0.82%	860	3,966	689

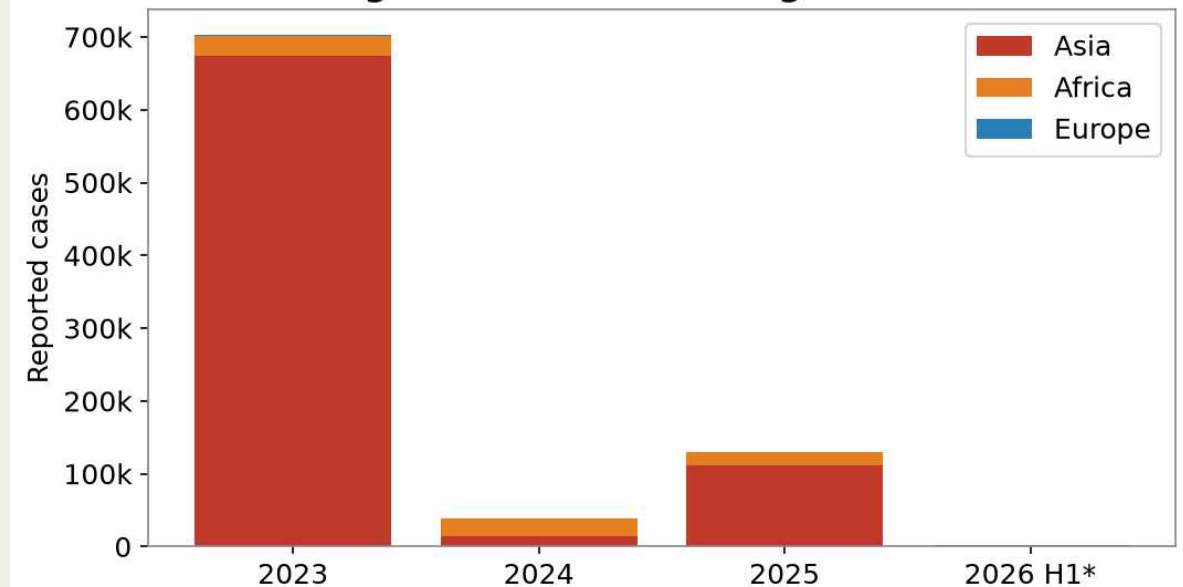
Reading 2026: With only 1,835 cases reported to date (1,775 in H1), 2026 is on track to be far lower than 2023–2025 — but this reflects reporting still in progress, not a confirmed decline. The comparable metric is **2026 H1 = 1,775 cases** vs 2025 H1 = 16,716 and 2024 H1 = 21,909.

Transmission Dynamics

Seasonality shifts between years



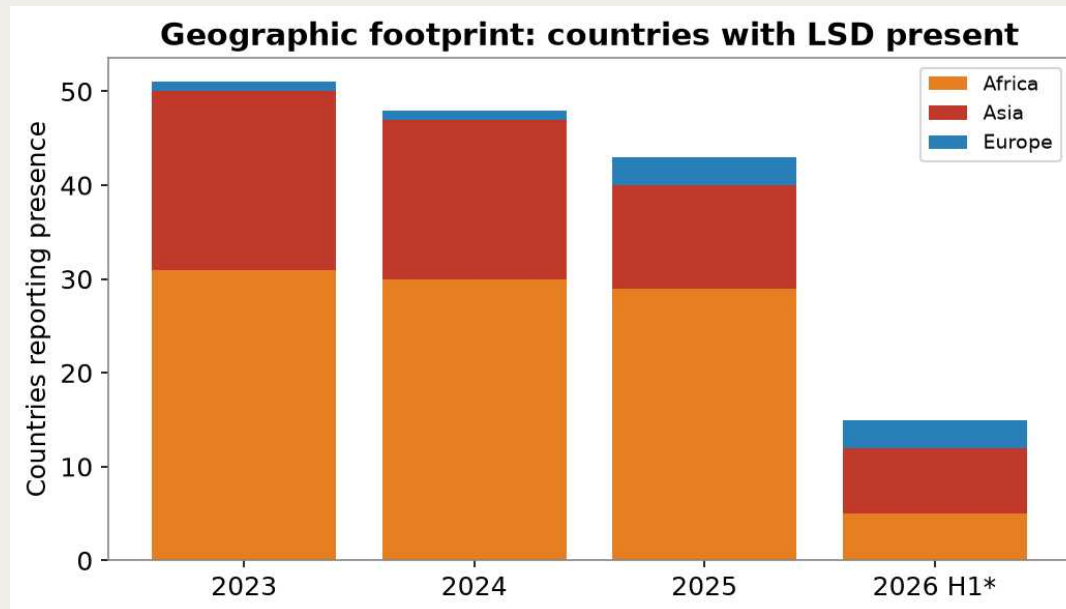
Regional contribution to global cases



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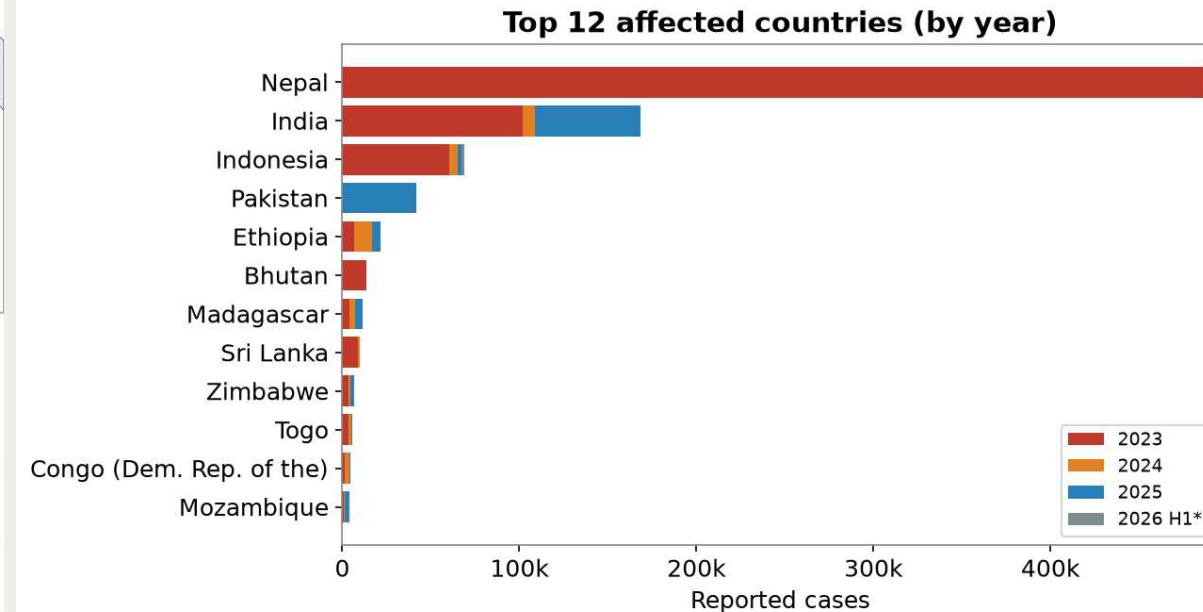
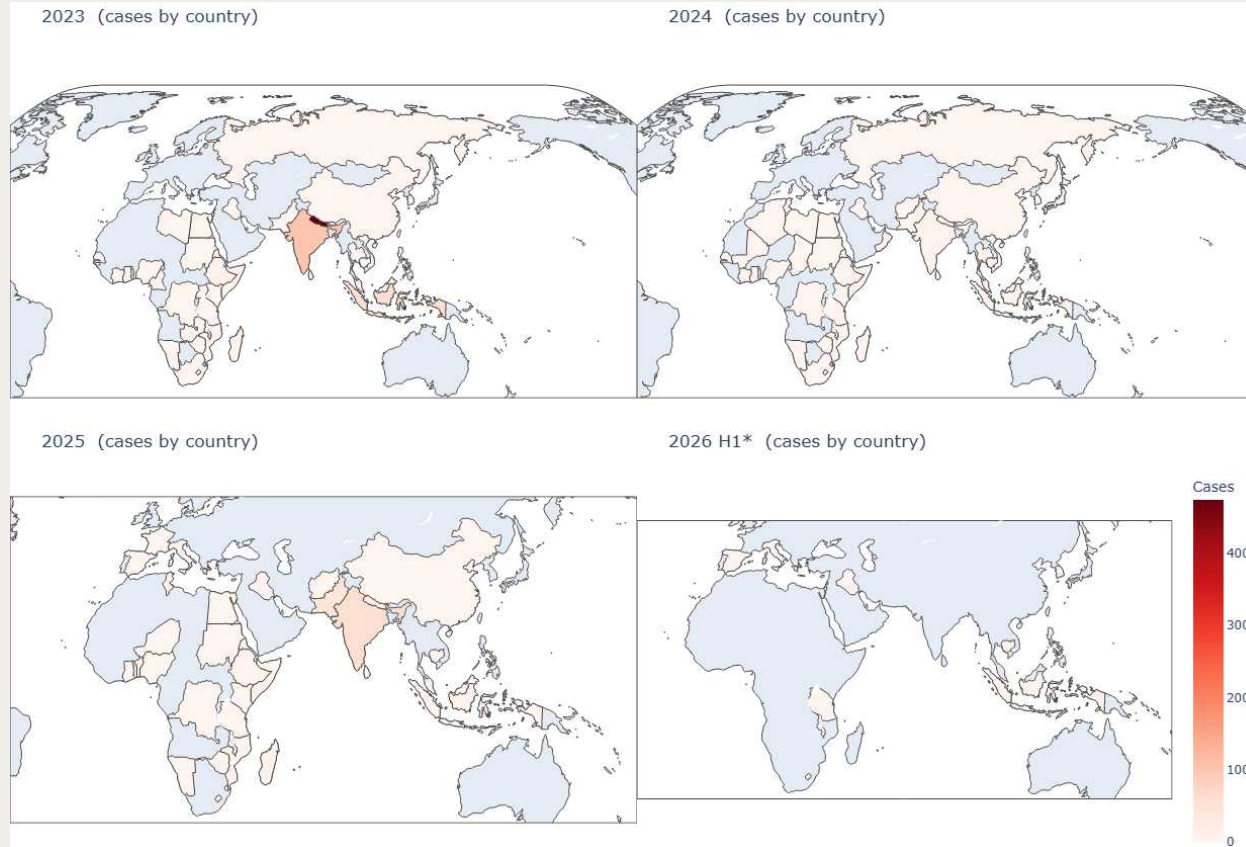
Geographic Distribution

Year	Africa	Asia	Europe	Global total
2023	31	19	1	51
2024	30	17	1	48
2025	29	11	3	43
2026 H1*	5	7	3	15



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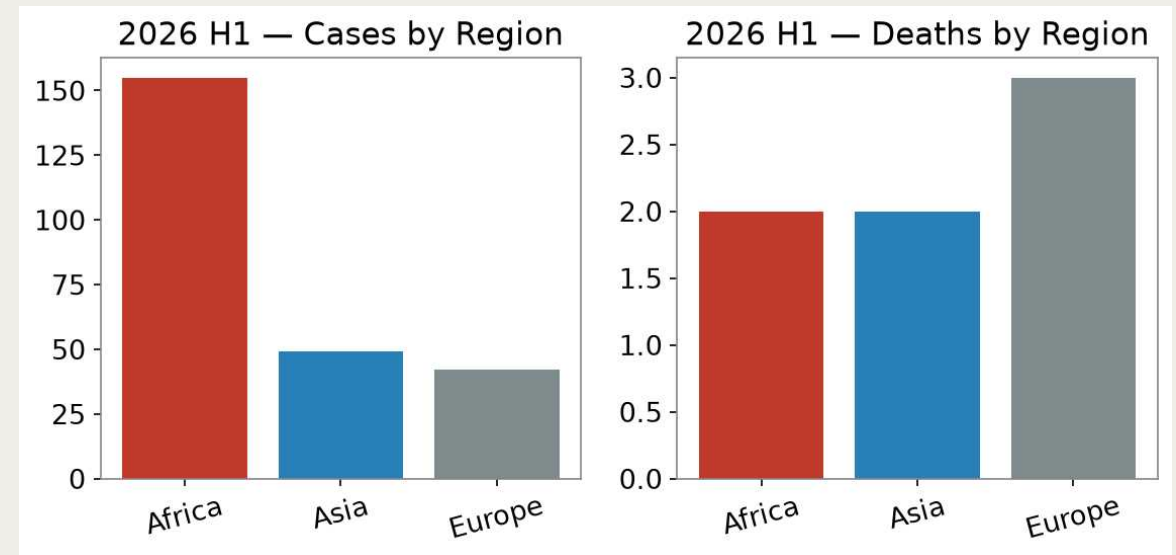
Geographic Distribution



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2026 (First Half) — Outbreak at a Glance

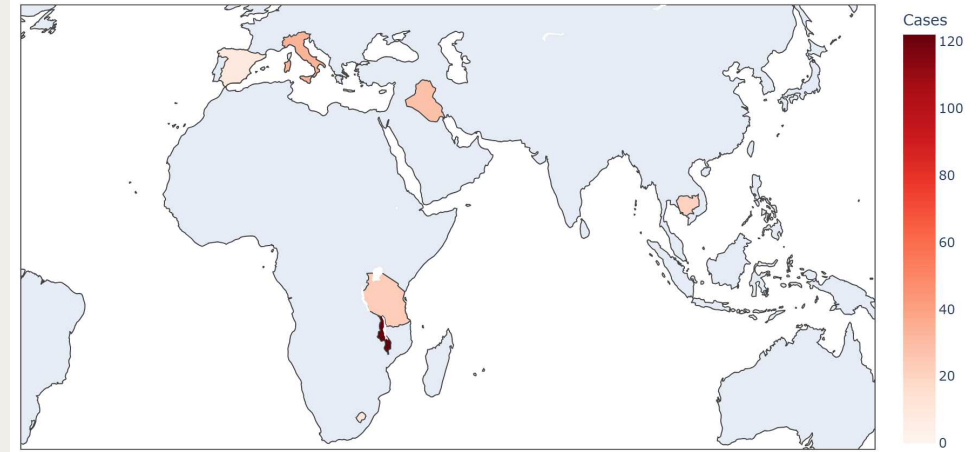
- 7 countries reported (vs 35 in full-2025).
- 16 outbreak sites; 246 cases; 7 deaths.
- ~2,902 susceptible; 689 vaccinated.
- 31 reported new outbreaks.
- ⚠ Numbers are LOW primarily because 2026 data are still being reported — NOT evidence of decline.
- Full-year 2026 must be read with H2 submissions still pending.



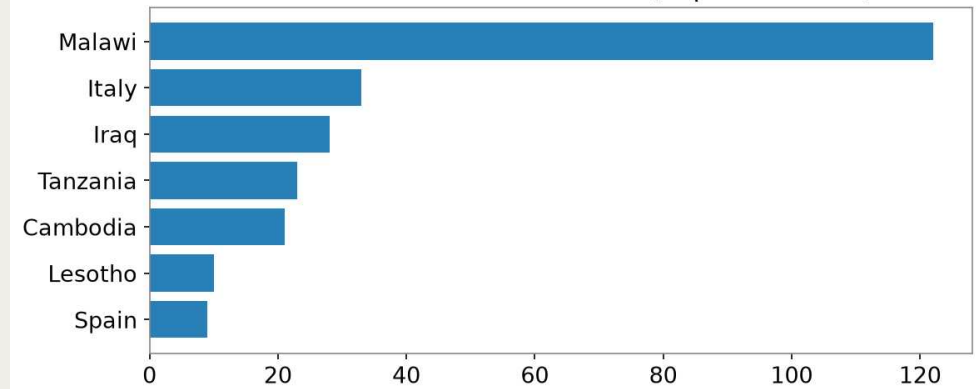
2026 H1 — Geographic Spread & Countries

- Reports span Africa, Asia & Europe but at small scale.
- Malawi leads (122 cases); Italy, Iraq, Tanzania, Cambodia follow.
- Former hotspots (India, Pakistan) not yet reported in H1 2026.
- Sparse map reflects reporting lag, not absence of disease.

LSD Reported Cases — 2026 H1



2026 H1 — Affected Countries (Reported Cases)



Summary — Key Takeaways

Year	Countries	Cases	Deaths	Vacc. doses
2023	42	702,417	30,788	32.9M
2024	42	38,166	2,728	47.1M
2025	35	129,953	3,613	40.3M
2026 H1*	8	1,835	15	0.00M

- **LSD is endemic and cyclical.**

Expect repeated waves; plan for persistence, not eradication in the short term.

- **South Asia drives the global number.**

Invest surveillance and pre-monsoon vaccination there first.

- **Africa is the permanent reservoir.**

Sustained regional capacity-building is essential.

- **Do not read 2026 as 'under control'.**

Watch H2; sustain reporting and vaccination.

02

Diagnostic Techniques for Lumpy Skin Disease

Extracted from the manual's Section B "DIAGNOSTIC TECHNIQUES"
Chapter 3.4.12

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02

SECTION TWO

01 Sample Clection & Diagnostic Methods Overview

- First use Table 1 to define the "testing purpose", then work backward to pick a method
- Sampling window: optimal within the first week; nucleic-acid window far exceeds virus isolation
- Storage temperature and preparation workflow are the floor for reliable results

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Method–Purpose Applicability Matrix

TABLE 1 · TEST METHODS AVAILABLE AND THEIR PURPOSE

For the same sample, the testing purpose changes everything — fix the purpose first, then choose the method

Test method	Population freedom	Individual freedom (pre-movement)	Contribute to eradication	Confirm clinical cases	Prevalence monitoring	Post-vaccination immune status
Virus isolation	+	++	+	+++	+	–
PCR	++	+++	++	+++	+	–
Electron microscopy (TEM)	–	–	–	+	–	–
Virus neutralization (VNT)	++	++	++	++	++	++
Indirect FA (IFAT)	+	+	+	+	+	+
ELISA	++	++	++	++	++	++

Legend: +++ recommended for this purpose ++ recommended but limited + applicable only in very limited cases – not applicable for this purpose

Key: PCR and virus isolation are the core for confirming clinical cases (+++); serology is the only category usable for **post-vaccination immune status evaluation**; TEM applies only to clinical-case confirmation (+), never to population-level purposes.

Sampling windows: 7 days • 35 days • 3 months

- Upper limit of virus-isolation window

35 days

From the **first appearance** of skin lesions, viable virus can still be isolated from nodules

≤ 7 days ^{Optimal}

Best window for virus isolation

Sample within the first week after clinical signs, before neutralizing antibodies appear; virus remains isolable from nodules for $\geq 3-4$ weeks thereafter

≈ 3 months ^{Longest}

Effective window for nucleic-acid testing

PCR is still possible after neutralizing antibodies appear; samples may be EDTA blood, semen, tissue or cell culture

So: Missing the first week **does not mean losing etiological evidence** — switch from "virus isolation" to "PCR", extending the effective window from 35 days to ~3 months.

Note: during viremia (before lesions generalize, or within 4 days after), use heparin/EDTA anticoagulated blood to prepare buffy coat for virus isolation.

Sample Storage, Transport & Preparation

Five steps for lesion-tissue preparation

- 1 Mince with sterile scalpel/forceps, grind with sterile sand or a bead-beater
- 2 Add equal volume of sterile PBS or serum-free MEM with penicillin, streptomycin and antifungal
- 3 Freeze–thaw 3×, then clarify partially by centrifugation at 600 g for 10 min
- 4 If bacterial contamination suspected (skin samples), filter supernatant through 0.45 µm membrane
- 5 Use supernatant to inoculate cell monolayers, or for nucleic-acid extraction and PCR

Buffy coat: centrifuge uncoagulated blood at 600 g for 15 min, take layer → cold distilled water 30 s → double-volume growth medium → centrifuge again, resuspend in GMEM; Ficoll gradient also works for heparin blood.

Four temperature red lines

Tissue (isolation / antigen)

Store at 4 °C, on ice, or –20 °C

Anticoagulated blood (buffy coat)

Place on ice immediately after mixing; store at 4 °C ≤ 2 days; **never freeze**

Unrefrigerated long-distance transport

Holding medium with 10% glycerol; ~1 g tissue per 10 ml, sample central portion

Histological samples

Lesion plus adjacent normal tissue, ≤ 2 cm², in 10× volume neutral buffered formalin

Formalin-fixed tissue carries **no special biorisk transport requirement**.

02

SECTION TWO

02 Agent Identification Techniques

- Virus isolation: examine over 7–14 days; intracytoplasmic eosinophilic inclusions are the read-out core
- PCR: mainstay for confirmation; real-time PCR is faster and more sensitive, DIVA has boundaries
- TEM / fluorescent antibody / IHC / LAMP: supplementary and field-rapid means

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Virus Isolation: Cell Culture

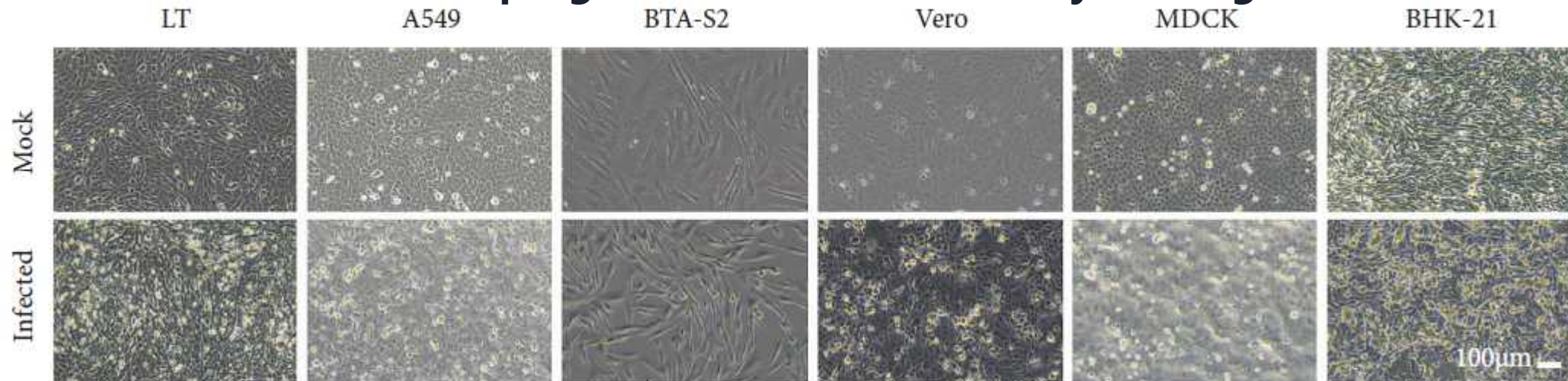
Procedure & reading points 1.2 VIRUS ISOLATION ON CELL CULTURE

- 1 Cells: MDBK preferred; primary cells such as LT must rule out BVDV contamination;
- 2 Inoculate: 1 ml clarified supernatant onto 25 cm² monolayer, adsorb 1 h at 37 °C, wash, add GMEM (2% serum)
- 3 Microscopy: observe daily for 7–14 days; if no CPE at 14 days, freeze–thaw 3× then blind passage
- 4 Reading: intracytoplasmic eosinophilic inclusions with a clear halo are poxvirus-specific; PCR can replace H&E
- 5 Differentiate: pseudo-LSD herpesvirus shows intranuclear Cowdry type A inclusions and syncytia

Adding specific anti-LSDV serum blocks or delays CPE

— a supplementary means to confirm the isolated virus is indeed LSDV

CPE progression & inclusion-body reading



Conventional Gel PCR: 192 bp Standard Protocol

1.3 POLYMERASE CHAIN REACTION — TEST PROCEDURE

SECTION 1.3

Conventional gel PCR

192bp

Expected amplicon length

Primer target: virus
attachment-protein gene

Applicable to: EDTA

blood · semen · tissue · cell
culture

Forward primer 5'-TCC-GAG-CTC-TTT-CCT-GAT-TTT-TCT-TAC-TAT-3'

Reverse primer 5'-TAT-GGT-ACC-TAA-ATT-ATA-TAC-GTA-AAT-AAC-3'

Reaction mix 50 µl

10× buffer 5 µl | MgCl₂ 1.5 µl | dNTP 1 µl
1 µl each primer | ~10 ng template | Taq
0.5 µl | add water to 50 µl

Cycling conditions

95 °C 2 min initial denaturation; then 34
cycles:
95 °C 45 s → 50 °C 50 s → 72 °C 1

Nucleic-acid extraction & gel reading

Lysis buffer contains 5 M guanidinium isothiocyanate, 50 mM KCl, 10 mM Tris/HCl (pH 8) and Tween 20; add proteinase K, incubate 56 °C 2 h or overnight, then 100 °C 10 min; phenol–chloroform–isoamyl alcohol extraction then pellet at 16,060 g; column kits are an alternative.

Only one reading rule: read against the 100 bp marker — a 192 bp band indicates a positive result; include positive and negative controls.

Primer source: Ireland & Binopal, 1998

Method source: Tuppurainen et al., 2005

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Key limitation • CRITICAL LIMITATION

Real-time PCR is faster and more sensitive, but DIVA is not a master key

DIVA PCR cannot distinguish the Neethling vaccine strain from Asian recombinants or southern African cluster 1.1 wild-type

Can distinguish

Neethling vaccine strain ↔ cluster-1.2 wild-type (Agianniotaki 2017; Pestova 2018; Vidanovic 2016)

Cannot distinguish

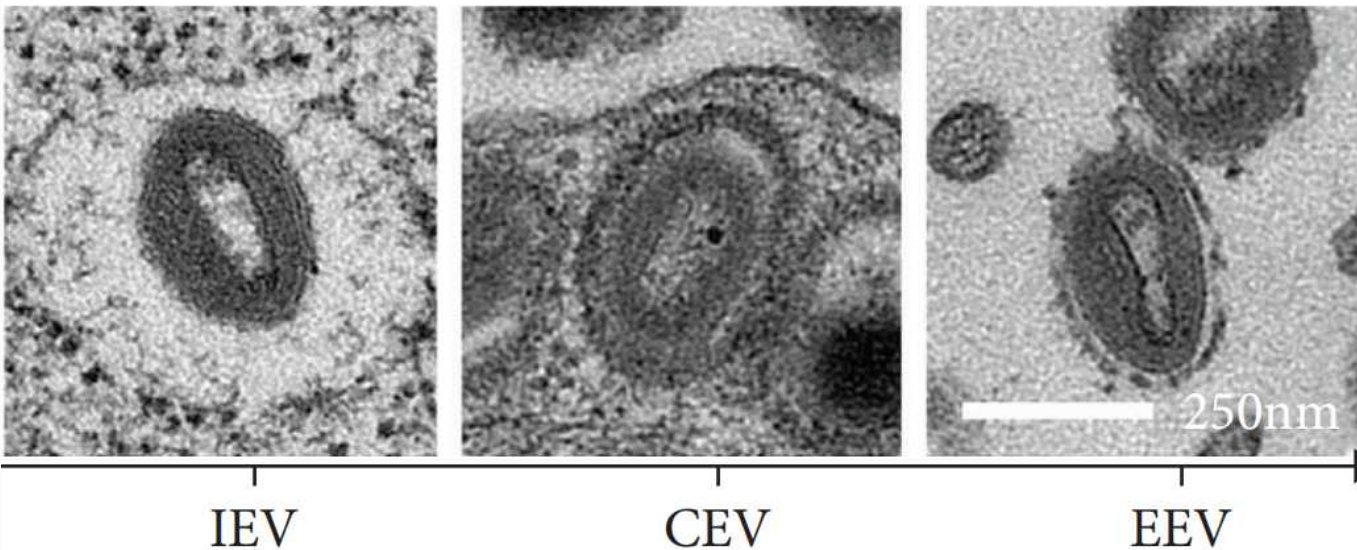
- ① Neethling vaccine strain ↔ Asian novel recombinants (Flannery et al., 2021)
- ② Neethling vaccine strain ↔ historical southern-African cluster-1.1 wild-type (Van Schalkwyk et al., 2020; 2021)

So: in areas where recombinants (currently Asia and possibly elsewhere) or cluster-1.1 wild-type (currently southern Africa and possibly elsewhere) circulate, DIVA is not applicable.

The manual's remedy: to overcome the above limitation, **whole-genome sequencing is recommended**. It can also distinguish LSDV from sheeppox and goatpox viruses (Lamien et al., 2011).

1.4 Transmission electron microscopy: morphological confirmation

Brick-shaped · short tubular elements



Limitation: indistinguishable morphologically from orthopoxviruses (**same for buffalopox**); parapoxviruses are smaller, ovoid, with a single continuous tubular element showing a cross-barred pattern; clearly distinct from pseudo-LSD herpesvirus.

So: TEM can confirm "it is a poxvirus" but not "it is capripoxvirus" — species-level identification must return to PCR or sequencing.

• 1.5 Fluorescent antibody test

Fix in cold acetone 10 min; indirect method has high background, prefer direct conjugate.

Always include an uninfected-cell negative control; pre-adsorb serum if needed.

• 1.6 Immunohistochemistry

mAb F80G5 targets capripoxvirus ORF 057 and detects antigen in bovine skin tissue.

Source: Babiuk et al., 2008

• 1.7 Isothermal amplification (LAMP)

Sensitivity and specificity close to real-time PCR, simpler and cheaper.

Das method field-validated: Das 2012; Murray 2013; Omega 2016

02

SECTION TWO

03 Serological Testing & Integrated Interpretation

- Shared intrageneric neutralizing antigen: serology cannot tell apart viruses from cattle, sheep or goat
- VNT: neutralization index ≥ 1.5 is positive; results and interpretation must consider immune background
- Workflow & threshold quick-ref: turn method choice into an actionable step

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Virus Neutralization Test (VNT)

03 Serology & Interpretation

2.1 VIRUS NEUTRALISATION — THE REFERENCE SEROLOGICAL TEST

SECTION 2.1

Virus neutralization test

≥1.5

Neutralization-index positive threshold

96-well flat-bottom plate;
neutralization-index method preferred, needs more serum

Examine daily from day 4; e.g. read final on day 9 for strain 0240 KSGP

Virus titre by Kärber method
two columns per serum · include positive/negative controls

Method choice: titrate serum against fixed virus titre (100 TCID₅₀), or titrate virus against fixed serum dilution to compute the neutralization index.

Because cell susceptibility varies and 100 TCID₅₀/well is hard to reproduce accurately, **most labs prefer the neutralization-index method.**

Serum handling

Dilute 1/5 in Eagle's/HEPES, inactivate 56 °C 30 min

Two columns per serum, rows A–H; row H is

Virus & cells

Reference-strain titre > log₁₀ 6 TCID₅₀ /ml, prepared as a log₁₀ 5.0 → 1.5 series

50 µl serum + 50 µl virus, 37 °C 1 h, then add

Plate reading & judgement

Observe daily from day 4 under inverted microscope; row H must show no CPE; compute virus titre from duplicate titrations by Kärber method.

Overtime risk: left too long, "breakthrough" occurs — neutralized virus dissociates from antibody,

Antibody time-course: detectable **1–2 days** after clinical signs, then for **~7 months**.

Most misread point: immunity is mainly cell-mediated, post-vaccination antibody response may be low — **negative ≠ unprotected.**

2.2 Enzyme-linked immunosorbent assay (ELISA)

- ELISAs detecting capripoxvirus antibodies are widely used, with commercial kits available (Milovanovic et al., 2019; Samojlovic et al., 2019).
- In Table 1, ELISA scores "++" for all 6 purposes; outside Table 1, note: shared intrageneric neutralizing antigen.
- A positive only shows exposure to capripoxvirus; it cannot tell cattle, sheep or goat origin.

2.3 Indirect fluorescent antibody test (IFAT)

- Infected-cell coverslips fixed in acetone at -20°C for 10 min, stored at 4°C ; serum diluted from 1/20 or 1/40, detected with FITC-labelled anti-bovine γ -globulin.
- Post-infection titre may exceed 1/1000; screen at double dilutions 1/50 and 1/500; include uninfected-cell and positive/negative serum controls.
- Cross-reactions: orf virus, bovine papular stomatitis virus and other poxviruses.

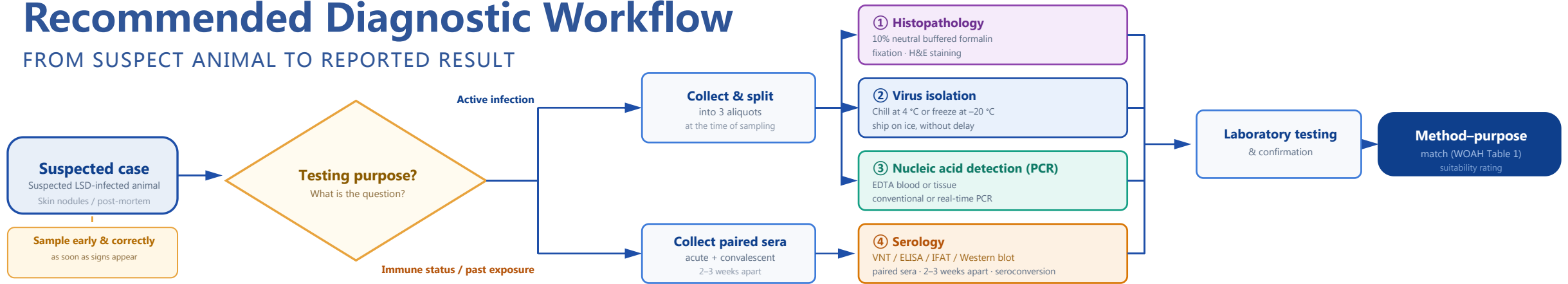
2.4 Western blot

- Antigen: harvest infected LT cells at 90% CPE, freeze–thaw 3 $\times$, centrifuge to remove debris, separate by SDS/PAGE and blot onto nitrocellulose.
- Procedure: block 3% BSA or 5% skim milk at 4°C overnight; serum 1/50 at room temp 1.5 h; HRP-labelled anti-species Ig; DAB 3–7 min, stop before background appears.
- Reading: positive serum reacts with the 67 / 32 / 26 / 19 / 17 kDa major structural proteins; negative serum reacts with none of them.
32kDa is a capripoxvirus-specific band.

Features: sensitive and specific, but **costly and laborious**; antigen may be replaced by purified virus or recombinant protein.

Recommended Diagnostic Workflow

FROM SUSPECT ANIMAL TO REPORTED RESULT



Legend:  Histopathology  Virus isolation  Nucleic acid detection  Serology  Terminator  Decision  Process  Placeholder (not in Table 1)

Biosafety: all procedures must follow the containment level defined by the biorisk analysis.

Purpose A · Confirm clinical case

PCR / Virus isolation + + +

TEM applies only in very limited cases (+);
fluorescent antibody and IHC serve as
supplementary confirmation.

Purpose B · Individual freedom pre-
movement

PCR + + + | Virus isolation + +

For herd freedom and eradication, PCR
also beats virus isolation (+ + vs +).

Purpose C · Post-vaccination
immune status

VNT / ELISA + +

All agent-detection methods are not
applicable (-); intragenetic typing is
impossible, negative ≠ unprotected.

CONCLUSION

01 **Sampling window sets the detection ceiling**

Sample within first week for virus isolation; if missed, switch to PCR — nucleic-acid window reaches ~3 months.

02 **PCR is the confirmation mainstay; DIVA has hard boundaries**

In areas with recombinants or cluster-1.1 wild-type, DIVA is not applicable; whole-genome sequencing is recommended.

03 **Serology reads immune status, not strain**

Shared intrageneric neutralizing antigen, no typing possible; negative ≠ unprotected.

Thank you!

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