

Airport and point-of-entry screening during Ebola outbreaks: Lessons for South Africa from West Africa and the Democratic Republic of the Congo

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Summary

Airport and point-of-entry (PoE) screening became a major component of international public health response efforts during the 2014–2016 West African Ebola disease epidemic and subsequent outbreaks in the Democratic Republic of the Congo (DRC) between 2018 and 2020. This opinion piece reviews operational experience with traveller screening, case detection and surveillance, and considers the implications for the 2026 Bundibugyo virus disease outbreak affecting the DRC and Uganda. Although very large numbers of travellers were screened, published evaluations provide limited evidence that airport entry screening alone identified confirmed Ebola disease cases. This should not, however, be interpreted as evidence that screening had no public health value. PoE measures may contribute indirectly through traveller education, risk communication, identification of persons requiring further assessment, traveller monitoring, data collection, referral, and public confidence. However, their effectiveness is also constrained by the incubation period, non-specific early clinical presentation, and the possibility that infected travellers are asymptomatic when screened. Recent evidence indicates that the risk of sustained international Ebola transmission outside Africa remains low, supporting proportionate, rather than indiscriminate, border measures. For South Africa, the priority should therefore be a layered system that combines risk-based PoE measures with airline notification, event-based and healthcare surveillance, laboratory capacity, rapid referral, contact tracing, and operational preparedness.

Background

The international spread of Ebola disease during the 2014–2016 West African epidemic prompted extensive implementation of entry and exit screening at airports, land borders, and seaports. Screening approaches included thermal scanning, symptom questionnaires, exposure-risk assessment, travel health declarations, and traveller monitoring. Similar measures were implemented during the 2018–2020 Ebola outbreak in the eastern Democratic Republic of the Congo (DRC). The current 2026 outbreak of Bundibugyo virus disease in the DRC and Uganda has again raised questions about the extent to which countries outside the affected area should strengthen airport and border measures.

On 17 May 2026, the World Health Organization (WHO) determined that the outbreak of Ebola disease caused by the Bundibugyo virus in the DRC and Uganda constituted a public health emergency of international concern. The WHO described the affected area as characterised by high population mobility, insecurity, and substantial cross-border connectivity, while Uganda reported imported cases linked to travel from the DRC. These features justify preparedness in neighbouring and connected countries, but they do not by themselves establish a high likelihood of sustained intercontinental transmission.^{1–4}

The distinction is important. The purpose of point-of-entry (PoE) screening should not be framed as preventing every infected traveller from crossing a border. Screening is one component of a broader system for reducing the probability that an infected person enters undetected, while ensuring that illness is recognised rapidly if

it develops during or after travel. Modelling studies have shown that the effectiveness of traveller screening is strongly influenced by pathogen natural history, the stage of the epidemic, the quality of exposure-risk information, and traveller behaviour. Even under favourable assumptions, arrival screening can miss a substantial proportion of infected travellers.^{5,6}

Historical experience with Ebola PoE screening

During the 2014–2016 West African epidemic, the United States implemented enhanced entry screening at five designated airports receiving most travellers arriving from affected countries. Approximately 38 000 travellers underwent enhanced screening. No confirmed Ebola case was identified solely through the airport screening process; cases entering the United States were subsequently recognised through healthcare presentation, monitoring, or contact tracing.^{7,8}

Sierra Leone conducted extensive exit screening at Freetown International Airport, including temperature assessment and exposure-risk assessment. More than 166 000 travellers were screened between September 2014 and February 2016. Five travellers were denied boarding after secondary assessment, but none subsequently tested positive for Ebola disease.⁹ The United Kingdom and Canada similarly implemented screening, traveller information, and monitoring measures during the epidemic.^{10,11}

The experience in eastern DRC illustrates both the scale and the surveillance value of PoE activity. By 11 August 2019, the WHO reported close to 84.5 million screenings, generating 2 063 alerts. Of these, 986 were validated as suspect cases, and 24 were subsequently confirmed with Ebola disease following laboratory testing. These figures do not demonstrate that PoE screening alone diagnosed all 24 cases; rather, they show that PoE activity generated signals that entered a broader investigation and laboratory system. This is an important distinction when evaluating the public health contribution of screening.¹²

The evidence therefore supports a more precise conclusion than simply describing PoE screening as ineffective. While direct case detection appears to have been uncommon, failure to identify a confirmed case at the screening point is not equivalent to absence of public health value. Screening can create a structured interface between public health authorities and travellers, provide an opportunity to communicate symptoms and risk, identify people who require further assessment, support monitoring and contact tracing, and increase awareness among transport operators and frontline personnel. WHO guidance for Ebola PoE measures has explicitly included risk communication, health declarations, symptom assessment, referral and contact-tracing arrangements, alongside temperature checks.¹³

What screening can and cannot achieve

The biological characteristics of Ebola disease place important limits on symptom-based screening. The incubation period can extend to 21 days for Ebola disease caused by Ebola virus, and infected travellers may therefore be asymptomatic at the time of departure or arrival. Fever and other early symptoms are also non-specific, while the clinical features associated with severe haemorrhagic disease occur later. Antipyretic

use, imperfect observation, and informal cross-border movement can further reduce the sensitivity of screening.

Mathematical modelling provides an important explanation for these observations. Gostic *et al.* demonstrated that traveller-screening effectiveness is determined by the interaction between pathogen natural history, epidemic phase, exposure-risk information, screening performance, and human behaviour.⁵ For pathogens with longer incubation periods, exposure-risk assessment can be particularly important, while symptom-based screening is inherently limited when infection is not yet clinically apparent.⁵ Read *et al.* similarly highlighted the limitations of airport screening for Ebola, particularly where infected travellers are asymptomatic during the screening window.⁶

Screening also has potential costs beyond the direct financial expenditure. False-positive alerts can require secondary assessment, isolation, or referral of people who ultimately do not have Ebola disease. Large-scale screening may create queues and delays, place additional demands on airport health services, and require substantial staffing, equipment, training, and logistics. During a prolonged response, these requirements can divert scarce public health personnel from surveillance, contact tracing, laboratory investigation, and healthcare preparedness. The appropriate question is, therefore, not whether screening produces zero or one confirmed case, but whether the expected benefit of a particular screening configuration justifies its operational and opportunity costs under the prevailing epidemiological conditions.

Expenditure and operational burden

Published estimates of PoE expenditure are heterogeneous and are not directly comparable because countries have included different combinations of screening, traveller monitoring, staffing, infrastructure, risk communication, and wider preparedness activities. For this reason, the expenditure figures in Table 1 should not be interpreted as the cost of detecting an individual case or as the cost of PoE screening alone unless the underlying source explicitly defines the expenditure in that way.

For example, an economic analysis of the 2014 Ebola response estimated that screening measures at London airports cost approximately £9 million over six months and that measures at Newark Airport were expected to cost approximately US\$2.6 million. These figures were programme-level estimates and should not be extrapolated to other airports without accounting for passenger volume, duration, staffing model, and the scope of activities included.¹⁴ The previously cited figures of US\$7–20 million for the United States and approximately £4.7 million for the United Kingdom have therefore been removed because the available sources do not provide a sufficiently clear basis for presenting them as direct PoE-screening expenditure.

Table 1. Ebola point-of-entry screening operations and outcomes

Outbreak country	Screening approach	Travellers screened	Confirmed cases identified solely through entry screening*	Expenditure / resource information	Other surveillance outcomes	Ref.
2014–2016 West Africa; United States	Thermal screening, symptom questionnaires, and exposure-risk assessment at five designated airports	~38 000	0	Programme-level costs reported in the literature; not treated here as a PoE-only estimate	Cases recognised through healthcare presentation, monitoring, and contact tracing	7–8
2014–2016 West Africa; Sierra Leone	Exit screening at Freetown International Airport, including thermal screening and risk assessment	166 242	0	Not publicly quantified in the cited evaluation	Five travellers denied boarding after secondary screening; none subsequently tested positive	9
2014–2016 West Africa; United Kingdom	Entry screening at Heathrow, Gatwick, and Eurostar terminals	More than 7 000 during early implementation	0	London airport screening estimated at ~£9 million over six months in a published economic analysis	Imported cases were recognised through healthcare systems and monitoring	10,14
2014–2016 West Africa; Canada	Traveller information, passive screening, and monitoring	Several thousand monitored	0	Not publicly quantified	No imported cases detected in the reported programme	11
2018–2020 North Kivu/Ituri; DRC	Screening at >80 points of entry and traveller-control points	>55 million screenings	No confirmed cases publicly	PoE expenditure not separately reported from	3 470 confirmed/probable cases identified through broader	15

			documented as identified solely through entry screening	the wider WHO response budget	surveillance, including contact tracing and healthcare surveillance	
2018–2020 North Kivu/Ituri; Uganda	Border screening, traveller registration, thermal scanning, and active surveillance	Hundreds of thousands; 641 alerts investigated	No confirmed cases publicly documented as identified solely through entry screening	Supported through international preparedness and response funding	Imported family cluster detected through integrated surveillance and laboratory confirmation	16
2018–2020 North Kivu/Ituri; DRC and neighbouring PoEs	Screening at airports, land crossings and other points of entry/control; symptom and exposure assessment, traveller registration, and referral	84.5 million cumulative screenings by 11 August 2019	Direct case detection at screening not established; alerts entered wider investigation	Included within wider outbreak response; PoE costs not separately quantified	2 063 alerts; 986 validated as suspect cases; 24 subsequently confirmed with Ebola after laboratory testing	12
2020 Équateur; DRC	Airport, river-port, and land-border screening	More than 3 million	No confirmed cases publicly documented as identified solely through entry screening	Included within wider outbreak-response costs	Cases primarily identified through community alerts and contact tracing	17

The table distinguishes direct case detection from wider surveillance and preparedness functions.

*A zero in the fourth column means that the cited/publicly available evidence did not document a confirmed case identified solely through the screening activity; it does not demonstrate that the screening programme had no indirect public health value. Expenditure figures are included only where their source and scope can be reasonably described. The London and Newark estimates derive from a published economic analysis of the 2014 Ebola response and are not directly comparable across countries.¹⁴

International travel risk: What the evidence shows

The risk of international spread should also be considered in proportion to the epidemiological evidence. Van Zandvoort *et al.* recently reviewed confirmed Ebola disease cases presenting outside Africa from 1976 through May 2026. They identified 28 confirmed cases outside Africa linked to outbreaks in Africa, including 25 primary imported cases and three secondary cases. Only four cases involved travellers with latent infection whose symptoms were detected after border screening, and the crude overall rate since 2000 was 0.17 Ebola disease cases outside Africa per 1 000 reported cases in Africa.¹⁸

This analysis is important because it places the threat of international exportation in historical context. The risk of exportation is not zero, and neighbouring countries with intense population movement remain at substantially greater risk than more distant destinations. However, sustained transmission outside Africa has been exceptionally uncommon. The evidence therefore supports proportionate preparedness rather than assuming that every outbreak in Africa creates a high probability of sustained intercontinental transmission.¹⁸

This manuscript does not undertake an independent mathematical model of international travel risk. The quantitative estimates presented above are drawn from published analyses, and their assumptions and denominators should be interpreted accordingly. In particular, the van Zandvoort analysis is a historical case-based assessment of confirmed Ebola disease cases outside Africa rather than a forecast of future importations. Its value for preparedness is therefore contextual: it helps calibrate the scale of international risk and avoids disproportionate responses, while recognising that the probability of a rare event can change as outbreak intensity, connectivity, and control measures change.¹⁸

The implications for South Africa are consequently twofold. First, preparedness should not be driven by the assumption that international spread is likely, simply because an outbreak is occurring in a neighbouring region of Africa. Second, low global risk does not justify complacency. A single imported case remains operationally important because delayed recognition can result in extensive contact-tracing requirements, healthcare exposure, reputational consequences, and avoidable disruption. Risk management should therefore focus on the probability of importation, the consequences of delayed detection, and the country's capacity to respond rapidly.

Implications for South Africa and recommendations

For South Africa, the historical evidence supports a layered approach rather than reliance on a single visible intervention at the airport:

- PoE measures should be risk-based and linked to the epidemiological situation in affected countries, patterns of travel and population movement, and the ability of the health system to detect and manage a suspected case.
- Thermal or symptom screening may remain appropriate at selected points of entry when epidemiologically justified. Its purpose should be clearly defined: identifying travellers who are visibly or symptomatically unwell, directing them for appropriate assessment, providing risk communication, and

creating a mechanism for referral and follow-up. Screening should not be presented as a reliable method for excluding all infected travellers from entering the country.

Airline-based surveillance and pre-arrival notification should form an important part of this layered approach:

- Airline operating routes involving affected countries should have clear procedures for notifying airport health authorities when a passenger becomes significantly unwell in flight.
- Cabin crew and airline medical support personnel should be familiar with the early, non-specific presentation of Ebola disease and with the process for requesting medical assessment on arrival. Pre-arrival notification allows airport health services to prepare rather than receiving an undifferentiated, ill traveller without warning.
- Airport medical assistance and aircraft response procedures should be reviewed in advance. A traveller with a compatible illness and relevant epidemiological exposure should have a clearly defined pathway from aircraft arrival to clinical assessment, referral, and, where necessary, isolation. The pathway should link airlines, airport health services, emergency medical services, designated referral facilities, and public health authorities.

Frontline preparedness should extend beyond airport staff:

- Emergency responders, airport health personnel, immigration and port-health personnel, emergency medical services, and clinicians in emergency departments should be able to recognise a viral haemorrhagic fever syndrome and obtain an appropriate travel and exposure history. Training should emphasise standard infection prevention and control precautions, appropriate personal protective equipment, and safe referral rather than relying on recognition of late haemorrhagic manifestations.

Healthcare preparedness remains central because imported Ebola disease is more likely to become apparent through healthcare or post-arrival surveillance than through airport screening alone:

- Emergency departments and clinics, particularly those serving major international travel hubs, should maintain the capacity to identify patients with compatible symptoms and relevant travel or exposure histories, initiate appropriate infection prevention and control measures, notify public health authorities, and arrange safe referral.
- Preparedness should also include aeromedical evacuation providers and aviation medicine services. Patients transferred internationally may initially present with non-specific febrile or gastrointestinal illness. Receiving facilities should therefore be notified before transfer, with clear arrangements for clinical assessment, infection prevention and control, laboratory testing, and patient movement.
- South Africa should also maintain situational awareness of occupational and commercial connectivity with affected areas. Mining, logistics, construction, humanitarian, aviation, and other sectors may have personnel travelling through commercial routes, charter operations, or regional land crossings. Understanding these mobility pathways can support targeted risk communication, occupational health preparedness, and event-based surveillance without resorting to blanket travel restrictions.

- Finally, measures should remain proportionate and should avoid unnecessary disruption or stigmatisation. WHO guidance has repeatedly emphasised risk-based measures at points of entry and has advised against broad travel or trade restrictions for Ebola outbreaks when such measures are not justified by the evidence.^{13,19} The objective should be to reduce the consequences of importation through rapid detection and response rather than attempting to eliminate international movement altogether.

Discussion

The central lesson from the Ebola experience is not that PoE screening is ineffective. Rather, its value depends on what the programme is designed to achieve and how it is connected to the rest of the surveillance and response system. Historical evidence from Ebola outbreaks between 2014 and 2020 demonstrates that direct case detection through airport and PoE screening was uncommon despite extensive implementation. In addition, the biological limitations of symptom-based screening mean that a substantial proportion of infected travellers will not be detectable at the time of screening.⁵⁻⁶

At the same time, screening can provide indirect benefits that are difficult to capture through simple case-detection metrics. These include traveller education, risk communication, awareness among transport operators, identification and referral of ill persons, collection of contact and travel information, linkage to monitoring systems, and visible demonstration of public health preparedness. These functions may be particularly important during an emerging outbreak when travellers and frontline staff require clear information about symptoms, exposure, and where to seek assistance.

The operational costs and opportunity costs must nevertheless be recognised. Large-scale screening can:

- divert personnel, equipment, and airport space;
- generate false-positive alerts;
- create delays; and
- divert resources from interventions with greater expected public health impact.

The appropriate response is therefore not to abandon PoE measures, but to calibrate them to risk and integrate them with stronger surveillance and response capabilities.

The recent evidence on international Ebola transmission reinforces this position. Historical exportation outside Africa has been rare, and sustained transmission outside Africa has been rarer still.¹⁸ This supports proportionate preparedness and argues against framing international spread as an inevitable consequence of an outbreak in Africa. It does not, however, remove the need for countries such as South Africa to maintain the capacity to detect and manage an imported case.

For South Africa, the most useful preparedness investment is therefore likely to be a connected system rather than a single intervention, i.e.,

- intelligence-led risk assessment;
- targeted PoE measures; airline notification;
- event-based and indicator-based surveillance;
- laboratory readiness;
- trained clinicians;
- safe referral and isolation pathways;
- contact tracing; and
- clear co-ordination between national, provincial, and port-of-entry authorities.

The effectiveness of airport screening should be judged within this system rather than in isolation.

Conclusion

Direct identification of confirmed Ebola disease at an airport has been uncommon. However, this should not be interpreted as evidence that screening had no public health value. PoE programmes can contribute indirect benefits such as traveller education, risk communication, and linkage to broader surveillance systems.

The 2026 Bundibugyo virus disease outbreak in the DRC and Uganda reinforces the need for preparedness in countries with epidemiological or travel connectivity to affected areas. At the same time, recent historical analysis indicates that sustained intercontinental Ebola transmission has been exceptionally rare, supporting proportionate and risk-based measures rather than broad travel restrictions or extensive screening programmes undertaken without a clear public health objective.

South Africa should therefore prioritise a layered preparedness system in which PoE screening is one component of a wider architecture that includes event-based and healthcare surveillance, laboratory diagnostics, airline notification, rapid response, contact tracing, and clinical preparedness. The objective is not to create the appearance of a sealed border. It is to ensure that if an infected traveller reaches South Africa, the system recognises the signal early, connects the traveller to appropriate care, and prevents onward transmission.

Conflict of interest

The authors declare that they have no conflicts of interest related to this work.

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