Rapid Risk Assessment: Yellow Fever Outbreak in South Sudan

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This document has been developed by the Gulf Center for Disease Prevention and Control (Gulf CDC) for the awareness of public health authorities within countries of the Gulf Cooperation Council. The rapid risk assessment provides guidance based on the information available to the Gulf Public Health Emergencies Network as of 01 Feb 2024

I. Background

(a) The Event

On 18 January 2024, the Gulf CDC detected a report of an outbreak of Yellow Fever in South Sudan. The report was published on 8 January 2024 by local media (1) based on the declaration made by the national Ministry of Health (MOH) on 6 January 2024 of a yellow fever outbreak in Yambio County. This declaration was made following the detection of one confirmed and five suspected cases. The confirmed case was an 18-year-old male who developed symptoms on 21 December 2023. Upon patient isolation, a sample was collected and tested at the National Public Health Laboratory and the Uganda Virus Research Institute (UVRI), confirming a yellow fever virus infection. In response to the outbreak, the MOH reported activation of its Public Health Emergency Operation Center and embarking on a mass vaccination campaign as well as initiating risk communication to the public and promotion of personal protective measures (e.g. urging bed net use) (2).

On 29 Jan 2024, additional cases were reported, raising the total count to 20 cases (19 suspected and 1 confirmed) and 5 deaths (25% CFR) in 3 counties of the Western Equatorial State: Yambio (n=10), Nzara (n=5), and Tambura (n=5) (as of 10 January 2024) Among the reported cases 70% (n=14) are males and 30 % (n=6) females; the median age is 26 with the range of 2-58 years. Six samples are undergoing serological testing at NPHL. The last suspected case was reported on 9 January 2024 showing that the outbreak is still active.

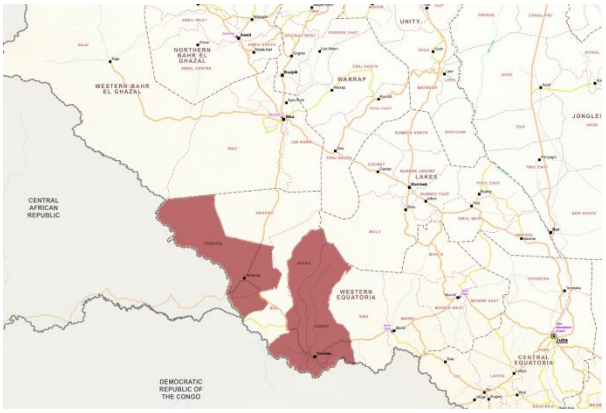

Figure 1. Map of counties in South Sudan the suspected cases of Yellow Fever are reported from (31 January 2024). Adapted from MSF General South Sudan reference map (12)

The Hazard

Yellow fever (YF) is a mosquito-borne viral illness caused by an arbovirus, yellow fever virus (YFV) of the family *Flaviviridae*, genus *Flavivirus*, encompassing positive-single-stranded RNA viruses.

The virus is spread to people by the bite of an infected mosquito. Mosquitoes able to transmit YFV belong to the *Aedes* spp. in Africa and *Haemagogus* spp. or *Sabethes* spp. in South America (3). Humans and nonhuman primates are the virus's primary reservoirs, and anthroponotic (human-to-vector-to-human) transmission occurs (3). YFV has three transmission cycles: jungle (sylvatic), inter-mediate (savannah), and urban. YFV is usually brought to the urban setting by a viremic human who was infected in the jungle or savannah (4).

The Incubation period for YFV is 3 to 6 days. Common symptoms include fever, muscle pain, headache, loss of appetite, nausea, or vomiting. In most cases, symptoms disappear after 3 to 4 days (4). The probability of being asymptomatic was 55%, whereas the probability of developing mild and severe diseases is 33% and 12%, respectively. In addition, the probability of death for people experiencing severe disease is 47%. A small percentage of patients enter a second phase, which is a more toxic phase, within 24 hours of recovering from initial symptoms. This causes high fever, and several body systems are affected, usually the liver and the kidneys. In this phase, people are likely to develop jaundice, dark urine, and abdominal pain with vomiting. Bleeding can occur from the mouth, nose, eyes, or stomach. The case fatality rate is 10% to 60%, occurring within 7 days of disease onset (3).

Diagnosis of YF relies on clinical features, travel history and exposure risk in an epidemiological context, such as recent travel to endemic areas or mosquito exposure. YF can be difficult to diagnose especially during early stages and deferential diagnosis in returning travelers include malaria, leptospirosis, hepatitis, dengue fever. However, definitive diagnosis requires laboratory confirmation, typically through testing for YFV-specific antibodies, YFV by isolation or YF viral RNA by real-time polymerase chain reaction (RT-PCR). Two blood samples must be sent to a reference laboratory for confirmation (5).

While there is no antiviral treatment for YF, vaccination is a highly effective method of prevention and is recommended for people living in or traveling to endemic areas. A single dose of the YF vaccine provides sustained immunity in over 99% of recipients (6). A booster dose of YF vaccine is not needed. In accordance with the International Health Regulation (IHR, 2005) (Annex 6,7), countries have the right to require travelers to provide a certificate of YF vaccination, particularly if travelling from regions where the virus is endemic or if they have recently been in a risk area

There is no specific anti-viral medication for YF. Treatment focuses on supportive care, including managing dehydration, addressing organ failure (liver, kidney), and preventing secondary infections.

II. Epidemiological Situation

(a) Latest outbreaks of yellow fever in South Sudan

South Sudan lies in the yellow fever belt and has reported the following outbreaks:

- March 2020: Two confirmed cases (no deaths) identified in Kajo Keji county, Central Equatorial State. Initial PCR testing showed negative, later confirmed positive by PRNT at Uganda Viral Research Institute.
- November 2018: Three confirmed cases (no deaths) were reported in Sakure payam, Nzara County, Western Equatoria State. A targeted reactive vaccination campaign was conducted.
- May 2003: a total of 178 cases with 27 deaths were reported in Imatong region, Torit County, Eastern Equatoria State. Targeted reactive vaccination campaign conducted.

Based on the latest WHO classification (revised on 3 January 2023), South Sudan is currently listed as a high risk country for yellow fever transmission (7).

(b) GCC Countries

No cases of yellow fever have been reported from GCC countries. However, the vector *Aedes Aegypti* has been detected in UAE, Bahrain, KSA (mostly in Jeddah and Jazan), Oman and Qatar (8,9).

III. Risk Assessment

(a) RRA Risk Question(s)

What is the risk of one case of YF being imported into the GCC Region from South Sudan in the upcoming 3 months, in terms of the likelihood and impact of the importation?

(b) Likelihood

The likelihood of importation of a yellow fever case from South Sudan into the GCC (through both direct and indirect routes) is **unlikely.**

Table 1. Forecasted number of travelers from South Sudan (Jan 2024) (BlueDot Data Portal, 2024)

GCC Country	UAE	Bahrain	KSA	Oman	Qatar	Kuwait
Forecasted number of travelers from South Sudan (Jan 2024)	1091	43	82	17	16	52

According to official IATA data on air travel and BlueDot's modeling projections, the forecasted number of travelers from South Sudan to each GCC country is low, except for UAE (Table 1). However, considering the current scale of the YF outbreak (and reported number of YF cases in South Sudan not linked to this outbreak) the projected likelihood (by BlueDot's model) of a YF case being imported into any GCC country from South Sudan in the next 30 days is 0%. South Sudan MOH reported that entry and exit screening is in place as all travelers are requested to present their YF vaccination card (1); however, the stringency of the policy implementation is unclear. An infected individual may enter the GCC through other indirect travel routes from South Sudan as well. As a member of the East African Community, South Sudan is a party to the free movement protocol and is a major transit hub on the route to Northern Africa (10). As such, migration (migrant workers, undocumented migrants, refugees etc.) travel through it regularly. YF outbreaks are also occurring in countries neighboring to South Sudan (11), such as the Central African Republic reporting 5 cases in 2023; increasing the likelihood of YF case importation to and exportation from South Sudan. Also, the current regulations of the GCC migrant screening program (Wafid) do not consider YF screening, including from high-risk countries.

(c) Impact

The impact of importation of YF case in the GCC countries is **moderate**. An infection with YFV could potentially lead to severe disease and death. Moreover, the GCC populations are vulnerable to the infection as nationals and long-term residents have not been vaccinated against YF (unless traveling to a high-risk country). Nevertheless, GCC countries are known to have robust vector control measures in place to combat mosquito-borne diseases. GCC countries generally have strong public health surveillance systems that can quickly identify and respond to imported cases of infectious diseases, limiting the potential for spread. All GCC countries have travel clinics providing advice and vaccinations to travelers to high-risk countries and have high capacities to tackle potentially imported YF cases. For example, Bahrain, Oman and Kuwait have established national capacities for YFV testing.

(b) Level of Confidence

The level of confidence in the assessment is **low**. The available data provides a reasonable basis for the assessment, but there is some uncertainty due to lack of information on the progression of the outbreak in South Sudan since its declaration and lack of information on the status of immunization of expat migrants in the GCC.

(c) Overall Risk level and statement

Risk assessed					
Negligible	Very Low	Low	Moderate	High	Extreme
*Based on the available data at this point of time, within the next 3 months, the overall risk of YF case importation in the GCC countries is assessed as **low**.*					
*The probability of YF importation in the GCC countries from South Sudan is **unlikely** due to the current scale of the outbreak, the limited direct travel links to GCC and the exit screening measures in place. The magnitude of the impact of YF case importation into the GCC on the general population is **moderate**, driven by low vaccination coverage in the GCC population, but high preparedness measures in place (e.g. vaccinations and diagnostic tests available). There is a **low** level of confidence due to lack of available data on the outbreak progression in South Sudan.*					

V. Recommendations

The GCC countries (particularly ones where *Aedes aegypti* is established or has been introduced*)* should consider the following recommended actions for strengthening preparedness to potentially imported cases from South Sudan:

1. Establish communication with the IHR focal point in South Sudan (and EMRO/AFRO IHR) to request updated information on the outbreak progression and exit screening measures;
2. Evaluate the national risk and need for temporary entry screening measures (*i.e*. implementation of yellow fever vaccination checks at airports for travelers coming from South Sudan or visited South Sudan within the last 14 days);
3. Advocate for pre-travel vaccination at least 10 days before travel to South Sudan or other high risk regions (except for infants under 9 months old).
4. Revision of the high-risk countries list used by travel clinics for recommending YF vaccination and ensuring inclusion of South Sudan. Based on the latest WHO classification (revised on 3 January 2023), South Sudan is currently listed as a high risk country for yellow fever transmission and is reported to have a mandatory requirement of proof of vaccination against yellow fever for travelers arriving from any country (7). As such, despite the current outbreak, South Sudan should have already been on the YF high-risk list of travel clinics in GCC and could be added now if it is not.
5. Contribute to the regional assessment of the feasibility and benefits of verifying the YF vaccination status both at centers registered with the GCC Wafid program in South Sudan and on major airlines traveling to and from South Sudan (or in high-risk countries classified by WHO). This action will support identification of migrants that require a YF vaccination and will ultimately support reducing the risk of spread in GCC.
6. Strengthen disease surveillance systems to quickly detect and respond to any imported cases of YF. For example, refer to WHO 2024 Laboratory Manual for YF: https://www.who.int/publications/i/item/9789240084476
7. Enhance vector control measures in high-risk areas to halt the possibility of introduction of YF by infected travelers.
8. Develop ready-to-disseminate risk communication materials that can be used when needed to raise awareness about YF, focusing on prevention and the importance of vaccination where appropriate.
9. Clinicians should consider yellow fever among travelers returning from affected areas of South Sudan.

VI. References

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VIII. Authors

Developed by:

Naif Alharbi, Lubna Al Ariqi, Leena Zeyad, Munira Aljohaim

Reviewed and validated by:

Gulf Public Health Emergencies Network (alphabetical*: Adel Al Sayyad, Amina Al Jardani, Amjad Ghanem, Emad El Mohammadi, Fatima Alalkeem, Fatma Al Attar, Ghada ALZayani, Hamad Bastaki, Hamad Alromaihi, Khalid AlHarthy, Soha Albayat, Shk. Mohammed Hamad Al-Thani, Nada Almarzouqi, Pasi Penttinen, Sabria Al-Marshudi, Sarah Alqabandi, Sondos Alqabandi*)