

YELLOW FEVER IN SUDAN

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Sudan Basic Information

- Sudan is one of the largest African countries, covering an area of 1.9 million km².
- The population is around 30 million people, the majority of whom (68%) live in rural areas.

Country Health Profile

- The epidemiological profile of Sudan, typical of other Sub-Saharan African Countries, is dominated by malnutrition and communicable diseases, frequently aggravated by natural disasters (floods, heavy rains and droughts) as well as sustained internal conflicts.
- The main causes of morbidity and mortality are infectious and parasitic diseases, particularly malaria, tuberculosis, schistosomiasis, diarrheal diseases, acute respiratory infections and protein-energy malnutrition.

Epidemics Profile

- Almost 80% of the population is exposed to malaria, and 8-16 million are at risk of malaria epidemics.
- Hemorrhagic fevers are a significant hazard e.g. Dengue and Chikungunya fevers in the eastern part of the country, Yellow fever in the Nuba mountains area and all the Darfur States.
- Other hemorrhagic fevers are also reported

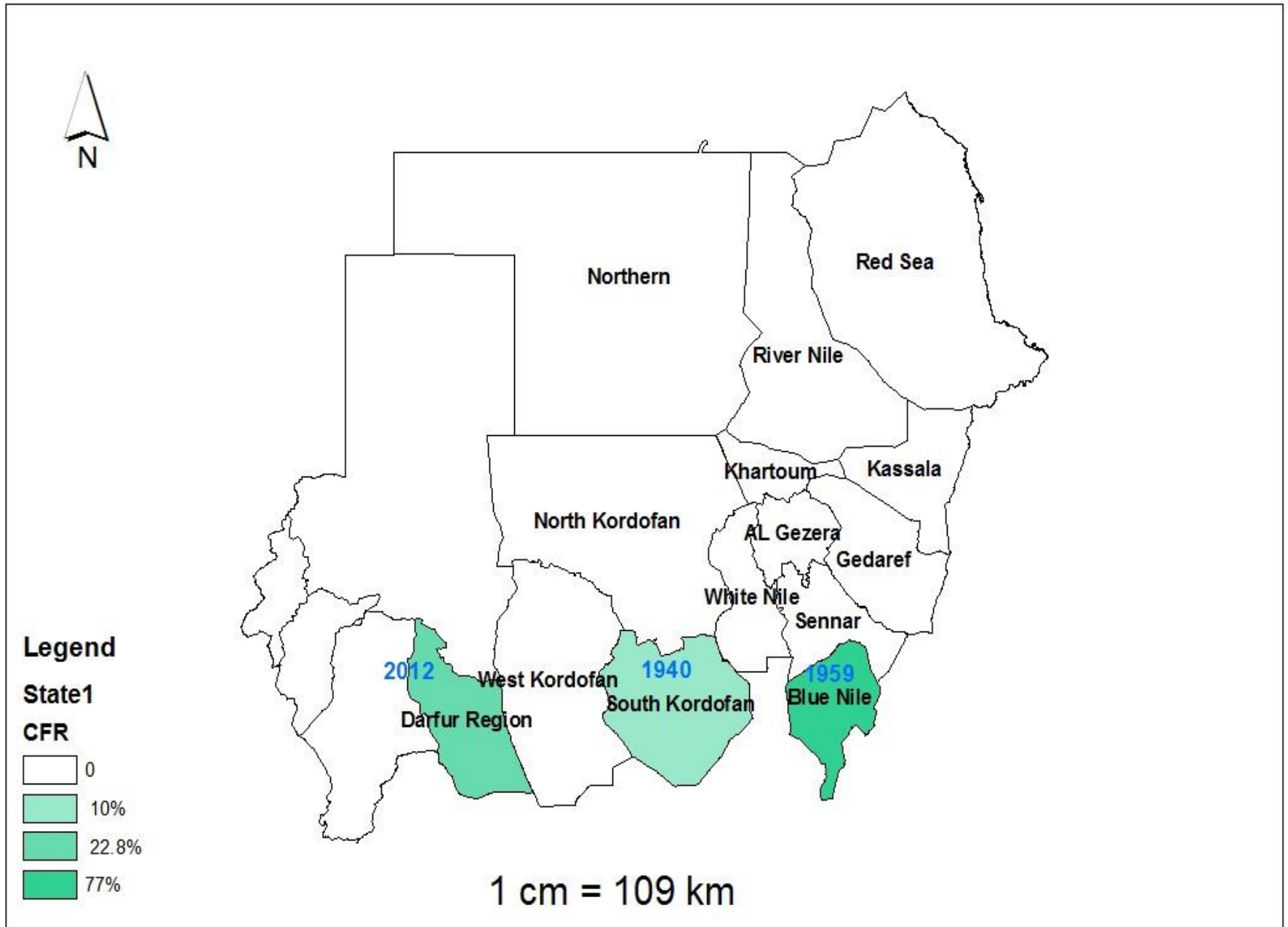


Yellow Fever in Sudan

History of Yellow Fever Outbreaks in Sudan

Year	Area	Cases	Deaths	CFR
1940	Nuba Mountains- S, Kordofan	15633	1627	10%
1959	Alfung- Blue Nile	114	88	77%
2003	Imatong-East Equatoria*	178	27	15%
2005	S, Kordofan	613	184	30%
2012	Darfur Region	732	165	22.5%
2013	West Kordofan	44	14	31.8%

History Of Yellow Fever Outbreaks in Sudan



S. Kordofan Outbreak, 2005



- According to the report of 20 September 2005, Dilling locality in South Kordofan was the first to be affected.
- In Rashad locality, the first case with a related death was reported with an approximate onset of the disease on 9 October.
- Most patients in Rashad were nomads.
- During October, the outbreak spread to Abu Gebiha, Kadugli and Talodi.
- By November, the outbreak had reached Lagawa and Abyei localities.

Confirming the Outbreak

- An outbreak investigation team was sent from the Federal Ministry of Health to the affected area to investigate the possible cause.
- 11 samples were taken and were tested;
 - Rapid test for dengue reactive for 3 out of 5.
 - ELISA for Dengue reactive in 3 out of 5
 - IFA for YF positive in 2 out of 5
- Possibility of YF notified to Epidemiology.
- 38 Samples referred to NAMRU₃ through WHO for confirmation

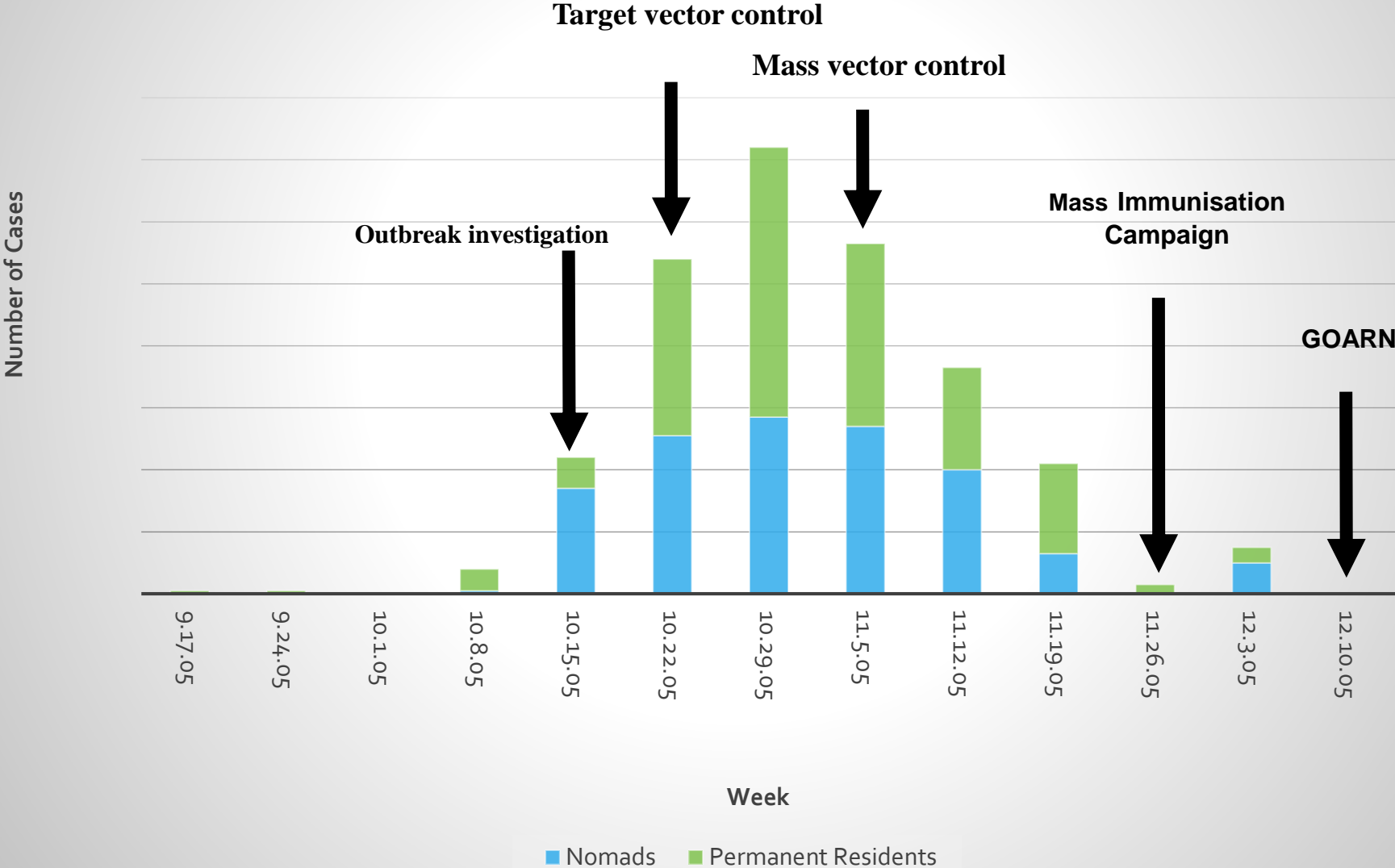
Affected population by Locality

State	Locality	Outcome		CFR
		cases	Deaths	%
South Kurdufan	Dileng	294	76	25.9
	Abu Jubaiyah	111	37	33.3
	Rashad	93	31	33.3
	Kadugli	65	22	33.9
	Talodi	34	14	41.2
	Lagawa	6	2	33.3
	Abyei	3	1	33.3
North Kurdufan	Sheikan	5	1	20.0
	Bara	1	0	0.0
	Gebaish	1	0	0.0
	Grand Total	613	184	30.0

Interventions

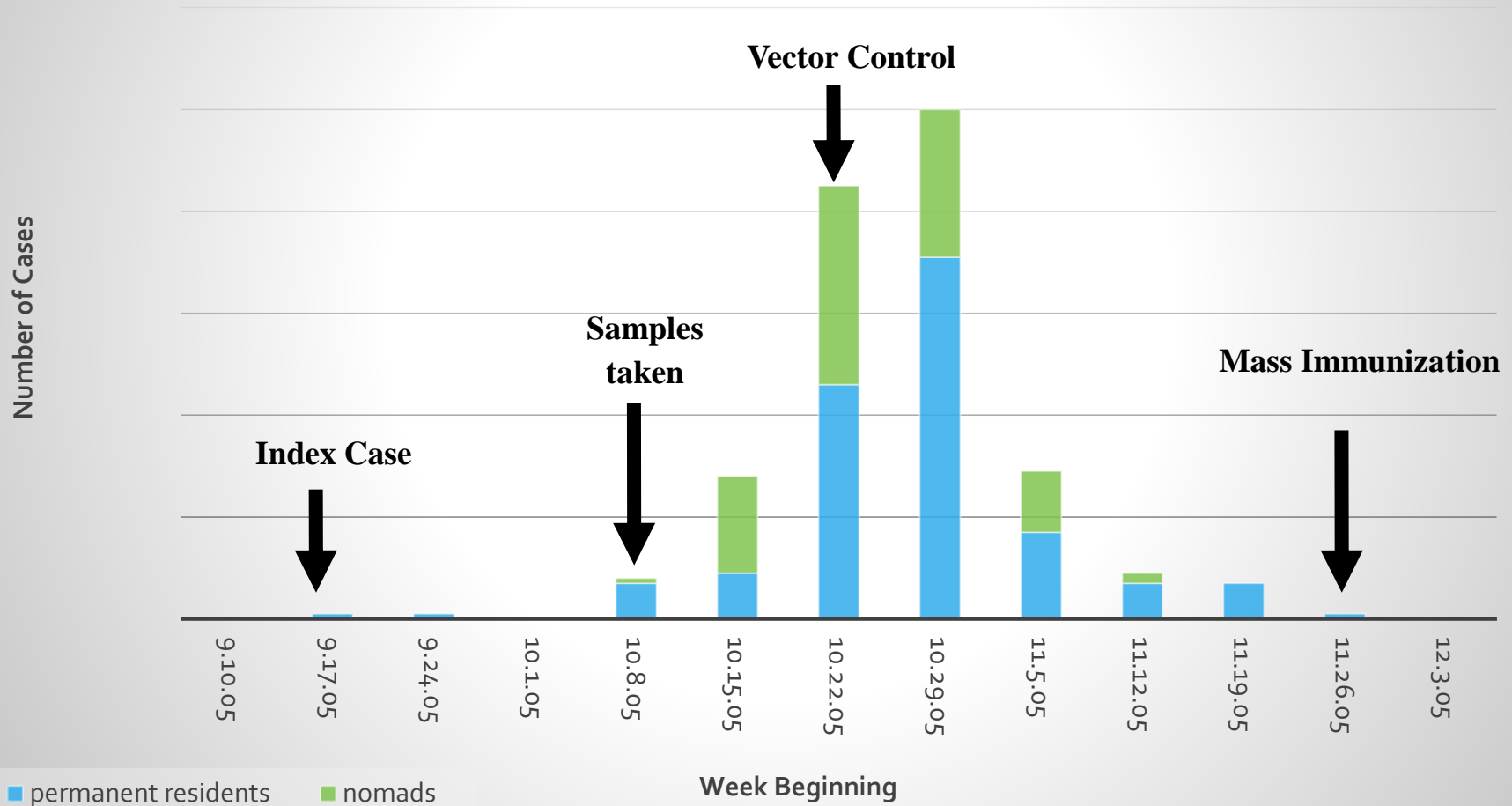
- Surveillance (reporting sites from 9 to 40)
- Case management
- Vector Control
- Mass Vaccination
- Health Education

Number of Cases of VHF in Nomads and Permanent Residents--South Korodofan, Sudan, 2005



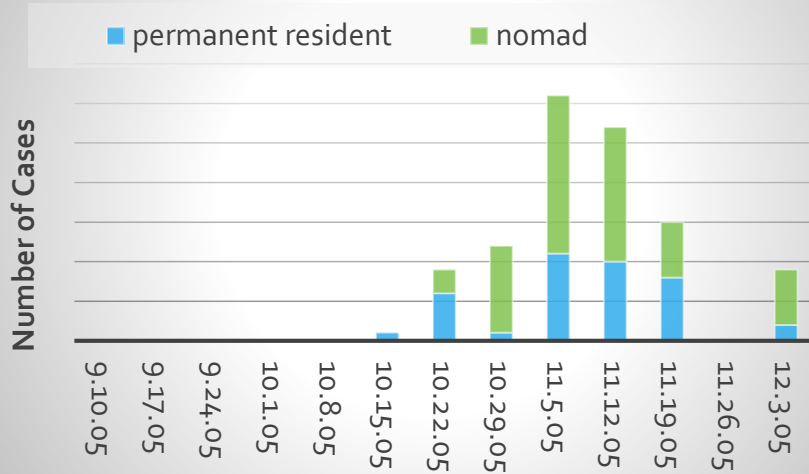
Epidemic Trends in Dilieng Locality

Number of Cases of VHF in Nomads and Permanent Residents--Dileng, Sudan, 2005

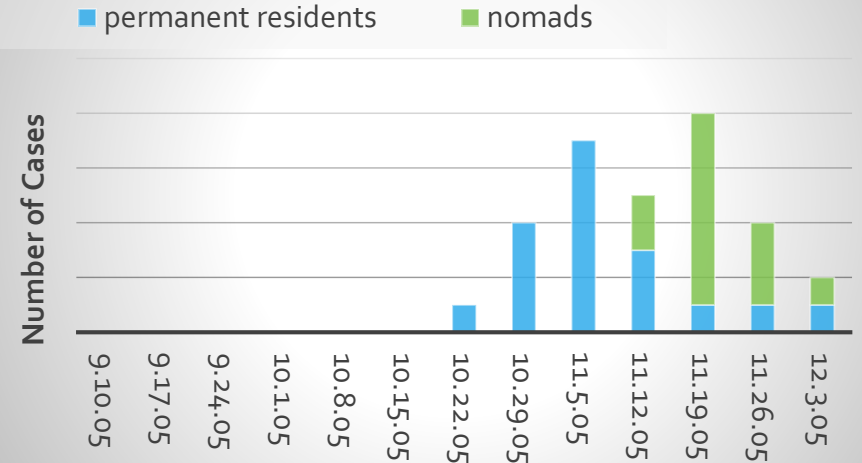


Epidemic Trends By Locality

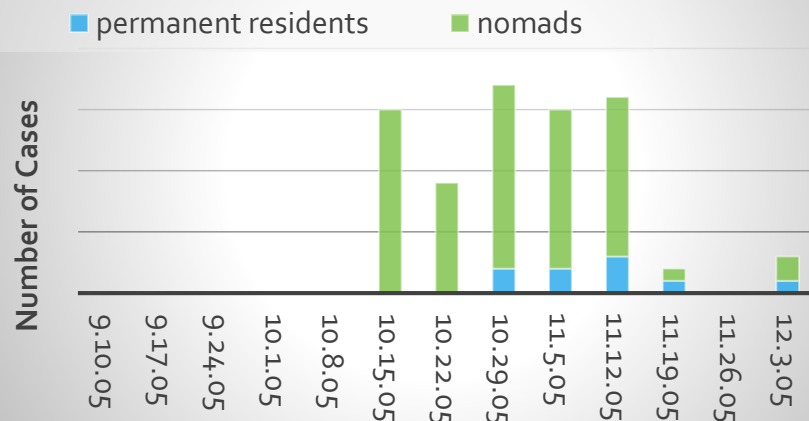
Abu Jubaiyah, Sudan, 2005



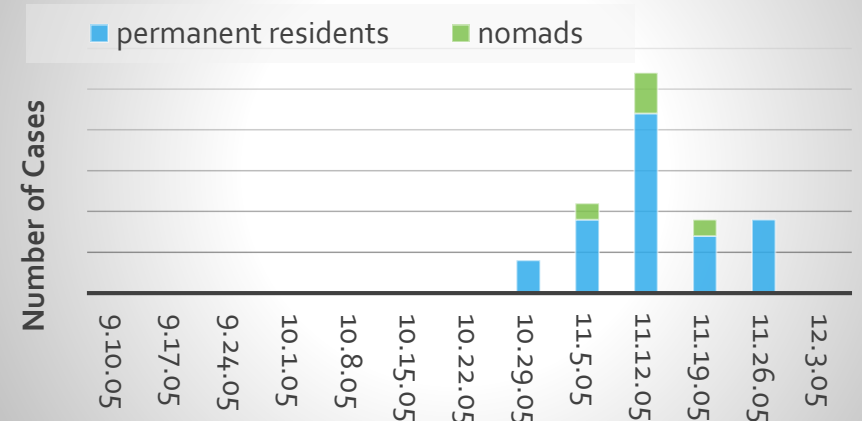
Talodi, Sudan, 2005

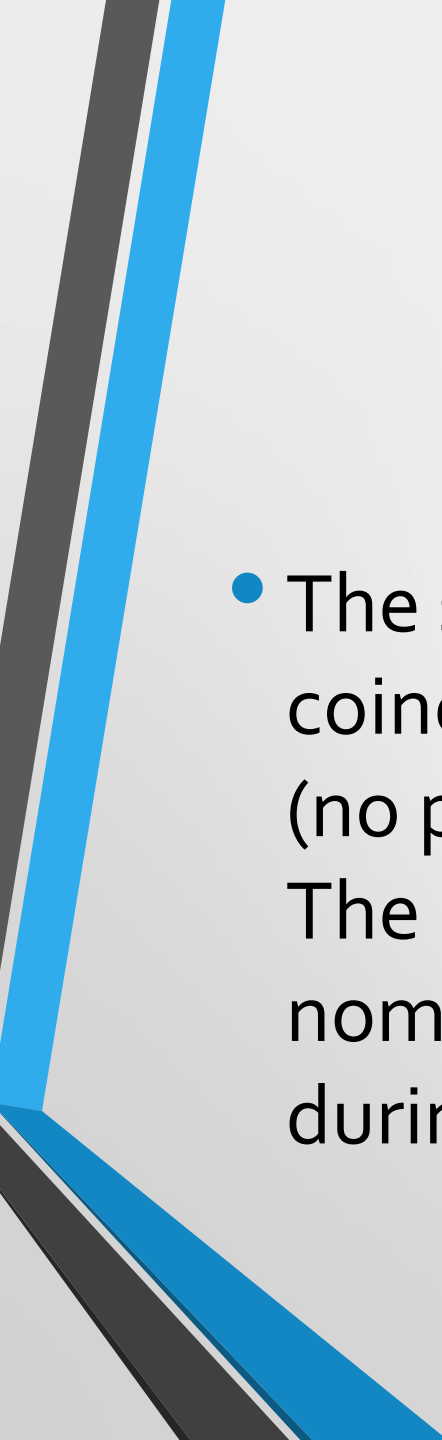


Rashad, Sudan, 2005



Kadugli, Sudan, 2005



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- The steady decrease of cases in November coincided with the end of the rainy season (no precipitations occurred in November). The Kortala community and the Shenabla nomads were the most severely affected during this outbreak.

Immunization Campaign

- The mass vaccination campaign was rapidly implemented and as of 18 December 2005, 1,473,349 people were vaccinated against yellow fever, which represents a coverage of around 91 percent according to population estimates of the State Ministry of Health.

The End of the outbreak

- During the second half of December, there was no further transmission of the disease in South Kordofan. This and the fact there was no evidence of the presence of the vector led to the conclusion that the yellow fever outbreak ended.

National Public Health Laboratory

1. Diagnosis of YF
2. Diagnosis of CCHF
3. Diagnosis of RVF
4. Diagnosis of DF

Tech. ELISA + IFA

PCR

Aftermath.....

- After that outbreak, the country was hit by another 2 major outbreaks in 2012 and 2013.
- WHO and the Ministry of Health have started the training programmes for more than 225 health staff in the affected localities on yellow fever surveillance, case management, outbreak investigation and infection prevention and control.
- The isolation wards in In Nyala Teaching Hospital has been operational since the first of November

Yellow Fever: Vaccination Campaign

Vaccination campaigns were conducted in the affected (Darfour region) area in phases:

- Phase one (2.178.403) were vaccinated
- Phase two (1.207.278) were vaccinated
- Phase three (2.100,000) were vaccinated
- Phase four (436.950) were vaccinated

Yellow fever vaccine proposed to introduce in the routine immunization (RI) in this year 2019

Yellow Fever Risk Assessment

- Following the containment of the YF epidemic in the Darfour States and in order to have a better understanding of YF viral activity in Sudan, the FMoH and its partner conducted a comprehensive risk assessment in December 2012.

Findings

- A total of 1775 humans were sampled and duplicate sera stored and transported to the lab for testing.
- Mosquito larvae were collected in only five sites and transported alive to the lab for rearing.
- Only 107 adult *Aedes aegypti* mosquitoes were caught in only three sites (two ecological zones), Port Sudan and Tokkar (zone 2) and Kosti (zone 4), stored in dry ice and transported to the lab.

Laboratory Findings

- The 1762 samples were received from the 8 selected sites, 21 samples were rejected because they were completely hemolysed and so only 1741 samples were valid for testing.
- For anti-Yellow fever virus IgM antibodies detection, 1686 samples were tested. Twenty two of these were found to be positive. Fifty five samples were left untested because of reagents shortage.
- For IgG antibodies detection 1507 samples were tested, of these 599 sera were positive. Two hundred thirty four samples could not be tested because the reagent was insufficient.
- Eight samples were found to be positive for both IgG and IgM.

Current Situation

There are many measures were taken by the ministry of Health to face recurrent outbreaks:

- Building strong partnerships;
 - *UN agencies; WHO, UNICEF, WFP, UNAMID*
 - *Robert-Koch Institute, Germany*
 - *London School of Hygiene and Tropical Medicine, UK.*
 - *Africa CDC*
 - *EMPHNET*

- Starting Field Epidemiology Training program; most trainees are coming from the states.
- Activating Emergency Operation Center.
- Conducting risk assessment for yellow fever.
- Strengthen different surveillance and emergency information systems;

- *Early Warning & Response System EWARs: is established early for Darfur*
- *Risk Assessment Mapping System*
- *Surveillance (Indicator-Based, Community –Based, Incidence Tracking System).*

Lessons Learned

According to the report of the risk assessment mission in 2012, the following are the recommendations:

- Include previous data, if they exist, of YF serological studies on Non Human Primates
- Describe the concentration and distribution on Non Human Primates susceptible to YF virus in the country
- Review all the entomological studies and give information concerning the YF potential vectors
- When possible, compare the serological results of humans, published in the scientific literature, with this survey
- Eco environment data may be included as information data

Challenges

- Inadequate financial resources for epidemic preparedness and control.
 - High Sensitive and low specific information flow of information with inadequate roamer analysis.
 - Low resources for data management in the peripheral level
 - Lack of well trained human resource in the field
 - Illiteracy, low awareness of reporting importance and lack of proper risk communication in rural areas.
 - WASH challenges
 - Limited resources for sample collection and transportation, with Limited laboratory network capabilities.
 - Limited access to conflict and low security Areas.
 - Frequent epidemics that lead to exhaustion and limited Post-Outbreak analysis.
 - High Turn over of staff
- Limited Information sharing among regional countries due to political differences.

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Onyango CO, Ofula VO, Sang RC, Konongoi SL, Sow A, De Cock KM, et al. Yellow fever outbreak, Imatong, southern Sudan. Emerging infectious diseases. 2004;10(6):1064



Thank You