

# Yellow fever in Nigeria

## Summary of past, present and possible future status

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### 1. RELEVANT RECENT PAST HISTORY.

Prior to 1969, epidemic yellow fever had not been recognized in Nigeria since 1952-53 although unconfirmed sporadic cases were reported in 1957. In 1951 and again in 1969 extensive epidemics occurred on the Jos Plateau, the latter confirmed, the former presumed to be caused by y.f. At the same time as the epidemic of « plateau jaundice » in 1951, an outbreak of confirmed y.f. occurred in East Central (EC) State (at Ngwo). By analogy, in 1968 and 1970 there was clinical and serological evidence for y.f. activity south of the Plateau (in Makurdi and in EC State), lending support to a theory of northward dissemination of y.f. virus from endemic foci in Eastern Nigeria.

When a period of amplified endemicity accounts for one epidemic, the likelihood of continued epidemic episodes with the following year's rains is increased. The 1951 epidemics were followed in 1952-53 by recurrent activity (in Ufuma, EC State); similarly, the 1969 Jos Plateau outbreak was followed a year later by an epidemic in Benue Province, South of the Benue R. (Okwoga District).

#### 1.1. The 1969 Jos Plateau Epidemic.

The 1969 epidemic first became apparent in September, though cases may have occurred as early as July. The epidemic peaked in late October; no cases were seen after December. Cases occurred only in rural areas on the geographical plateau and in herding areas of North East (Lere, Zagon, Katab, and Jemaa Districts) and North East (Jarawa, Lere, Dass Districts in Benue Province) States. Review of hospital records at 7 hospitals revealed a total of 307 patients with a diagnosis of y.f., hepatitis, or jaundice between 7 Sept. and 31 Dec., with 116 deaths. Most

were young adults and males outnumbered females 4:1. Serum surveys at Du and Gindiri, areas from which cases were confirmed, showed evidence for recent y.f. infection in 7 and 17 % of those sampled respectively (Table 2). A total of 55 hospitalized cases were confirmed as y.f. including 17 by virus isolation, but the total morbidity in areas affected probably included many thousands of cases. *Ae. luteocephalus*, and possibly other stegomyias, were thought to be involved (Table 3); the ubiquitous *Euphorbia* hedges providing numerous oviposition sites, are a unique ecological feature in this part of Nigeria.

### 2. PRESENT YELLOW FEVER ACTIVITY :

#### The 1970 Okwoga Epidemic.

During the last 3 months of 1970 another, geographically and numerically more limited epidemic occurred in Nigeria, in Okwoga District (Idoma Division), 30 mi. SW of Oturkpo (7° N 7° 45' E) (see map). This was also a rural outbreak, associated with wild-breeding mosquitoes, most likely *Ae. africanus* (Table 3). The onset of the epidemic was in October and the peak in November, with few or no cases in Jan. 1971 (Fig. 1). Three villages (Okwoga, Okpudu, and Aidogodo) seem to have been most severely affected. In 2 of these (Okwoga and Aidogodo) surveys indicated infection rates of 21 and 41 per 100 respectively; most infections were clinically apparent (Table 4). Children 0-9 were less often infected (13 %) than adults (26 %) (Table 4). There was no sex difference in infection rates or history of illness. Correlation between serological diagnosis and a history of illness was good (Table 4), but other diseases, including hepatitis were also prevalent in the area. On the basis of the serology and house-to-house surveys, an estimated 550

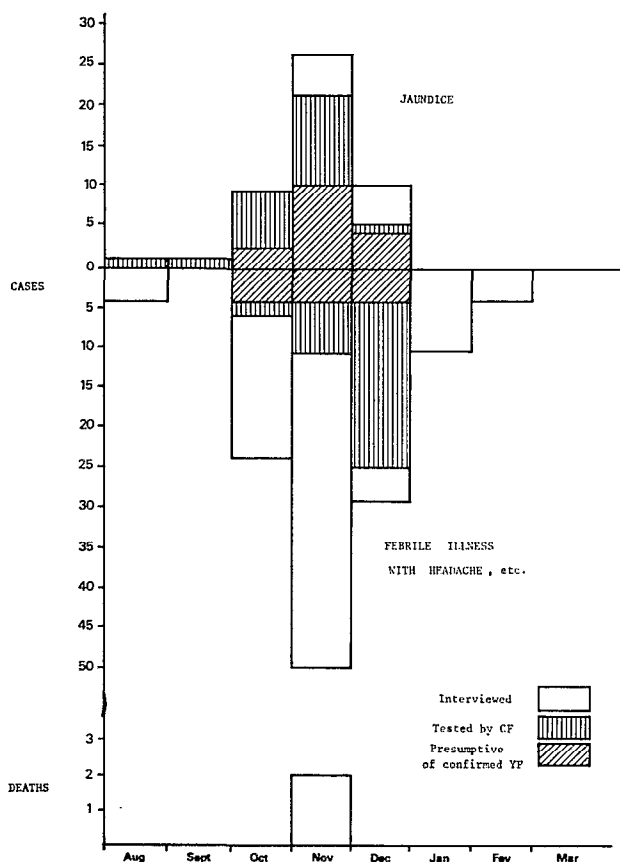
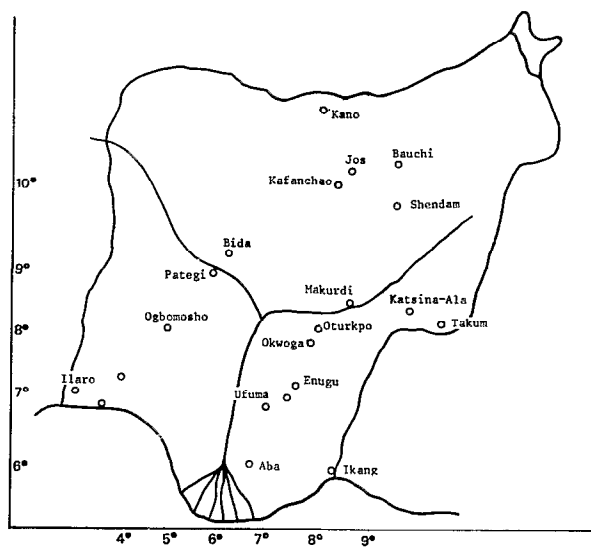


FIG. 1. — Epidemic curve for Okwoga and Aidogodo villages

clinical cases occurred in Okwoga and Aidogodo alone, with a cases-fatality ratio of 1.4%. The total number



bered over 1000. In all, 69 cases were presumed or confirmed to be y.f. on the basis of serology or virus isolation (Table 5).

### 3. SEROLOGIC SURVEYS.

Serologic surveys as an indicator of y.f. activity or of the susceptibility of population groups has not been especially helpful, mainly because of the problem of serologic specificity. A review of data obtained in surveys during 1955-71 is given in Table 2. Conflicting results exist with regard to y.f. immunity in Western Nigeria. There is some evidence for rural endemi-

TABLE I. — Summary of recent epidemic yellow fever in Nigeria

Date	Locality	Morbidity		Mortality		Vector
		Estim.	Recorded (Confirmed)	Estim.	Recorded (Confirmed)	
1946 (June)	Ogbomosho	Thousands	60	Low	10	<i>Ac. aegypti</i>
1951-52 (Oct.-Jan.)	Ngwo	5 500	13	600	8	?
1951 (Oct.-Nov.)	Jos Plateau	Thousands	—	600 +	—	?
1952-53 (Dec.-Jan.)	Jos Plateau	2 000	12	Low	—	?
1969 (Sept.-Nov.)	Ufuma	Thousands	252 (55)	—	116 (15)	? <i>Ae luteoc.</i>
1970 (Oct.-Dec.)	Okwoga	1 000 +	(69)	25 +	2	? <i>Ae. afric.</i>

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hyperendemic in Guinea savannah zones in B/P, Western, and Mid West States, but less so in South East State, in the forested zone near Cameroun.

4. FUTURE POTENTIAL FOR EPIDEMIC SPREAD.

The presence of epidemic y.f. affecting all age groups in the Guinea woodland area S. of the Benue R. in 1970 and the low levels of y.f. N antibody in samples from Katsina-Ala and Takum (Table 2) indicate that rural areas in Benue Province and adjacent Kwara State and Northern South East State are susceptible to epidemic incursions in 1971 should the virus be present and ecological factors favorable. It is unli-

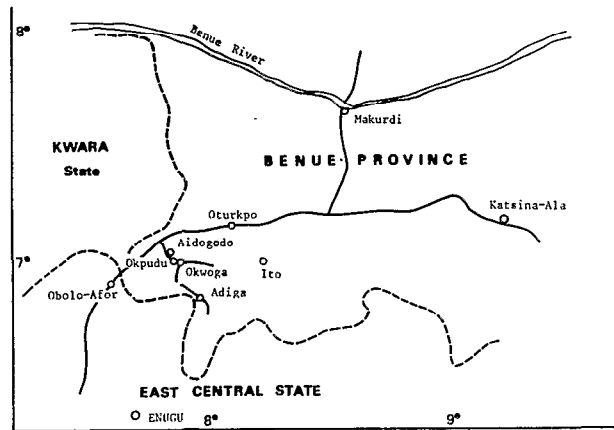


TABLE II. — Summarized results of serological surveys in Nigeria 1955-71

Reference	Source	Year	Locality	Age	Test	No. tested	YF (+)	Gp.B (+) (%)
Yaba (MacNamara) .....	Human	1955	Ilaro	< 17	N	97	4 ( 4.1)	60 (62.0)
				< 15	N	96	1 ( 1.0)	48 (50.0)
				> 15	N	111	2 ( 1.8)	105 (95.0)
Yaru (Casals) WHO Yaws Survey	Human	1965-66	Berue Plateau State	0-9	HI	295	6 ( 2.0)	83 (28 )
				10-19	HI	134	0	51 (38 )
				20 +	HI	372	6 ( 1.6)	305 (82 )
				All	CF	82	0	18 (22 )
Dakar (ROBIN and MARTIN) WHO Yaws Survey	Human	1966-67	Mid-West	< 15	HI	171	7 * ( 4.1)	43 (25 )
				> 15	HI	87	2 * ( 2.3)	48 (55 )
			West	< 15	HI	160	10 * ( 6.3)	69 (43 )
				> 15	HI	90	4 * ( 4.5)	74 (82 )
Ibadan .....	Galago	1965-68	North		N	31	3 ( 9.7)	1
					HI	(N +)	0	
	Baboon Monkey	»	Bauchi		N	2	1	
				Mostly West		N	22	6 (27 )
					B-ssa (nr. Jos)		N	7
Ibadan .....	Human	Nov. 1965	Du	< 15	CF	77	3 ( 4 )	
				> 15	N	75	5 ( 7 )	
					CF	98	9 ( 9 )	
					N	100	14 (14 )	
					N	166	28 (17 )	
	Human	»	Gindiri	15-34	CF	174	29 (17 )	
					N	15	0	
					N	17	2 (12 )	
					N	6	0	
					N	15	1 ( 7 )	
Ibadan .....	Human	1970	Ibadan	15-30	N	213	32 (15 )	
				< 15	HI	24		
				> 15	HI	31		
	Human	1971	Ikang (Cameroun bord.)	< 20	CF	4	0	
				> 20	CF	22	4 (18 )	
					CF	22		
C.D.C. ....	Human	1970	Dorra (NW State)	< 15	N	352	1 ( 0.3)	

kely that these areas contain large endemic foci, since vectors are absent during the dry season. The large towns and cities on the periphery of suspected endemic areas in EC State are also potentially at risk (e.g. Enugu, Onitsha, Abakaliki). However, other population centers, such as Ibadan, with high *Ae. aegypti* indices, are also at risk due to the free movement of persons in Nigeria. Areas affected during the Jos Plateau out-

less than 50 %.

5. SURVEILLANCE.

Surveillance based on submission of diagnostic specimens from hospitals has been in effect since August, 1970. A total of 98 specimens on jaundiced cases were received at the Ibadan laboratory for testing (Table 6). Hospitals submitting specimens were mostly from Northern Nigeria. One case of yellow fever was detected by this method. This was a 25 y.o. woman from Doko District, S. of Bida, near the Niger R.

from this same area (Pategi) occurred in Dec., 1969. The area is ecologically somewhat distinctive, and bears further study as as possible endemic focus.

Hospital surveillance is inefficient because persons in remote rural areas rarely reach hospital. The Okwoga epidemic in 1970 did not result in a single suspect case being hospitalized at Oturkpo only 30 miles away by good roads. Epidemic surveillance must depend on reports from the same local medical units (dispensaries, primarily) in remote areas. Such a system is being established in Benue Plateau State at present.

Prospective human serology is now also being used in selected population groups in B/P, EC, and SE States as a tool for detecting endemic y.f.

Surveillance of vectors is currently being done only in Ibadan.

Primate collections are spotty and efforts should be intensified. However, because of the small populations involved throughout most of Nigeria, it is unlikely that vector endemicity could depend on a mass

TABLE 3. — Summary of entomologic investigations (D<sup>r</sup> V. LEE)  
1. Jos Plateau epidemic

Species	Oct-Nov. 1969		April 1970		June 1970		Aug-Sept. 1970	
	Larvae	Adult	Larvae	Adult	Larvae (2)	Adult	Larvae (3)	Adult
<i>Ae. aegypti</i> .....	+ (1)	10	+ (1)	0	+	220	+	76
» <i>africanus</i> .....	0	10	0	0	+	42	+	57
» <i>luteocephalus</i> .....	0	354	0	0	+	239	++	687
» <i>simpsoni</i> .....	++	1	0	0	+	3	±	7
» <i>vittatus</i> .....	+	36	+	0	+	250		16
» <i>unilineatus</i> .....	0	0	0	0	0	0	0	0
» (Steg.) spp. ....		35						
» <i>dentatus</i> .....	0	54	0	0	0	22	0	318

- (1) Domestic sites.
- (2) Tree holes, *Euphorbia*.
- (3) *Euphorbia* only.

Virus isolations

Date	Source	Yf	Virus Zika	D II
Nov. 69 .....	<i>Ae. luteocephalus</i>	0	2	1
	<i>Ae. (St.) spp.</i> *	1		

\* Probably *Ae. luteocephalus*.

2. Okwoga epidemic (Aidogodo Village)  
No *Ae. aegypti* immatures present in domestic oviposition sites

Date	Source	Species (Immatures)		
		<i>Ae africanus</i>	<i>Ae simpsoni</i>	Other Ae (Non-Steg.)
28-29 jan. 1971	Bamboo stumps	+	0	+
»	Artif. flooded bamboo st.	+	+	+
»	Artif. flooded tree holes	+	0	+

TABLE 4. — *Préliminary sérological résultats: Okwoga epidemic*  
*Infection rates by locality*

Village (popln.)	No Tested	No. CF (+)	No. (+) w/illness	Overall Infection rate (/100)	Clin. Apparent Infection rate (/100)
Okwoga (200) .....	116	24	15	21	13
Aidogodo (1.530) .....	71	29	24	41	34
Adigo (825) .....	38		1	16	3
Ito (1 180) .....	40	5	1	13	3
Obolo-Afor .....	28	1	1	4	4

*Age-specific infection rates*

Village	Age	No Tested	No. CF (+)	No. (+) w/illness	Overall Infection rate (/100)	Clin. App. Infection rate (/100)
Okwoga et Aidogodo .....	0-9	61	10	8	16	13
	10-19	46	15	10	33	22
	20 +	80	28	21	35	26

*Relationship between history of illness and presence of CF antibody to YF*

Village	No illness		Jaundice		Other illness		Total	
	Tested	CF (+)	Tested	CF (+)	Tested	CF (+)	Tested	CF (+)
Okwoga .....	92	10 (11 %)	21	13 (62 %)	3	1 (33 %)	116	24 (21 %)
Aidogodo ...	22	5 (23 %)	16	9 (56 %)	33	15 (46 %)	71	29 (41 %)

Relationship of clinical illness to type of serologic reaction

Clinical Group	No. Tested	CF (+)	
		Primary *	Secondary **
Not ill .....	113	12	2
Jaundiced .....	37	14	8
Other ill. ....	37	16	
	187	42	11

\* Primary type serologic reaction, specific for YF.

\*\* Secondary, anamnestic type reaction (superinfection in person previously exposed to a Gp. B arbovirus) (10/11 persons in the group are adults over 20).

TABLE 5. — Laboratory diagnosis of yellow fever (Okwoga epidemic)

	Négative (1)	Inconclusive (2)	Presumptive (3)	Confirmed	
				Serology (4)	Virus (5)
Okwoga .....	76	14	19	6	1
Okpudu .....	0	0	0	1	1
Aidogodo .....	33	8	26	4	
Adiga .....	19	8	4		
Ito .....	26	15	5		
Obolo-Afor .....	25	1	2		
	179	46	56	11	2

(1) CF < 8 in single convalescent or in paired sera.

(2) CF ≤ 16.

(3) CF ≥ 32 in single convalescent or in paired sera showing no significant change in titer.

(4) Four-fold (or greater) CF titer rise or fall between paired sera.

(5) Virus isolated by ic inoculation undiluted serum into SM, identified as YF by CF.

TABLE 6. — Yellow fever hospital-based surveillance in Nigeria 1970

State	Hospital Submitting Specimens	Single Conval. Sérum	Paired Sera	Liver
Benue-Plateau .....	Jos (Genl. Hosp.)	3	43	1
	(Evangel)	2	1	
	Vom	2	9	
	Gboko (Mkar Hosp.)		7	
	Makurdi		1	
North West .....	Bida	1	13	
	Sokoto		1	
North East .....	Bauchi	4	2	
North Central .....	Kafanchan	1		
Kwara .....	Ilorin	1		1
Kano .....	Katsina		1	
East Central .....	Asaba	6		
	Abakaliki			1
		20	78	3

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*Laboratory diagnostic (serology only)*

Serologic Interpret.	Jos (2 Hosp.)	Vom	Gboko	Bida	Bauchi	Asaba	Other	Total
1. Yellow Fever Infection..				1				1
2. Recent Gp. B or YF infec. of ? rel. to current ill. ..	3				1			4
3. Gp. B infec .at some un- deter. time in past, not rel. to current illn. ....	13			3	1	1	1	19
4. Negative .....	30	11	3	9	4	5	3	65
5. Inconclusive .....	3		4	1			1	9
	49	11	7	14	6	6	5	98