LAGOS COMMUNITY PARTNERS FOR HEALTH.
MALARIA RAPID ASSESSMENT

January 29-February 10, 1998

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This was a joint effort and report between
the Environmental Health Project
and the BASICS Project

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## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tr>
<td>BASICS</td>
<td>Basic Support for Institutionalizing Child Survival</td>
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<tr>
<td>CPHs</td>
<td>Community Partnerships for Health</td>
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<tr>
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<td>Environmental Health Project</td>
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<td>Focus Group Discussions</td>
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<tr>
<td>KAP</td>
<td>Knowledge, Attitude, and Practices</td>
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<td>Malaria Rapid Assessment</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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PART ONE

I BACKGROUND

The BASICS Urban Private Health Sector Project in Nigeria focuses on improving child health services and home health practices in under-served, high-risk urban communities. This three-year USAID-funded project’s goal is to improve the maternal and child health practices in six neighborhoods with relatively low socioeconomic status and high public health needs. By strengthening the quality, outreach, and management of urban non-profit health services, this project aims to increase the number of private sector organizations delivering low cost, high quality health care to low-income families. This community-based project aims to mobilize a variety of commercial and nonprofit health facilities in partnership with existing religious, social, and occupational organizations. Key results to date have been the establishment of partnerships called “Community Partnerships for Health” (CPHs), identification of each community’s health priority problems and baseline data, and preparation of community interventions. The results will be stated in terms of process indicators, not in quantitative terms.

Prior to the implementation of activities, BASICS completed a country activity plan (CAP) and submitted a proposal to USAID/Nigeria for the Lagos Private Sector Child Survival Project. BASICS also conducted an “Urban Private Sector Inventory” (UPSI) to identify the existence of private sector resources potential Lagos health facilities and community-based organizations that could serve as partners to BASICS for the implementation of child survival activities. In addition, BASICS also initiated the development of a national integrated health baseline survey administered by USAID. The data collected provides baseline information on health practices in the home and service utilization patterns for care sought outside the home.

The formation of CPHs has encouraged well established, community-based organizations that do not ordinarily provide health services to mobilize to improve the health status of their community’s children. Immediately upon their formation, community action programs were initiated in target neighborhoods. One example is the establishment of preventive measures against malaria, perceived as an important problem in the area. CPH members used environmental sanitation days in their neighborhoods to clean up raw sewage—what they presumed to be a breeding area for mosquitoes, and by extension, a cause of the “malaria” they believed existed in their communities.

No systematic effort has been instituted to define or describe the malaria problem in the community, i.e., if it truly is malaria, and if it is indigenous, (contracted locally) or imported (contracted when people visit rural areas). Nor has there been a systematic effort to survey malaria vectors and associated environmental factors in these communities. Without the ability to collect this information, the CPHs cannot develop appropriate malaria control strategies, or indeed know if a strategy is even feasible or required. (Cleaning up raw sewage is good in the efforts against diarrheal diseases, but these polluted water bodies are probably not breeding sites for malaria vectors, and so the effort would have little impact on malaria prevalence.) There is a
need for BASICS, in collaboration with EHP, to assist the CPHs in collecting and interpreting information needed to choose appropriate malaria control efforts

II OVERALL GOAL

The CPHs, in collaboration, define through a rapid assessment the overall prevalence, distribution, and associated socio-behavioral, demographic, and environmental factors related to malaria and its transmission in urban Lagos. They then use this information to formulate an appropriate CPH malaria prevention and control strategy within the context of BASICS' overall child health improvement programs in the community.

III ACTIVITIES/TASKS

A Review background materials related to the overall activity

B Discuss overall health care partnership strategies in Lagos and BASICS/USAID expectations with BASICS/Headquarters and Nigeria staff, the USAID Mission in Lagos, and the existing local project team.

C Hold team planning meetings and meet with the relevant partners, institutions, and individuals to establish an initial understanding of the overall environment, including population distribution, community and commercial characteristics, and available cartographic maps, as well as GIS and other databases, including environmental- and health-related data.

D Establish personnel requirements within the context of availability in the BASICS team and identify short-term local consultants, which may include a malaria proficient parasitologist with epidemiology training, an entomologist or field entomological assistants, a social scientist with anthropological skills, a nursing/public health/environmental health professional, and a data analysis and statistical person with computer skills in mapping/GIS.

E Adapt the following assessment process to the Lagos context.

F Conduct a preliminary survey of the project area and develop an overall survey design and health profile of the population to include the target population, create a sampling scheme (with a sampling frame, sample size, and age distribution).

F Establish a detailed work plan with time frame, levels of effort, and a project design with objectives, expected outcomes, and indicators.
G Collaborate with the CPHs to conduct a rapid assessment of the malaria situation (an overall level of effort could be a time frame of 35 field days with a team of 8-10 persons) with the following elements

- Human A demographic profile of the areas, including population and a socio-anthropological assessment of malaria KAP and beliefs

- Vector Environmental and entomological assessment(s), including localization of malaria vector breeding sites

- Parasitic Prevalence of parasitemia, verification of clinical diagnosis, interviews with suspected cases, and localization of suspected place of infection

H Map information on the above three factors both on wall maps in the CPH offices and using preexisting digitized base maps to analyze and display with a computerized Geographic Information System (GIS), establish indicators

I Complete processing and data analysis of the data (preliminary analysis will be done daily by the teams as information is collected)

J Define risk factors for local transmission and through a workshop of all partners, present and discuss the survey results and proposed recommendations for intervention strategies

K Generate a detailed plan of action for malaria prevention/control

IV PRINCIPAL PRODUCTS

The principal products of this activity are a baseline profile of the survey area, including localization of malaria and environmental factors associated with transmission, and an integrated plan of action for malaria prevention/control based on the above

V LOGISTICS

A Schedule

January 1998 During the initial visit to Lagos of 7-10 days, the activity manager will meet with BASICS and USAID staff to assess the field situation and institutional capability, identify the personnel and resources, develop a detailed scope of work and time frame, and introduce the study design and data collection instruments
March/April 1998  Following this first mission, the field project manager will visit for up to 35 days, and with the CPHs, finalize the design and begin data collection and preliminary analysis. The activity manager may also visit for 7-10 days during this second phase of the project, depending on need.

May/June 1998  After the preliminary data analysis has been completed, the activity manager and the field project manager will return to Lagos for 7-10 days to present the data and, with all relevant partners, develop an integrated intervention strategy within the context of the BASICS child health improvement program.

B  Personnel Required

Activity Manager  will have a broad range of inter-disciplinary skills in tropical disease prevention (including malaria) with African urban experience to provide the overall direction and vision to the activity. Level of effort  2 or 3 visits + Washington time = 30 days (up to 20 days in field).

Field Project Manager  will have extensive field experience in interdisciplinary studies in tropical diseases, including urban health and malaria. The field project manager will also have experience in team leadership, report preparation, and data analysis. Level of effort  1 or 2 visits + Washington time = 50 days (up to 45 days in field).

Local consultants  As outlined in section 4 above, these may include persons with social science, parasitology, entomology, environmental health, data analysis, and/or mapping experience. Level of effort  60 days—may be via BASICS (Nigeria) and not a budgetary item.

C  Other Costs

Other direct costs  communications, etc., laboratory and field supplies, supplementary GIS mapping resources as needed for local institution, transportation—local as well as international to and from Lagos.
PART TWO

After the completion of tasks A-F that were outlined in Section III, the author developed the specific scopes of work necessary for the activity, along with the level of effort and the personnel required

VI SCOPE OF WORK (A) DEMOGRAPHY AND MAPPING

No systematic effort has been instituted to define or describe the malaria problem in the community, i.e., if it truly is malaria, and if it is indigenous, (contracted locally) or imported (contracted when people visit rural areas) Nor has there been a systematic effort to survey malaria vectors and associated environmental factors in these communities. Without the ability to collect this information, the CPHs cannot develop appropriate malaria control strategies, or indeed know if one is even feasible or required (Cleaning up raw sewage is good in the efforts against diarrheal diseases, but these polluted water bodies are probably not breeding sites for malaria vectors, and so the effort would have little impact on malaria prevalence.) There is a need for BASICS, in collaboration with EHP, to assist the CPHs in collecting and interpreting information needed to choose appropriate malaria control efforts

A Purpose of Activity

In order to determine accurately the association between the distribution of malaria-carrying mosquitoes and environmental variables, and in order to determine a link between endemicity of the disease and the quality of the environment, detailed mapping of each CPH area will have to be carried out

B Personnel Required And Their Tasks

A A qualified cartographer/town planner will be responsible for the detailed survey and updating of the maps already drawn (Mr Ogunleye JF, a senior lecturer in The Polytechnic, Ibadan, Nigeria. He will be needed for 20 working days. He will have an assistant who is a geographer, familiar with town planning. The assistant will be needed for 15 days (local hire) Their tasks will include—

1 Carrying out a detailed survey of the project CPA areas—

   a noting and recording all swamps, lakes, streams, rivers, and other water areas
   b noting and recording all markets, health facilities, and the diagnostic laboratories
   c sketching all the housing areas, open areas, and road networks

2 Mapping all the entomological information produced by the other teams
B A specialist in Geographic Information Systems (GIS) will be responsible for digitizing all the maps produced by the cartographer. He will be responsible for linking all the data with the GIS. He will be needed for 20 days (local hire).

C Products/deliverables

Their assignments will be to produce maps of the following:

1. Distribution of all swamps, streams, rivers, and other water surfaces in all the project’s CPH areas
2. Distribution of markets, health facilities, and all laboratories in the affected CPH areas
3. Housing areas, open or undeveloped areas, and road networks
4. GIS maps of 1-3 above

All these activities will be coordinated by BASICS’ M&EPO, and all consultants will work under his supervision.

D Supplies And Resources

1. Tracing paper, copying, and printing
2. Cartographic equipment
3. Digitizer (en route)
4. Updated computer for all GIS software

VII SCOPE OF WORK (B) SOCIOLOGY AND ANTHROPOLOGY

Each CPH developed a work plan which included this objective: Reduce the number of children and pregnant mothers getting sick from malaria (in the community, and/or among the organizational members of the CPH) and reduce the number dying, despite contact with partner health facilities.

One of the interventions used by the CPHs against malaria has been environmental sanitation, especially the clearing of gutters in the neighborhoods. BASICS provided a set of equipment to each CPH to undertake this activity. CPHs have engaged in environmental clean-up as a special campaign activity as well as a regularly scheduled intervention. Admittedly, the cleaning of refuse from the streets and backed-up open gutters along these streets is not likely to address the problem of the breeding of anopheline mosquitoes. The effort may have little impact on the transmission of malaria, although other mosquitoes may be affected. This activity underscores the fact that local people, and even local health workers, may not distinguish among the types of mosquitoes and among the types of fevers that their children suffer.
A  **Purpose of This Activity**

Assuming malaria is a major cause of urban child morbidity, it is not only necessary to learn about the breeding of mosquitoes from an entomological perspective and the prevalence of malaria from a parasitological viewpoint, but also to understand how the communities perceive both the vectors and the disease. The social/anthropological component of this rapid assessment will gather information about local beliefs, perceptions and behaviors that can form the basis of CPH efforts at designing and implementing culturally and environmentally appropriate health education and community action against malaria.

B  **Personnel and Their Tasks**

1 One senior- and one middle-level social scientist/health educator with experience in social and intervention research in malaria and/or other tropical diseases and in the use of rapid and qualitative methods. The senior-level social scientist/health educator (Dr. W. Brieger based in Ibadan, Nigeria) will be needed for 20 working days. The middle-level social scientist (Dr. Ogunlade of University of Lagos working in a private capacity) will be needed for 30 working days.

2 Research assistants with training in social and related sciences and experience in conducting field studies, especially in the conduct of focus group discussions (FGDs), eight research assistants (local hire) for 15 days each.

3 Selected members of CPHs in order that they gain knowledge and skills needed to gather information needed to understand malaria in their own communities and to plan for appropriate malaria control activities.

There are two general tasks for the social/anthropological component of the Malaria Rapid Assessment (MRA) in Lagos:

1. Identify community beliefs, perceptions and behaviors concerning the recognition of malaria and its vector and community responses to these.

2. Determine jointly with the parasitology/entomology team, travel history, mobility patterns, and disease perceptions associated with the parasitological findings of the overall study, and utilize these findings to aid the CPHs in developing more appropriate educational and environmental interventions against malaria.

C  **Community Perceptions and Behaviors**

Focus group discussions (FGDs) will be organized in each of the selected CPH communities in each of the three ecological zones to be studied. FGDs will be stratified by gender and major resident ethnic group for adults, with two FGDs being conducted for each gender/ethnic...
Combination in each CPH, yielding a minimum of eight adult FGDs per community. In addition, there will be two FGDs per CPH held among secondary school students who live and attend school in the community. FGDs will identify local beliefs, perceptions, and other factors affecting human behavior regarding malaria recognition, treatment, and prevention. Particular focus will be on perceptions about mosquito breeding, including recognition of mosquito larvae and ideas about human activities (environmental, travel) that may influence malaria transmission.

Observational studies will be conducted in each of the selected communities to determine what vector control products are available for sale (nets, sprays, etc.), and their prices and positioning in the shops. CPH members will play a major role in data collection in order to pass on skills to the community.

D Mobility and Disease Perception

Integrated into the parasitological investigations will be a few basic interview questions that are aimed at determining the recent travel (within two weeks) behavior of persons who complained of fever and whose blood film examination was positive. All persons examined will be asked (or the mothers for small children) to name the type of fever that they believe is affecting them and how they distinguished this from other locally (culturally) known fevers. Staff conducting the parasitological investigations will be trained in interviewing techniques to enable them to ask these questions in a nonthreatening way.

E Health Education and Action Planning

Selected CPH members will participate as assistant FGD recorders so that they learn how FGDs are conducted and have first-hand access to the information generated from and about their communities. They will assist in the revision of written notes taken during the FGDs and will develop a simple results summary for future use in planning. Subsequent to the FGDs in each CPH, the CPH recorders as a group will meet together to compare their summary data sheets and discuss the implications for planning appropriate health education and action programs in their areas.

F Products/deliverables

1 Instruments and methodologies for use in future MRAs in the CPH communities include a FGD guide, an observation checklist, and a brief survey on mobility included with parasitological examination.

2 Planning process guidelines for CPHs to utilize FGD and observational data to plan an educational and action program.
G Supplies and Resources

**FGDs** Lists of participating organizations in each CPH are already available for use in selecting FGD participants. Meeting locations will be provided by the CPHs, such as halls belonging to CPH member organizations. Additional materials that should be purchased or assigned include—

- 48 note pads
- 4 tape recorders
- 60 90-minute blank cassette tapes
- 96 batteries
- 1 box of pens
- 12 file folders

**Observations** Street maps with busy shopping/market intersections denoted will be used to start off observations. Checklists will be printed—approximate sample size of approximately 80 stores per CPH.

VIII SCOPE OF WORK (C) ENTOMOLOGY AND PARASITOLOGY

A Purpose of This Activity

The specific focus of this activity will be on determining the *Anopheles* mosquito vectors and their distribution and habits, as well as the prevalence and history of diagnosed malaria cases and Plasmodium Parasitemia in selected CPH areas.

B Personnel and Overall Skills Required

1. Middle level/senior entomologists/entomological assistants with malaria field experience and training and community survey skills. The entomological team (three local hires), plus any designated CPH members, will be needed for 30 working days. The senior-level entomologist/parasitologist will be needed for 40 working days in Lagos, including the planning of activities, analysis, and report-writing time.

2. Medical laboratory scientists with special experience in malaria diagnosis and survey methods—laboratory parasitology team, plus the CPH technicians and the trainees will be needed for 20-35 working days.

3. An environmental biologist with survey and data recording skills.

4. Selected members of CPHs who will be trained and form part of the team.
C General Tasks

1 A qualified and experienced team leader (external consultant) will be responsible for the planning and coordination of all entomological and parasitological tasks. The field and laboratory teams will be under the overall oversight of EHP Activity Manager Dr. Pandu Wijeyaratne.

2 CPH-designated persons will work closely with both the entomological and parasitological teams after an initial period of training in the basic methods that will be used in the assessments. Building capacity in the CPHs for continuation of these tasks will be an integral function of the overall activity.

D Specific Tasks

[To be conducted in a pre-determined sampling framework]

Entomological Assessments

1 Vector breeding habitats will be mapped, and surveys in the area will be carried out. Species identification will be established and characterized to breeding situations, on a sampling basis, through standard malariometric survey methods.

2 Adult mosquito and human contact assessments will be done in the community to determine anopheline potential vector presence and densities in households and their human contact times. Wherever possible, nonintrusive methods, e.g., mechanical light traps and outdoor and indoor biting assessments, will be carried out.

Parasitological Verification

1 CPH laboratory technicians will work closely with the specialized malaria laboratory scientists to carry out parasitemia assessments in all children under 5 years old and pregnant women diagnosed with malaria in the health facilities.

2 Parasite species, parasite density, and gametocytaemia will be recorded.

3 Jointly with the socio-anthropological team, a two-week travel history and mobility assessment will be done in all malaria-diagnosed cases to determine whether infection was likely acquired within or outside the Lagos area of residence.

E Products/deliverables

1 Documentation on methods, techniques, and instruments, for future use by CPHs.
2 Anopheline (potential) vector breeding and density site maps of the area with delineated ecological characteristics of each situation and amenability to specific sustainable environmental methods of control through CPH involvement

3 Anopheline mosquito biting pattern inside and outside households and an assessment of the optimal methods of protection of the community from biting contact

4 Assessment of current situation of malaria in the community through presumptive diagnosis at health facilities and the proportion of parasitemia Plasmodium species prevalence and gametocytæmia levels

5 An assessment of malaria laboratory diagnostic practices and verification of positivity levels in CPH participating laboratories

6 Travel and mobility patterns among malaria cases (particularly children under 5 years of age and pregnant women) and an interpretation of local acquisition of malaria infection

7 Identification of pointers to CPH malaria prevention/control strategy

F Time Frame And Coverage

Overall duration—40 working days
Overall field coverage—3 CPH areas in 3 ecological/environmental strata—e.g., lagoon, waterfront area, inland non-swampy area, inland swampy area

G Schedule

1 February 1-Detailed mapping activities continue
2 February 27/28-External consultant arrives
3 March 2-4-Orientation and preparation for TPM Team planning meeting-venue TBD
4 March 4-5-Start up workshop with CPHs
5 March 9-Area I entomological training surveys begin
6 March 10-Sociological training assessments begin
7 March 17-Laboratory and health facility training and assessment begin
8 March 23-Area I midterm review and monitoring workshop, review of Area I results
9 March 24-Area II planning workshop and activities begin
10 March 25-April 3-Area II field activities
11 April 6-Area II review of results
12 April 7-16-Area III field activities
13 April 17-Review of Area III results
14 April 20-27-Consolidation of results and preparation of draft report
15 April 23-24-Preparation of draft malaria action plan
16 April 24 a.m. - Presentation of findings and action plan to CPHs, and discussion and feedback
17 April 24 a.m. - Briefing of USAID
18 April 25/26 - External consultant departs

IX SUMMARY OF PERSONNEL/RESOURCES NEEDED FOR THREE TEAMS

Team 1 Demography, Mapping, and Data Analysis

**Personnel**

(1) Cartographer-20 days
(2) Assistant yield mapper/geographer-15 days
(3) GIS oriented digitizer for field data-20 days

**Supplies and Resources**

Tracing paper and copying and printing costs
Cartographic equipment
Digitizer (en route?)
Upgraded computer for Atlas GIS software

Team 2 Socio-Anthropology and Community Mobilization

**Personnel**

(1) Local sociologist-30 days (Dr Ogunlade)
(2) Research assistant (8)-15 days (TED)
(3) Research assistant (1)-20 days (Ms F Akerele)

**Supplies and Resources**

48 note pads
4 tape recorders
60 90-minute blank cassette tapes
96 batteries
1 box of pens
12 file folders
Team 3 Environmental/Entomology/Parasitology

Personnel

(1) Epidemiologist/coordinator (1)-15 days (Dr M B Mosanya)
(2) Parasitologists (2)-35 days (Messers R N Chedu and M A Aro), 35 days (Messers D A Ordu and H O Omoigiatu)
(3) Field entomologists (2)
(4) Environmental health assistant (1)
(5) Laboratory assistant (1)-20 days (Ms F Akerele), 35 days (Mr B Abduraman)

Supplies and Resources

Dissecting microscopes (2)
Microscopes (2) *
Mosquito larva dippers *
Malaria diagnostic charts *
Taxonomic keys
Health education material Para-sight F kits *
Slide marking pens
Tissues buffer giemsa
Oil emersion liquid
Battery aspirator
Paper cups

* To be purchased in the USA via BASICS
APPENDIX A

MAPS OF AFRICA AND NIGERIA
APPENDIX B

OVERALL SCOPE OF WORK
FOR URBAN MALARIA RAPID ASSESSMENT
SCOPE OF WORK

1. Institutional and Field Orientation to CPHs
2. Develop and Introduce Study Design and Data Collection Instruments
3. Identify Project Teams, Personnel, and Resources
4. Develop Detailed Scopes of Work
5. Develop Time Frame
APPENDIX C

THREE MAPS OF CPH AREAS IN LAGOS
Fig I  Map of Lagos Showing Basics CPHs

Key to Map
Pages (1 to 20)

INDI A
For quick reference, there are 21 grids, and each one has been indexed accordingly:
Grid 1 — Abule Egba
Grid 20 — Ikoyi
Oshodi-Isolo, Victoria Island

Locations of Basics CPHs
x Location of USAID office

21
Fig II  Map generated for Mushin area CPH's
OVERALL FRAMEWORK

MALARIA RAPID ASSESSMENT LAGOS COMMUNITY PARTNERS FOR HEALTH (CPH)

RESPONSIBILITY
Indicated in ( )

ACTIVITIES
(Overall Resp Pandu Wyeyaratne, EHP)
- Planning visit
- CPH Field & Lab visits
- Mapping review
- Team recruitment
- Integrated Study Design *
- Scopes of Work for all components

Demography, Mapping & Analysis
Team A
- CPH Mobilization (S 0) & PLANNING
- Detailed mapping (Adesina)
- Population & Demography (Adesina)
- Analysis (Ext C + W B + Ade + EHP (P W)
- Reports (Ext C + Ade + W B)
- M & E Plans (Ade) + CPH

Sociology / Anthropology
Team B
- CPH Mobilization (S 0) & PLANNING
- Socio-Cultural and anthropological & KAP & Focus grps (W B & Ogunlade)

Entomology / Parasitology / Epidemiology
Team C
- CPH Mobilization (S 0) & PLANNING
- Environmental & Household Entomology (Ext C)
- Parasitology Verification (Ext C)
- Epidemiology and co-ordination (Ext C) + (M M )
+ CPH

- Malana situation & Analysis
  (E HP-PW + Ext C)
- Design of CPH Malana strategy
- M&E plans & Indicators for CPHs (EHP & BASICS + CPH

Integrated Malaria
- Implementation strategy
- Periodic Monitoring & Review (CPH & BASICS )

* See attached page for details

TIMING

Jan 29 to Feb 10, 1998

March/ April 1998

April, 1998

May, 1998
APPENDIX E

ESTIMATED POPULATION OF CPHS
**B) ESTIMATED POPULATION OF CPHs - Lagos (Census Estimate for 1992)**

Calculation done using the population figures and the proportion of land occupied by each of the CPHs (1992)

<table>
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<th>CPHs</th>
<th>OLD LGA</th>
<th>Total LGA Population</th>
<th>CPH/LGA Proportion</th>
<th>CPH total Proportion</th>
<th>CPH Density/ sq km</th>
<th>Under One Population</th>
<th>Under 5's Pop</th>
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<td>Mushin</td>
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<td>LCPH</td>
<td>Mainland</td>
<td>895,689</td>
<td>22.46%</td>
<td>201,261</td>
<td>29,000</td>
<td>8,292</td>
<td>41,460</td>
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<td>Lagos Island</td>
<td>169,283</td>
<td>23.0%</td>
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<td>440,404</td>
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<td>131,924</td>
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APPENDIX F

OVERALL STUDY DESIGN
LAGOS COMMUNITY PARTNERS FOR HEALTH  MALARIA RAPID ASSESSMENT (MRA)

Overall Study Design

A  SELECTION OF MRA AREAS

1  CONSIDER  SIX (6) COMMUNITIES

   CONSIDER THREE (3) ENVIRONMENTAL STRATA

   WATER-FRONT AREA  INLAND SWAMPY AREA  INLAND NON-SWAMPY AREA

   Makoko  Lagos Island  Amukoko  Ajegunle  Mushin  Lawanson

2  CONSIDER

   Principal Criteria for Selection
   • Malaria burden & relevance level of assessment
   • CPH factors e.g. demand, capacity, track record
   • Population and demographics e.g. density sampling
   • Diagnostic facility e.g. Laboratory quality control etc
   • Logistics e.g. accessibility, space availability etc
   • Other critical success factors
   • Technical resources and time available

3  BASED ON ABOVE CRITERIA SELECT  THREE (3) Areas I  II  & III

B  MRA MEASUREMENTS IN ALL THREE AREAS I, II, III -

<table>
<thead>
<tr>
<th>What</th>
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<td>Anopheline breeding and environment assessment</td>
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<td>Mapping of relevant variables</td>
<td>- total area</td>
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<tr>
<td>Community Assessment - Adults &amp; School Children</td>
<td>- Focus groups</td>
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<td>Market insecticide Survey</td>
<td>- sample</td>
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<td>Household Mosquito assessment</td>
<td>- sample</td>
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<td>- Anopheline mosquito density &amp; species</td>
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<tr>
<td>- Indoor &amp; Outdoor biting assessments</td>
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<td>CPH health facility sample</td>
<td>- Exit interviews</td>
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<td>-sample</td>
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APPENDIX G

SUMMARY TIME FRAME FOR CPHS
Lagos Community Partners for Health  Malara Rapid Assessment (MRA)

Summary Time Frame for CPHs

1 March 9th 1998  Full day start up Workshop  All 3 areas

2 March 10 -23, 1998  Area I  -  11 days
March 24 - April 3, 1998  Area II  -  9 days
April 7 - April 17, 1998  Area III  -  9 days

3 April 20 - 27  Consolidation of results, Preparation of Draft Malaria Action Plan (MAP) by small group, Reporting

4 April 27th Presentation of MAP to all CPHs and finalization of implementation plans

5 May 4th 1998  -  Launching of MAP 1
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BASICS 1997 FY97 Annual Program Report and FY98 Workplan


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Fagbam, AH, Monath, TP, Fabiyi A YEAR Dengue virus infections in Nigeria A survey for antibodies in monkeys and humans Trans Roy Soc Trop Med & Hyg 71(1) 60-65


National Malaria & Vector Control Division, Dept of Primary Health Care and Disease Control, Federal Ministry of Health & Social Services, Yaba, Lagos, Nigeria 1992 New Initiative in Malaria Control in Nigeria Report of Workshops for Patient Medicine Vendors in Lagos State and Ogun State

Nigeria National Malaria Control Unit nd Facts to Know about Malaria (one-page public information sheet)

Nigeria Bulletin of Epidemiology November 1991 13 (a quarterly publication of the Epidemiological Division, Disease Control and International Health Department, Federal Ministry of Health, Lagos, Nigeria) whole issue is devoted to malaria and new guidelines

Silimperi, DR, Macauley, RMJ, Ayodele, JO, Orisasona, S, and Williams, C nd Lagos Community Partners for Health Innovative Private Sector Partnerships Promote Child Survival

SuLwa, TY et al February 1996 A Rapid Assessment of Urban Malaria in the City of Kitwe, Zambia EHP Report for the File No 121 Arlington, Va, EHP
Wijeyaratne, Pandu November 1997 *Initial Investigation of Insects and Other Pests in Communities around the As-Samra Wastewater Treatment Plant (Jordan)* EHP Report for the File No 140 Arlington, Va, EHP
APPENDIX I

BIBLIOGRAPHY ON URBAN MALARIA IN NIGERIA
Bibliography on Urban Malaria in Nigeria


Although both malaria and diarrhoea are major public health problems in developing countries, and separately each has been the subject of intense research, few studies have investigated the interaction between these two conditions The interaction between diarrhoea and malaria among children aged 4 months to 12 years in two tertiary health-care facilities, University College Hospital, Ibadan, and Lagos University Teaching Hospital, Lagos, Nigeria was studied In Ibadan, the prevalence of diarrhoea among the cerebral malaria patients on admission was 11.7% (7/60) compared to 9.3% (215/2312) among other admissions in 1990 (chi square = 0 16, p = 0.6913) Similarly, no significant difference in the prevalence of diarrhoea was found between the cerebral malaria patients (14.3%) and other patients (16.1%) seen in Lagos in 1992 (chi square = 0 06, p = 0.81) Thus, cerebral malaria does not seem to be associated with an increased or decreased prevalence of diarrhoea when compared with other conditions The prevalence of malarial parasitaemia among the 554 diarrhoea patients studied in Ibadan during 1993-1994 was 13.6% compared with 17.9% among the 347 controls (chi square = 3.75, p = 0.053) However, of the children with diarrhoea, malarial parasitaemia was more common among the dehydrated patients (25.4%) than among the well-hydrated patients (11.6%) (chi square 8.11, p = 0.004) These data suggest that diarrhoea is merely coincidental in severe malaria and conversely, malarial parasitaemia is similarly coincidental in children with acute diarrhoea, although it may be more frequent among dehydrated diarrhoea patients than well-hydrated ones

Malaria in pregnancy efficacy of a low dose of mefloquine in an area holoendemic for multi-drug resistant Plasmodium falciparum Okeych JN, Lege-Oguntoye L, Emembolu JO, Agbo M Department of Pharmacology and Clinical Pharmacy, Ahmadu Bello University, Zaria, Nigeria Ann Trop Med Parasitol(ENGLAND) Jun 1996, 90 (3) p265-8, ISSN

Thirty-three pregnant women with pure P falciparum parasitaemias (> or = 10(3) parasites/microliters blood), were each treated with a single, oral dose (12.5 mg/kg body weight) of mefloquinebase(MQ), at Ahmadu Bello University Teaching Hospital, Zaria urban area, Nigeria All 33 women were aparasitaemic by day 6 post-treatment and none became parasitaemic during the remaining 21 days of observation Minimal side-effects were reported by the patients The mean (S D ) fever- and parasite-clearance times were 48 (17) and 50 (26) h, respectively In standard microtests in vitro, schizont maturation was inhibited with MQ at 16 pmol/well (3.2 pmol/microliters) These findings indicate that, at least in the study area, semi-immune, pregnant women have high tolerability to relatively low doses of MQ and that such doses are fully effective against the local P falciparum isolates
In vivo efficacy of chloroquine, halofantrine, pyrimethamine-sulfadoxine and qinghaosu (artesunate) in the treatment of malaria in Calabar, Nigeria  Ezedinachi E Department of Medicine, University of Calabar, Nigeria  Cent Afr J Med (ZIMBABWE) Apr 1996, 42 (4) p109-11, ISSN 0008-9176

We used the WHO in vivo seven day test, extended to 14 day follow up to evaluate the efficacy of the alternative antimalarial drugs in Nigeria (1992), where chloroquine resistant P. falciparum (CRPD) has been confirmed. One thousand and four patients were screened. Those fulfilling recruitment criteria were randomly treated with chloroquine (CQ), n = 50, halofantrine (H), n = 53, pyrimethamine-sulfadoxine (P-S), n = 52 and qinghaosu (Q), n = 53. Parasitological treatment failures were found with all drugs. I.e. CQ-53%pc, H-9%pc, P-S-28%pc and Q-2%pc. H and Q were significantly more efficacious than CQ and P-S, p < 0.003 and p < 0.006, respectively. Similarly, symptom clearance after 48 hours by H and Q was 76%pc and 94%pc, respectively, better than CQ. P-S was not significantly better than CQ, 64%pc and 63%pc, respectively, p > 0.05. The symptom clearance rate of CQ has markedly reduced from 97%pc to 67%pc, and an increased proportion of RIII, from 5%pc to 14%pc, are signs of increase in chloroquine resistant Plasmodium falciparum. Drug resistant P. falciparum in Nigeria constitutes a serious problem to malaria chemotherapy.


Total leukocyte counts were done in 180 apparently healthy rural school children aged 6-12 years in a malaria endemic area in southwestern Nigeria. Total leukocyte counts and their distribution in aparasitaemic and asymptomatic parasitaemic children were similar. Total leukocyte counts, and the relationship between the density of parasitaemia and total leukocyte counts were studied in 55 consecutive children presenting with acute symptomatic falciparum malaria. Children without parasitaemia were older and had lower total leukocyte counts when compared with children with parasitaemia (7.61 +/- 4.11 x 10^9/L, Vs 9.04 +/- 5.0 x 10^9/L), but the difference was not statistically significant (P > 0.05). In non-hyperparasitaemic children and in hyperparasitaemic children with percentage infected red cells < 10%, there was poor correlation between density of parasitaemia and total leukocyte counts. However, at > or = 10% parasitaemia, there was a positive correlation (r = 0.55, P = 0.032) between increasing parasitaemia and leukocytosis. Combination of hyperparasitaemia (> 5% parasitaemia) and leukocytosis (> 12 x 10^9/L) occurred in 15% of the children and was not a poor prognostic index in the absence of other evidence of severe or complicated disease, as response to oral mefloquine was prompt. This would suggest that in African children from an endemic area, this combination is not a reliable indicator of severity or poor prognosis in falciparum malaria.
Malaria is still highly prevalent in many tropical countries and this disease can only survive in areas where mosquitoes and infected human populations are high. Relevant information on the species of mosquitoes, their habitats and their population are important in planning preventative strategies in the control of malaria, hence this study. Mosquito species and their habitats were investigated in both high and low density areas of Benin City, Edo State, Nigeria. The results showed that *Culex pipiens fatigans*, *Aedes aegypti*, *Aedes albopictus*, *Anopheles gambiae* and *Culex tringipes* were the commonest mosquitoes found in Benin City. Among the habitats studied, containers and gutters had the highest population of mosquitoes. The serious public health implications of these various species of mosquitoes is the possibility of outbreaks of infectious diseases like yellow fever, dengue, which some of these mosquitoes are known to transmit. Malaria, though endemic, is also important because of its associated high morbidity and mortality rates. This study provides some useful information on the habitats and species of mosquitoes found in Benin City. Follow-up studies are being carried out by the authors on quantitative studies on the population of these species of mosquitoes, the dissolved elements present in the different habitats that could promote or inhibit the breeding of mosquitoes, and KAP surveys on mosquitoes and malaria among the Benin populace. It is hoped that such comprehensive data would be very useful in planning effective preventative strategies in the control of malaria in Benin City.

The sensitivity of Zaria strains of *Plasmodium falciparum* to chloroquine, mefloquine, quinine and sulphadoxine/pyrimethamine was investigated 5 years after the appearance of *in vivo*/*in vitro* chloroquine resistance in urban Zaria. Infections in 36/43 children (83.7%) treated with chloroquine were sensitive while those in 7 (16.3%) were resistant. 8/13 isolates cultured (61.5%) were sensitive *in vitro* to chloroquine and 5 (38.5%) were resistant. Of the cultured isolates, 13/13 (100%), 12/13 (92.3%) and 5/7 (71.4%) showed mefloquine, quinine and sulphadoxine/pyrimethamine sensitivity, respectively. The results confirmed chloroquine and sulphadoxine/pyrimethamine resistance in urban Zaria and revealed emerging quinine resistance. Resistance to chloroquine and sulphadoxine/pyrimethamine is at RI level and chloroquine should continue to be the first-line drug for the treatment and prevention of *P. falciparum* infection in the Zaria area of northern Nigeria. We suggest that, while quinine serves as second-line drug, mefloquine should be reserved for infections resistant to chloroquine, quinine and sulphadoxine/pyrimethamine.
The prevalence of malaria parasitaemia was investigated among secondary school students in Ibadan city and a neighbouring rural community in Nigeria. Of 343 urban and 249 rural seemingly healthy subjects examined, 8% and 27% respectively were found positive for malaria parasitaemia. This showed a significantly higher parasite rate in the rural area as compared to the urban areas (p < 0.05). Only P. falciparum was found in the urban subjects while 74% of the rural infection was due to P. malariae. All the different erythrocytic stages both sexual and asexual forms of P. falciparum were seen in the rural samples whereas no schizont was seen in the urban samples. The haemoglobin genotype did not affect the prevalence of parasitaemia in the two populations studied. However, a lower parasite rate was observed among G6PD deficient subjects in both populations. There was also a significantly lower parasite infection rate among those with the B-antigen in the two populations studied.

A case of Plasmodium falciparum malaria successfully treated with halofantrine

Obana M, Oda T, Matsuoka Y, Irimajiri S, Kano S, Suzuki M

Department of Internal Medicine, Kawasaki Municipal Hospital

Kansenshokaku Zasshi (JAPAN) Mar 1994, 68 (3) p399-402, ISSN

A 44-year-old male, who had been to Lagos, Nigeria, was admitted to our hospital because of a high grade fever on July 20, 1993. On admission, Plasmodium falciparum was detected in his blood smears and the antibody titers against P. falciparum and Plasmodium vivax antigens were 1:256 and < 1:4 respectively by the indirect fluorescent antibody test. Therefore, he was diagnosed as having P. falciparum malaria. He was treated with halofantrine (Halfan, Smith Kline Beecham Pharmaceuticals, England), two tablets at six-hourly intervals, a total of six tablets (1500mg). Parasites were cleared rapidly and remission was achieved without any adverse reactions. Halofantrine can therefore be recommended for the treatment of imported P. falciparum malaria.

A study of malaria parasitaemia in pregnant women, placentae, cord blood and newborn babies in Lagos, Nigeria

Lamikaora OT Institute of Child Health and Primary Care, College of Medicine, University of Lagos, Surulere West Afr J Med (NIGERIA) Oct-Dec 1993, 12 (4) p213-7, ISSN 0189-160X

The peripheral blood of 101 pregnant women at delivery, their new born babies blood and the corresponding placental, and cord blood smears were examined cross sectionally for malaria parasites, during a 3 month period (May-July, 1986). The average maternal age was 26.3 years. Positive parasitaemia was found in 2.97% of maternal peripheral thick blood films, in 2.94% of
placental smears, and in 0.95% of cord blood films, Congenital malaria did not occur in the babies.

Rising incidence of cerebral malaria in Lagos, Nigeria: a postmortem study  
Elesha SO, Adepoju FB, Banjo AA  Department of Morbid Anatomy, College of Medicine, University of Lagos, Nigeria  East Afr Med (KENYA) May 1993, 70 (5) p302-6, ISSN 0012-835X

One hundred and forty-seven cases of acute malaria were diagnosed at autopsy between 1988 and 1991 at the Lagos University Teaching Hospital (LUTH) In 67 (46.5%) cases death was attributed to cerebral malaria (CM) There was a gradual increase in the incidence of CM during the period under review Both sexes were affected equally but more children than adults succumbed The highest death rate was recorded in the age group 1-5 years with a peak in the 2nd and 3rd year There were seven adults out of which one was an itinerant white lady Only one of the six adult Nigerians had traveled outside Africa and stayed away for about four years The commonest presenting symptoms were fever only, fever with convulsions and/or coma and fever with gastrointestinal symptoms such as vomiting and diarrhea The majority of the adults were comatose (five out of seven) without fever on admission A review of the English literature on the diagnosis, pathogenesis and management of CM is also presented The possible reasons of the rising incidence of CM in a holoendemic region such as Nigeria are discussed.

Problems of chloroquine-resistant P falciparum in Nigeria: one antimalaria drugs' utilisation in metropolitan Calabar  
Ezedinachi EN, Ejezie GC, Emeribe AO  Department of Medicine, University of Calabar, Nigeria  Cent Afr J Med (ZIMBABWE) Jan 1991, 37 (1) p16-20, ISSN 0008-9176

We studied the antimalarial drugs utilisation pattern in urban Calabar, with a view to determining what drugs people take when they have malaria attack and who diagnoses and prescribes the drugs We used a standard questionnaire data sheet to record the results of the interview carried out by the authors Malaria symptoms and the drugs consumed were diagnosed and prescribed respectively by self (54%), qualified medical doctor (32%) and others including paramedical staff (2%) The rest (12%) took traditional remedies The antimalarial drugs (chloroquine, fansidar, camouqin) were chosen because of their efficacy/popularity (21%), cheapness (43%) and availability (34%) Among those interviewed, only 21 (2%) took the adequate curative dose of 25 mg/kg chloroquine for 3 days according to WHO recommendations Majority of the consumers took their drugs orally, but some (17%) had chloroquine injections, administered, in some cases, by ill-qualified patent medicine dealer The results show that there is an association between the level of education and the pattern of remedy sought by the respondents (p less than 0.05) Self-medication was practised significantly more by those with formal education than by those without (p less than 0.05) The trend of consulting patent medicine dealers for prescription decreased with acquisition of more formal education Conversely, significantly more of the respondents with higher education consulted qualified medical doctors or paramedical staff (P less than 0.05) Two aspects of drug abuse observed here, i.e. the utilisation of sub-curative doses of chloroquine and monotherapy are believed to be two of the factors that lead to the several chloroquine treatment failures which have been recently reported in Calabar, and other areas of Nigeria.
Resistance of Plasmodium falciparum to sulfadoxine-pyrimethamine combination in semi-immune children in Zaria, northern Nigeria

Lege-Oguntoye L, Adagu SI, Worblinska B, Ogala WN, Slotboom AB. Department of Pharmacology, Ahmadu Bello University, Zaria, Nigeria

Trans R Soc Trop Med Hyg (ENGLAND) Jul-Aug 1990, 84 (4) p505-6, ISSN

The World Health Organization (WHO) extended field test was employed to assess the in vivo sensitivity of Plasmodium falciparum to sulfadoxine-pyrimethamine combination in 44 children in Zaria urban area. 36 children (82%) were fully sensitive to the drug and 8 (18%) were resistant at the RI level. 8 parasite isolates were obtained from the children and successfully cultured in vitro using the WHO microtest (mark II) system. The 8 isolates underwent schizogony at concentrations of 10,000 pmol sulfadoxine/125 pmol pyrimethamine per well, indicating in vitro resistance.

Malaria in Nigeria a revisit

Salako LA, Ajayi FO, Sowunmi A, Walker O. Clinical Pharmacology Unit, University College Hospital, Ibadan, Nigeria


The frequency of asymptomatic malaria parasitaemia was investigated in rural and urban school-children aged six to 12 years in southwestern Nigeria between January 1987 and October 1988. Asymptomatic parasitaemia was detected in the rural school-children all year round with the lowest parasite rate in January and the highest in July, corresponding to the mid-dry and wet seasons respectively. Asymptomatic parasitaemia was also common amongst urban school-children, but the frequency was lower than in the rural children. Parasite density was less than or equal to 1000 microliters-l in 42% of parasite-positive asymptomatic children and was greater than 10,000 microliters-1 in only 20% of them. Mass treatment with chloroquine, to which the parasites were fully sensitive, was followed by the same rate of re-infection in the parasite-positive and parasite-negative groups. Of 7713 patients clinically diagnosed as having malaria, 4425 were found to have parasitologically-proven malaria, and of these 4239 had pure Plasmodium falciparum malaria. Of the patients with falciparum malaria only 4.6% were below the age of one year. In 47% the parasite count was less than or equal to 1000 microliters-1, and it was over 10,000 microliters-1 in 37% and over 250,000 microliters-1 in 16%. There was no significant difference between the asymptomatic children and the acutely ill patients in the percentage with parasite densities less than or equal to 1000 microliters-1, but the percentage with parasite densities greater than 10,000 microliters-1 was significantly greater in the acute malaria patients than in those with asymptomatic parasitaemia.

Neurological disorders in Nigerian Africans a community-based study

Osuntokun BO, Adeuja AO, Schoenberg BS, Bademosi O, Nottage VA, Olumide AO, Ige O, Yara F, Bolis CL

Acta Neurol Scand (DENMARK) Jan 1987, 75(1) p13-21, ISSN 0001-6314

In a Nigerian town with a stable population of 20,000, a door-to-door survey was conducted, using a questionnaire involving a complete census and a simple neurological evaluation which had previously showed a 95% sensitivity and an 80% specificity for detecting neurological disease. Positive responders were evaluated and categorized, using agreed criteria for diagnoses. Nearly 100% cooperation was obtained. Life prevalence ratio for at least one episode of
headache was 51/1000. Crude point prevalence ratio for migrainous headache was 53/100,000 and peak age-specific ratio was in the first decade. Prevalence ratio for epilepsy was 53/100,000 and peak age-specific prevalence ratio occurred in the 5-14 years age groups. The prevalence ratio for peripheral nerve disorders was 268/100,000, and age-specific prevalence ratio for tropical neuropathy increased with age. Prevalence ratio for stroke was rather low at 58/100,000, but was probably due to the people's attitude to the disabled elderly and high mortality of stroke which showed annual mortality rate of 70/10,000 which increased with age to 1519/100,000 per year in the eighth decade. Crude prevalence ratios (cases per 100,000) for others are 112 for neurological complications (including sciatica) of spondylosis, 15 each for poliomyelitis, motor neurone disease, development speech disorders, 10 each for syncope, hereditary neuropathies Parkinson's disease, benign essential tremor, primary cerebellar degeneration, cerebral palsy, mental retardation, organic psychosis (probable intracranial tumor) and 5 each for muscular dystrophy, pyomyositis, spine bifida occulta, alcohol dependence and cerebral malaria. The implications of the findings are important for development of community neurological services in the developing countries.

**Chloroquine resistance of Plasmodium falciparum in semi-immune children in Zaria, northern Nigeria**


Fifty-nine children with Plasmodium falciparum malaria were subjected to the World Health Organization (WHO) extended field test to assess the in vivo sensitivity of the parasite to chloroquine in Zaria urban area, Nigeria. The parasites in 53 children (90%) were positive but those in 6 (10%) were resistant at the RI-RII level. 36 isolates from the patients were successfully cultured in vitro for the WHO standard microtest. 13 (37%) of the isolates underwent schizogony at chloroquine concentrations of 1.6 microM/litre and above. Probit analysis showed that the chloroquine concentrations producing 50% (EC50), 90% (EC90) and 99% (EC99) schizont inhibition were 0.4, 1.6 and 4.9 microM/litre, respectively. The results indicate a rapid decline in the sensitivity of P. falciparum to chloroquine in the study area during the past 3 years.

**Child health and child care in Okelele an indigenous area of the city of Ilorin, Nigeria**


This paper provides a detailed analysis of the survival rates and health problems of a cohort of children born during a 5-yr period in part of the city of Ilorin, Nigeria. The findings are linked to a demographic and environmental study which indicates that the study area was relatively stable in terms of family structure and population turnover. Most people work in the informal sector, in trading, small scale crafts and service industries. At the time the survey began, in 1979, the provision of piped water supplies to the area was unreliable and sanitation provisions rudimentary. Most of the people had little or no formal education and were very poor. The study indicated that health status had improved over the 5-yr period, compared to a baseline study conducted in 1979. Common causes of child mortality and morbidity included diarrhea, acute
respiratory infections, measles, and malaria. The infant mortality rate was 41.5/1000. The availability of clinic care at nominal cost, and the attendance of mothers at the clinic for checkups and immunization, resulted in a higher level of health for their children than otherwise would have been possible. Some problems of primary health care in the area are mentioned, in the light of Nigeria's current budgetary problems, and the utilization of existing strong social support networks to improve health care and environmental sanitation and water supply is suggested.


In 33 children with confirmed Plasmodium falciparum malaria, the WHO Extended Field Test was employed to test the sensitivity of the parasite to chloroquine in Zaria urban area. No evidence of resistance to the drug was found. In 82% of the patients parasitaemia had disappeared within 3 days, while the remaining 18% were parasite negative on day 4 or 5. The mean parasite clearance time was calculated as 3.45 +/- 1.23 days. The results suggest that chloroquine sensitivity of P. falciparum may be decreased in this part of Nigeria.
APPENDIX J

BIBLIOGRAPHY ON CULEX SPECIES IN NIGERIA
Bibliography on Culex Species in Nigeria

Towards malaria control in Nigeria  a qualitative study on the population of mosquitoes
Wagbatsoma VA, Ogbeide O  Dept of Community Health, University of Benin, Nigeria
J R Soc Health (ENGLAND) Dec 1995, 115 (6) p363-5, ISSN 0264-0325

Malaria is still highly prevalent in many tropical countries and this disease can only survive in areas where mosquitoes and infected human populations are high. Relevant information on the species of mosquitoes, their habitats and their population are important in planning preventative strategies in the control of malaria, hence this study. Mosquito species and their habitats were investigated in both high and low density areas of Benin City, Edo State, Nigeria. The results showed that Culex pipiens fatigans, Aedes aegypti, Aedes albopictus, Anopheles gambiae and Culex tringipes were the commonest mosquitoes found in Benin City. Among the habitats studied, containers and gutters had the highest population of mosquitoes. The serious public health implications of these various species of mosquitoes is the possibility of outbreaks of infectious diseases like yellow fever, dengue, which some of these mosquitoes are known to transmit. Malaria, though endemic, is also important because of its associated high morbidity and mortality rates. This study provides some useful information on the habitats and species of mosquitoes found in Benin City. Follow-up studies are being carried out by the authors on quantitative studies on the population of these species of mosquitoes, the dissolved elements present in the different habitats that could promote or inhibit the breeding of mosquitoes, and KAP surveys on mosquitoes and malaria among the Benin populace. It is hoped that such comprehensive data would be very useful in planning effective preventative strategies in the control of malaria in Benin City.

Sustainable urban development and human health  septic tank as a major breeding habitat of mosquito vectors of human diseases in south-eastern Nigeria
Nwoke BE, Nduka FO, Okereke OM, Ehigbibe OC  Medical Entomology & Parasitology Unit, School of Biological Sciences, Abia (former Imo) State University, Okigwe, Nigeria  Appl Parasitol (GERMANY) Feb 1993, 34 (1) pl-10, ISSN 0943-0938

Septic tank mosquitoes in Abia State University Okigwe, south-eastern Nigeria were studied using exit traps between November 1988 and April 1989. The results were revealing and striking. Apart from the common septic tank mosquitoes, Culex p. quinquefasciatus, Cx. cinereus and Aedes aegypti, which have been previously commonly found breeding in ammonia and nitrate-rich waters of latrines and septic tanks, the other species, Cx. horridus, Cx. tringipes and Aedes vittatus, have not been commonly reported as colonizing septic tanks in Nigeria. Three out of these six mosquito species observed are vectors of human diseases. Aedes aegypti and Aedes vittatus are vectors of Yellow fever and Cx. p. quinquefasciatus is a potential vector of Bancroftian filariasis and a world-wide vector of various arboviruses. The fact that these mosquito vectors are able to breed in highly polluted waters of septic tanks during the harsh dry months when most surface water bodies are dry is epidemiologically important. The breeding of these mosquito vectors of human diseases around human dwellings indicates an intense man-vector contact creating a high level risk to the crowded urban population. The public health implications of this urbanization/modernization problem and solutions are discussed.
Experimental Wuchereria bancrofti infection of Culex quinquefasciatus and Aedes aegypti
Anosike JC, Onwuliri CO Medical Entomology and Parasitology Research Laboratory
Department of Zoology, University of Jos, Nigeria Angew Parasitol (GERMANY) Aug 1992,
33 (3) p 139-42, ISSN 0003-3162

Laboratory-derived females of Culex quinquefasciatus and Aedes aegypti were experimentally
infected with Wuchereria bancrofti by allowing the insects to feed on infected volunteers of
known microfilariae density between 24 00 and 2 00 hours Of the 240 mosquitoes used for the
experiments only 67 (55.8%) of C quinquefasciatus and 83 (69.2%) of the Aedes aegypti
actually fed on the volunteers’ blood After 16 days post-infection period, 50 (74.62%) of the
engorged C quinquefasciatus harboured infective L3 larval stages of W bancrofti, while 16
(23.9%) and 1 (1.49%) harboured L2 and L1 pre-infective larval stages, respectively On the
other hand, no development to the L3 infective stage was observed in the engorged Aedes
aegypti although 34 (40.96%) harboured L1 pre-infective stages of the parasite Our results suggest
that C quinquefasciatus could be actively involved in the transmission of urban bancroftian
filariasis in Nigeria

Isolation and characterization of four new strains of Bacillus sphaericus from central Nigeria
highly toxic to mosquito larvae Orduz-Peralta S, Diaz T, Restrepo N, Rojas W, Yousten AA
Biological Control Section, H P T U, Medellin, Colombia J Invertebr Pathol(UNITED
STATES) Jul 1992, 60 (1)p107-8, ISSN

Septic tank mosquitoes competition between species in central Nigeria Irving-Bell RJ, Okoli
EI, DnyelungDY, Lymo EO, Onyia OC Department of Zoology, University of Jos, Nigeria
Med Vet Entomol (ENGLAND) Jul 1987, 1 (3) p243-50, ISSN 0269-283X

Exit traps, placed over the air vents of septic tanks, were used to examine species diversity and
relative abundance of mosquitoes breeding in ammonia-rich waters of septic tanks Of the six
species found, Culex decens Theobald and Culex cinereus Theobald appeared to be competing
successfully with Culex quinquefasciatus during the wet season but not during the long dry
season The seasonal timing of their displacement by Cx quinquefasciatus was variable and did
not correlate well with climatic factors The three other species present, generally during the wet
season and early dry season, were Culex tigrpes G & C, Culex horndus Edwards and Aedes
aegypti (L ) Experimental bucket ovitraps were used to assess preference towards covered (dark)
septic tank water in comparison with sunlit septic tank water, covered and sunlit compost water
These were colonized by Cx quinquefasciatus, Cx decens, Aedese aegypti and Aedes
vittatus Bigot The covered septic tank water was more abundantly colonized by Cx quinquefasciatus and
marginally so by the two Aedes species Cx decens appeared to colonize the exposed compost
water more readily in the dry season, but changed to the covered septic tank water in the wet
season The discussion centers around competition between these mosquitoes species and
concludes that it would be useful to know what environmental factors, or what aspects of
competition, lead to severe natural reductions in the abundance of the major pest species Cx
quinquefasciatus
A 12-month field and laboratory study was carried out to determine the epidemiology, clinical features, and transmission dynamics of bancroftian filariasis in the Igwun Basin, Nigeria. A total of 1,418 individuals (768 males, and 650 females) were examined for clinical signs of filariasis. 690 day provocative blood samples (DPS), and 728 night blood samples (NBS) were examined for microfilaraemia. 14.3% of males and 11.1% of females were mf positive. 5.8% of DPS, and 19.5% of the NBS were mf positive. An overall microfilaria rate of 12.8% was recorded in the basin. Prevalence and microfilarial density increased with age. The highest mf density of 35 mf/20 ml blood occurred in the 40-49 year old male individuals. Disease rates of 55.5% and 65.3% were recorded for males and females respectively. Chyluria (9.3% males, 16.7% females), hydrocele (17.8%), elephantiasis (15.9% males, 29.2% females), and enlarged groin glands (16.4% males, 19.4% females) were the major clinical signs, all associated with microfilaraemia. Anopheles gambiae and Culex pipiens were the principal vectors. The estimated mean daily, weekly, and monthly per capita biting densities were 26, 161, and 753 respectively. The overall infection rate of mosquitoes was 22.3%, with a mean mf density of approximately 5 mf/mosquito. These vector parameters were indicative of active transmission in the area, and may be responsible for the high prevalence of infection, the diversity of clinical signs, and high morbidity rates.

Experimental Wuchereria bancrofti infection of Culex quinquefasciatus and Aedes aegypti
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Department of Zoology, University of Jos, Nigeria Angew Parasitol (GERMANY) Aug 1992, 33 (3) p139-42, ISSN 0003-3162

Laboratory-derived females of Culex quinquefasciatus and Aedes aegypti were experimentally infected with Wuchereria bancrofti by allowing the insects to feed on infected volunteers of known microfilariae density between 24 00 and 2 00 hours. Of the 240 mosquitoes used for the experiments only 67 (55.8%) of C. quinquefasciatus and 83 (69.2%) of the A. aegypti actually fed on the volunteers' blood. After 16 days post-infection period, 50 (74.6%) of the engorged C. quinquefasciatus harboured infective L3 larval stages of W. bancrofti, while 16 (23.9%) and 1 (1.49%) harboured L2 and L1 pre-infective larval stages, respectively. On the other hand, no development to the L3 infective stage was observed in the engorged Aedes aegypti though 34 (40.96%) harboured L1 pre-infective stages of the parasite. Our results suggest that C. quinquefasciatus could be actively involved in the transmission of urban bancroftian filariasis in Nigeria.
Aedes albopictus is originated from Asia, and is known as a natural vector of dengue in South-East Asia. Since about 10 years, Aedes albopictus has spread all around the world. It was introduced into the Americas, United States, Mexico, Brazil, Barbados and the Dominican Republic, into some Pacific islands as Solomons, Fiji and Australia, into Africa in Nigeria, and finally into Europe in Italy and Albany. These introductions were made primarily through imported tires containing eggs and/or larvae of Aedes albopictus. The tire international trade plays a significant role in the expansion of Aedes albopictus. Furthermore, this mosquito species has a broad ecological spectrum and found suitable conditions either into tropical and temperate countries. In some situations in the Americas, Aedes albopictus has displaced Aedes aegypti. The spread of Aedes albopictus is of great concern because it can experimentally transmit several arboviruses and filarial worms.


Malaria is still highly prevalent in many tropical countries and this disease can only survive in areas where mosquitoes and infected human populations are high. Relevant information on the species of mosquitoes, their habitats and their population are important in planning preventative strategies in the control of malaria. Hence this study. Mosquito species and their habitats were investigated in both high and low density areas of Benin City, Edo State, Nigeria. The results showed that Culex pipiens fatigans, Aedes aegypti, Aedes albopictus, Anopheles gambiae and Culex trinervipes were the commonest mosquitoes found in Benin City. Among the habitats studied, containers and gutters had the highest population of mosquitoes. The serious public health implications of these various species of mosquitoes is the possibility of outbreaks of infectious diseases like yellow fever, dengue, which some of these mosquitoes are known to transmit. Malaria, though endemic, is also important because of its associated high morbidity and mortality rates. This study provides some useful information on the habitats and species of mosquitoes found in Benin City. Follow-up studies are being carried out by the authors on quantitative studies on the population of these species of mosquitoes, the dissolved elements present in the different habitats that could promote or inhibit the breeding of mosquitoes, and KAP surveys on mosquitoes and malaria among the Benin populace. It is hoped that such comprehensive data would be very useful in planning effective preventative strategies in the control of malaria in Benin City.
Wesselsbron virus antibody in domestic animals in Nigeria: retrospective and prospective studies  Baba SS, Fagbami AH, Ojeh CK, Olaleye OD, Omilabu SA  Department of Veterinary Microbiology and Parasitology, University of Maiduguri, Nigeria  New Microbiology (ITALY) Apr 1995, 18 (2) p151-62, ISSN 1121-7138

Retrospective and prospective serological surveys to determine the prevalence of Wesselsbron (WSL) virus infections in animal populations were carried out in different vegetational zones in Nigeria. Sera from 1,492 animals comprising 292 camels, 81 horses, 4 donkeys, 320 cattle, 235 sheep, 260 goats, 114 pigs, 101 dogs and 85 domestic fowls were essayed by haemagglutination-inhibition (HI) test for presence of antibodies to WSL virus and other flavivirus antigens: Yellow Fever (YF), Potiskum (POT), Banzi (BAN), Uganda S (UGS) and West Nile (WN) viruses. Four hundred and eighty one (32%) of the total sera tested were positive for the presence of flavivirus antibodies. The prevalence rates among animals varied with species and vegetational zones of the country. The highest prevalence was noted in animals from a swamp forest zone and was higher among camels, horses, donkeys and sheep when compared with goats, pigs and fowls in different zones. Although monotypic reactions with WSL virus antigen were observed in positive sera, the majority of the WSL virus positive sera cross-reacted with more than two other flavivirus antigens. Serological cross-reactions were most extensive in WSL virus positive horse sera. A ten month sentinel survey among 28 cattle, 68 sheep and 30 goats revealed considerable activity of WSL virus in Nigeria. Of these, 11 cattle and 12 sheep showed antibody conversion to WSL virus antigen. None of the goats seroconverted. Although, there are no records of outbreak of WSL disease in Nigeria, this study revealed that WSL virus is actively circulating among livestock populations in this environment. Flavivirus nucleotide data are needed for final determination of genetic relatedness in this group of viruses.


Sustainable urban development and human health: septic tank as a major breeding habitat of mosquito vectors of human diseases in south-eastern Nigeria  Nwoke BE, Nduka FO, Okereke OM, Ehighibe OC  Medical Entomology & Parasitology Unit, School of Biological Sciences, Abia (former Imo) State University, Okigwe, Nigeria  Appl Parasitol (GERMANY) Feb 1993, 34 (1) pl-10, ISSN 0943-0938

Septic tank mosquitoes in Abia State University Okigwe, south-eastern Nigeria were studied using exit traps between November 1988 and April 1989. The results were revealing and striking. Apart from the common septic tank mosquitoes, Culex p. quinquefasciatus, C. cinererus and Aedes aegypti, which have been previously commonly found breeding in ammonia and nitrate-rich waters of latrines and septic tanks, the other species, C. horridus, C. tigripes and Aedes vittatus, have not been commonly reported as colonizing septic tanks in Nigeria. Three out of these six mosquito species observed are vectors of human diseases: Aedes aegypti and Aedes vittatus are vectors of Yellow fever and C. p. quinquefasciatus is a potential vector of Bancroftian filariasis and a world-wide vector of various arboviruses. The fact that these mosquito vectors are able to breed in highly polluted waters of septic tanks during the harsh dry months when most surface water bodies are dry is epidemiologically important. The breeding of
these mosquito vectors of human diseases around human dwellings indicates an intense man-vector contact creating a high level risk to the crowded urban population. The public health implications of this urbanization/modernization problem and solutions are discussed.

First record of breeding populations of Aedes albopictus in continental Africa implications for arboviral transmission  

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J Am Mosq Control Assoc (UNITED STATES) Mar 1992, 8 (1) p101-3, ISSN

Eggs of Aedes albopictus were collected in oviposition cups from 3 forested areas of Delta State in south-central Nigeria during September 1991 as part of a post-yellow fever outbreak investigation. These eggs were shipped to the Centers for Disease Control in Colorado, where they were reared to the adult stage and identified. This is the first record of breeding populations of Aedes albopictus in continental Africa. Other taxa reared from the same oviposition cups included Aedes aegypti, Aedes apicoargenteus, Aedes africanus, Aedes hilyi and Aedes simpsoni subgroup. The introduction and establishment of Aedes albopictus in Africa may have important implications for transmission of indigenous arboviruses.

Genetic selection of a flavivirus-refractory strain of the yellow fever mosquito Aedes aegypti  
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Medical Entomology-Ecology Branch, Centers for Disease Control, Fort Collins, Colorado  

Two inbred (isofemale) Aedes aegypti mosquito lines were derived that manifested a resistant or susceptible phenotype following ingestion of yellow fever virus, lack of virus movement from the midgut defined the resistant phenotype. Other flaviviruses, including dengue 1-4, Uganda S and Zika, viruses behaved in a similar fashion in the two mosquito lines. Crosses between the two lines produced progeny that were of intermediate susceptibility, indicating codominance. F2 backcrosses to the parents yielded results consistent with a major controlling genetic locus and provide evidence of a second locus capable of modulating the phenotype of the major gene. The rapid selection necessary to fix the susceptible and refractory phenotypes support the hypothesis of a single major controlling locus. Viral movement across the midgut is likely to be governed by a single major gene and modifying minor genes or a group of closely linked genes. These inbred mosquito lines will be useful in discovering the molecular basis for flavivirus resistance in Aedes aegypti.

Aedes albopictus introduction into continental Africa, 1991  

From April 15 through July 20, 1991, an epidemic of yellow fever (YF) occurred in Delta State, Nigeria. In September 1991, as part of a follow-up investigation, mosquito oviposition cups were deployed in four rural communities with YF, all within a 24-kilometer radius of the principal town of Agbor. Based on findings from the follow-up investigation, this report documents the first record of breeding populations of Aedes albopictus—a competent YF virus vector—in continental Africa.
Observations made during the epidemics in Côte d'Ivoire (1982), Burkina Faso (1983), Nigeria (1986 and 1987) and Mali (1987), together with studies conducted in the last 10 years, particularly in Côte d'Ivoire, now make it possible, without calling into question the dynamics of yellow fever virus circulation in space and time, to redefine some features of the pattern suggested in 1977 and refined on a number of occasions up to 1983. The endemicity area is still the region of epizootic and enzootic sylvatic circulation, and contains the natural focus and the endemic emergence zone. The natural focus is no longer confined to the forest alone, now that transovarial transmission has been demonstrated. The endemic emergence zone is tending to become conterminous with the endemicity area on account of increasing deforestation.

Emergence in forest regions, due to *Aedes africanus*, is still few and isolated, unlike that observed in savanna regions where *Aedes furcifer* is the major vector. The different behaviour of these two vectors and their population dynamics determine the quality of the man-vector contact and are responsible for these two patterns of emergence. The emergence front limits the endemicity area in the north. Its position varies and depends on annual rainfall patterns. The epidemicity area, where the virus does not circulate before an epidemic and where the immunity status of unvaccinated populations is low, is geographically heterogeneous. It consists of regions to the north of the emergence front and of towns anywhere. It is characterized by high potentials for the development of *Aedes aegypti* populations. Only man can introduce the virus into this area. Three types of epidemic are distinguished, depending on the vectors. Urban epidemics resulting from transmission by a domestic vector. These epidemics always occur within the epidemicity area, either in dry savanna (rural subtype) or in towns (urban subtype). The virus is introduced into the ecosystem by man. Transmission is always strictly interhuman. Intermediate epidemics consist of two successive phases: first of all there is a series of endemic emergences, followed by interhuman transmission involving *Aedes aegypti*. These epidemics can only occur in the endemicity area. Sylvatic epidemics occur in villages, but only involve the sylvatic vectors. They result from a conjunction of a very large number of emergences for which *Aedes furcifer* is almost always mainly responsible and occur in the endemicity area, usually close to the emergence front. Transmission is never strictly interhuman, as the same vector populations are responsible for epizootic and epidemic transmission.

*West Nile Complement Fixing antibodies in Nigerian domestic animals and humans*

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A survey for West Nile Complement Fixing (CF) antibody was carried out in humans and domestic animals in Nigeria. Human sera were obtained from two communities namely Ibadan and Ogbomoso but animal sera were collected from Ibadan and Maiduguri. The overall CF antibody to West Nile virus in the two localities surveyed was 65%. Of 170 persons tested, 53% and 75% were positive in Ibadan and Ogbomoso respectively. Antibody prevalence increased with
age in both communities. Tests for antibody against other flaviviruses revealed that monotypic complement fixation reactions were found frequently in young people, but broadly reacting sera were common among the older age groups. Sex distribution of West Nile CF antibody showed that 49/82 (60%) of females and 62/88 (75%) of males had West Nile CF antibody. Tests on animal sera showed that 33% contained CF antibody to West Nile virus. Prevalence of CF antibody in different animal species was 62% in camels, 4% in cattle and 0% in goats.

Seroepidemiological survey for yellow fever antibodies in domestic animals

AduF, Esan J, Baba SS. Department of Virology, College of Medicine, University College Hospital, Ibadan, Nigeria. Rev Roum Virol (ROMANIA) Jul-Dec 1990, 41 (3-4) p147-50, ISSN

A total of 192 out of 300 serum samples from camel, cattle, sheep and goats tested for yellow fever virus antibody by the counterimmunoelectrophoresis were found positive. This test was confirmed by the single radial haemolysis and serum neutralization tests. Twenty-one and 36 sera were positive for specific yellow fever virus antibodies by the single radial haemolysis and serum neutralization tests respectively. The possible role of these animals in the epidemiology of yellow fever is discussed.


This global analysis of the situation is based on a review of notifications, observations, and studies concerning yellow fever in 16 of 17 countries of the West African subregion (Algeria is not affected for the years 1973-1987). In view of this analysis and the epidemiological picture, the author proposes a plan of concerted action to confine yellow fever to its monkey-to-monkey cycle in the wild. Official notifications vary greatly from one country to the next. Any of five major causes could explain this ecological and ethological conditions that favor circulation of the virus in the wild and man-to-man transmission to different extents, the immune status of the populations, the difficulty of diagnosing especially isolated cases, lack of means for investigation, and negligence. The quantity and gravity of human cases are systematically underestimated, sometimes to a great extent. Lack of resources and difficulty of diagnosis, but also in many instances the attitude of the population, can account for this. Modern means of investigation, faster intervention by specialists, and better knowledge of how the virus is transmitted, have shown recently an increasing gap between notifications and the actual situation. Research and monitoring programmes are particularly important. The programmes under way in Senegal and Cote d'Ivoire have already resulted in considerable improvement in the action against epidemics. Because of these programmes, our knowledge of the very complex pattern of viral circulation is improving, thereby helping us develop systems for prevention and enabling us to forecast epidemics. Priority areas for study and research are (1) Basic programmes for detailed study of all the topotypes of the virus, and identification of the viral amplification cycles that
recur over several years. Such studies are under way in Senegal and Cote d'Ivoire. They would be particularly useful in Ghana and in Nigeria, where the taxonomy and bioecology of A. africanus should also be studied. (ii) Surveys of sylvatic vectors should show, for the endemic zones of each country, the type of contact between sylvatic vectors and man in both rural and wild biotopes. (iii) A complete map of the Stegomyia foci with an assessment of their potential epidemic risk (an analysis of the productivity of the sites depending on their type). (iv) Assessment of the immune status of the populations of the various ecosystems of each country, taking account of past or present vaccination strategies. There are several prevention strategies to choose from. The author advocates preparation of a scientifically based, subregional plan for optimum cost effectiveness (ABSTRACT TRUNCATED AT 400 WORDS).

A survey for haemagglutination-inhibiting antibody to West Nile virus in human and animal sera in Nigeria Olaleye OD, Omlabu SA, Ilomechina EN, Fagbam AH Department of Virology, College of Medicine, University of Ibadan, Nigeria Comp Immunol Microbiol Infect Dis (ENGLAND) 1990, 13 (1) p35-9, ISSN

A survey for West Nile Virus (WNV) haemagglutination-inhibition (HI) antibody was carried out in humans and domestic animals. Human sera were collected from Ibadan, while the animal sera were collected from both Ibadan and Maiduguri. Out of 304 human sera tested, 123 were positive (40%). There was a higher prevalence of HI antibody in adults than children. Sex distribution of positive sera showed that 37% of males and 43% of females had WNV HI antibody. There was no significant difference in the prevalence of HI antibody in both sexes. On the 123 WNV HI positive sera tested, 104 (85%) and 78 (75%) had yellow fever and Potiskum HI antibody respectively. Monotypic WNV virus reactions were frequently found in children while polytypic reactions were frequently found in adults. A total of 200 animal sera were examined, 50 camels, 50 goats, 49 cattle and 51 sheep. The highest prevalence of HI antibody was found in camels (26%), followed by sheep (20%). Percentage of positive sera in other species were goat (18%) and cattle (6%). Of the 35 WNV HI positive animal sera, 26 and 20% reacted with Yellow fever and Potiskum virus antigens respectively.

Epidemic yellow fever caused by an incompetent mosquito vector Miller BR, Monath TP, Tabachnick WJ, Ezike VI Division of Vector-Borne Viral Diseases, Centers for Disease Control, U S Department of Health and Human Services, Fort Collins, Colorado Trop Med Parasitol (GERMANY, WEST) Dec 1989, 40 (4)p396-9, ISSN

Arbovirus epidemics in a geographic region are believed to depend on the presence of susceptible or "competent" arthropod vectors. We demonstrate that an urban, Aedes aegypti-borne, epidemic of yellow fever occurred in 1987 although the mosquito vector was relatively resistant to infection and transmitted the virus inefficiently. Twenty-six percent of the experimental mosquitoes from the epidemic area that ingested yellow fever virus became infected and only 7% of these transmitted the virus. In contrast, 80% of an exotic susceptible strain of Ae. aegypti became infected and 43% were able to transmit. We also show that no other potential vectors were active during the epidemic and that the local Ae. aegypti were present in extremely large numbers. These results document, for the first time, that, in the presence of high
population density an incompetent mosquito vector can initiate and maintain virus transmission resulting in an epidemic


A large epidemic of urban yellow fever occurred in April and May 1987 in Oyo State, western Nigeria. The principal vector was Aedes aegypti, breeding in domestic water containers. The 1987 outbreak followed an epidemic of sylvatic yellow fever in eastern Nigeria the previous year, and probably resulted from introduction of the virus by viraemic travellers. The outbreak in Oyo State ended in early July, by which time 805 cases and 416 deaths had been officially notified. However, surveys of 3 villages in the epicentre, a region with over 4 million inhabitants, indicated an infection rate of approximately 20%, a clinical attack rate of 2.9% and a mortality rate of 0.6%, suggesting that the true incidence of cases and deaths far exceeded the official reports. Yellow fever virus was isolated from persons with fully developed yellow fever as well as mild febrile illness. One virus isolate was made from blood of an individual with mild illness, who had received 17D vaccine 5d earlier, monoclonal antibody analysis showed that the isolate was a wild-type virus. Larval indices of Ae. aegypti were very high, however, low vector competence of the Ae aegypti population may have provided a constraint on spread of the epidemic. In late 1987 a third epidemic appeared in Niger State, northern Nigeria, with 644 reported cases and 149 deaths. The vector(s) involved is (are) unknown.


An epidemic of yellow fever occurred in the eastern part of Nigeria during the second half of 1986. Oju, in Benue State, was the most heavily affected region, but yellow fever also occurred in surrounding areas, particularly Ogoja, in Cross River State. In Oju, the mean attack and mortality rates were 4.9% and 2.8%, respectively. Sex and age specific rates were highest in males and in the 20-29 yr age group. The overall case fatality rate was approximately 50% Diagnosis was confirmed by IgM capture enzyme-linked immunosorbent assay (ELISA) and complement fixation (CF) tests. Entomological investigations implicated Aedes africanus as the epidemic vector. Oju alone probably had about 9800 cases of yellow fever with jaundice, and some 5600 deaths. Outbreaks of this nature could be prevented by inclusion of yellow fever in the Expanded Programme on Immunisation, in areas subject to recurrent epidemics.