República de Angola
Ministério da Saúde
Programa Nacional de controlo da Malária

Public Private Partnership on Country Capacity Strengthening for Vector Control

Basic Course on Entomology

Caxito, Bengo, Angola, 15th February – 4th March 2010

ACTIVITY REPORT

EXECUTIVE SUMMARY

Malaria is the main cause of illness and mortality in Angola. In 2002, there were 1,409,328 reported cases of malaria in Angola, up by 23,731 from 2001, according to the Roll Back Malaria Partnership (RBM). The President's Malaria Initiative (PMI) reports that malaria accounts for 35 percent mortality in children under the age of five, and 25 percent of maternal mortality. In April 2009, it was estimated that only 30 percent of the population had access to government healthcare facilities. As Angola begins to rebuild critical infrastructure after a 27-year civil war, the scale-up of malaria control activities has become a top national and international priority.

In addition to being a major public health threat, there is a significant economic impact on malaria-endemic countries according to the World Health Organization (WHO). This financial burden can cut economic growth rates by as much as 1.3 percent.

Recently, the Angola National Malaria Control Program (NMCP) developed a five-year strategic plan (2008-2012) aimed to reduce the impact of malaria by 60 percent by 2012. The plan outlines areas for key intervention as capacity building at the national level, strengthening case management systems and increasing epidemic preparedness by way of education, outreach and the development of effective monitoring and evaluation programs. In an effort to scale-up prevention methods, NMCP also indentified building capacity in entomology to scale up vector control.

In 2009, PMI, top global companies and the Government of Angola formed a public-private partnership (PPP) aimed to strengthen malaria control in Angola. The focal point of this partnership was a pilot activity to train 45 community health workers from areas where vector control is being implemented . By harnessing private sector core competencies and public sector technical expertise, this partnership intends to support the scale up of locally sustainable and cost-effective malaria control.

A successful outcome of the PPP was the convening of a three-week Entomology Training Workshop in the city of Caxito, capital of Bengo Province, Angola, from February 15 – March 4, 2010. The workshop was organized by **the Corporate Alliance on Malaria in Africa (CAMA)/ Global Business Coalition on HIV/AIDS, Tuberculosis and Malaria (GBC), PMI, the Government of Angola, and USAID's implementing partner Research Triangle Institute International (RTI**).

Other partners in the effort included the **World Health Organization African Regional Office.** Lead corporate sponsorship by the **Chevron Corporation**, with additional private sector support from **Halliburton, Bayer, Sumitomo Chemicals, Cameron International and Vestergaard Frandsen.**

The workshop effectively trained 39 community health workers in basic entomological monitoring methodologies. Through a combination of field work and practical classes, students learned to conduct standardized larval and adult mosquito collections. Collected specimens were then used for mosquito identification. Other procedures included evaluations on vector susceptibility and insecticide residual effectiveness (wall bioassays). There were also lectures and demonstrations on the effectiveness of long-lasting insecticide-treated nets (LLINs) as well as a session on indoor residual spraying.

Beyond mastering fundamental entomologic principals, this training is a first step toward achieving broader knowledge of malaria prevention and control outlined in the NMCP's strategic plan. Several important next steps include following up with teams that are currently conducting entomology research, providing entomological equipment, establishing an insectary and conducting an intermediate entomology course on ELISA-based procedures that will enable evaluation of the infective rates among mosquitoes – to further enhance the evaluation of vector control impact on malaria transmission.

The success of the workshop is attributed to the dedication and effort by the partners involved. As an essential coordinating and implementing partner, **RTI** offered technical assistance in the form of on-the-ground trainers and consultants, developed and executed theoretical and theoretical-practical classes and exercises, donated entomology equipment, and conducted pre and post-test evaluations.

Private sector partners played an essential role by contributing core competencies to assist with pre-workshop preparations and in-country activities.

- **Chevron Corporation** led government relations and coordination on the ground, provided financial support and lodging for several trainers in Luanda.
- **Halliburton** provided transportation for all workshop participants throughout the duration of the course, which allowed for essential mobility between Luanda, Bengo and various field locations.
- **Sumitomo Chemicals** provided financial support as well as 200 LLINs.
- **Cameron International** provided financial support.
- **Bayer** provided financial support, training supplies including mosquito specimens.
- **Vestergaard Frandsen** provided financial support, long lasting insecticide treated nets, an expert trainer and training supplies.

Consultant report on the activity follows

CONSULTANT REPORT

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Introduction

Between the 15th of February and the 4th of March 2010 the "Entomology Technicians course – Basic Level" was held in the city of Caxito, capital of Bengo Province, Angola. The activity was a collaboration between The National Malaria Control Program (PNCM) of the Ministry of Health of Angola, The Corporate Alliance for Malaria in Africa (CAMA) and the Global Business Coalition for HIV/AIDS, TB and Malaria (GBC), the US President's Malaria Initiative (PMI) and the Research Triangle Institute (RTI) . It was aimed at supporting efforts by PNCM to build a critical mass of trained staff to support entomology surveillance and monitoring within the provinces for a rational scale up of malaria vector control interventions.

The course had the participation of 40 students from all the 18 Provinces of the country (annex 1). The students attending the course were technicians enrolled either in the National Malaria Control Program (PNCM) of the Ministry of Health of Angola, or in the National Larval Control Project currently being implemented by the PNCM and the Cuban Cooperation.

The teaching staff of the course was composed by Dr. Jacob Williams (RTI International), Dr. Nelson Cuamba (INS, Maputo-Mozambique), Dr. Cani Pedro (PNCM), Dr. Nilton Saraiva (PNCM), Dr. João Pinto (UEM/CMDT.LA-IHMT/UNL, Lisbon-Portugal) and Dr. Chouaibou Mouhamadou (Vestergaard Frandsen/Africa Lab, Abidjan-Côte d'Ivoire). In the second week, Dr. Carla Sousa (UEM-IHMT/UNL Lisbon-Portugal) was invited to co-lecture the practical class on WHO insecticide susceptibility tests. In the third week, demonstration classes on vector control operational tools and products were delivered by the agents of the companies that sponsored the course. The CAMA/Global Business Coalition (GBC) Program Manager Ms. Sihle Zulu also attended the course as an observer during the 1st week. PMI/Angola (Drs Jules Mihigo and Francisco Saute) frequented the training sessions and provided timely support to logistics and other needs.

Coordination and logistics were provided by RTI International (Dr. Jacob Williams), CAMA/GBC under the leadership of Anna Thompson-Quaye, the PNCM (Mr. Manzambi Ferreira, Mr. David Mendes, Dr. Cani Pedro, Dr. Antónia Ribeiro, Dr. Nilton Saraiva, Dr. Arlete Troco and the Director Dr. Filomeno Fortes), the Provincial Branch of PNCM (Dr. Alberto Kalupeteca) and CONSAÚDE (Mr. Dionísio António, Dr. Paula Figueiredo)- contractual partner for the GBC. The course took place in the facility of Restaurante Açude (Manager: Mr. Mário Mendes), where theoretical classes and demonstrations were conducted. Logistic support was also given by the Instituto Médio de Saúde do Bengo (Director: Guilhermina Guilherme). Students were accommodated in the residence of this campus and the opening and closing ceremonies were held in its conference room. Some of the long lasting insecticidal nets (LLINs) made available by Vestergaard-Frandsen and Sumitomo were provided for use by the students for protection against malaria. Room space was also made available for storage of the equipments and materials of the course.

The objectives of the course were to provide to entomology technicians involved in malaria vector control, basic knowledge on the biology of mosquito vectors and on the rational and methodologies used for malaria vector surveillance and monitoring of vector control interventions.

Program of the course and classes

The course was divided into three main blocks, each taking place in one week (annex 2). The first week was devoted to theoretical classes and theoretical-practical exercises; the second week concerned field- and laboratory-based practical classes; the third week was committed to sponsors demonstrations, revisions and general discussion classes, students' evaluation and course evaluation.

Week 1

At the opening session the students were provided with the course documentation that included a Basic Entomology Manual, compiled by J. Williams and translated and adapted to Portuguese by N. Cuamba and J. Pinto.

In the opening session, the Provincial Health Director of Bengo emphasized the burden of malaria in Angola, the ongoing malaria control activities and the importance of the course for vector control monitoring within the perspectives of achievement of the Millennium Development Goals.

The opening session, with the Provincial Health Director and representatives of PNCM, GBC, PMI and CONSAÚDE

The opening session included remarks by USAID/PMI, Chevron as lead corporate partner, and GBC. They all emphasized the important role of entomology and their commitment to work with the Government of Angola in its malaria control efforts.

In the first day, students replied to a pre-test that provided baseline information on the previous knowledge of the students regarding medical entomology, biology of malaria, mosquito vectors and vector control (annex 3).

In the first week, the following theoretical classes were given to the students:

1. *Global malaria situation and malaria in Angola* (Nilton Saraiva, PNCM)
   An overview of basic concepts on the epidemiology of malaria was given, with emphasis in the African continent and on the current situation of the disease in Angola.

2. *Objectives of the course* (Nilton Saraiva, PNCM)
   The objectives and program of the course were presented.

3. *History of malaria vector control in Angola* (Cani Pedro, PNCM)
   Historical and contemporary aspects of the main strategies and achievements of vector control implemented in Angola were described.

4. *The role of entomology in vector control* (Nelson Cuamba, INS-Maputo)
   Basic concepts on insect science were given as well as its application for the study of the bio-ecology of mosquitoes aspects relevant to the vector control.

5. *Principles of malaria control* (Nelson Cuamba, INS-Maputo)
   An introduction was given to the major strategies and methods for fighting against malaria, including targeting the parasite, the vector and the human population.

6. *Major vector control interventions* (Jacob Williams, RTI International)
   The major vector control interventions were addressed with emphasis on the factors that govern selection of strategies and implementation success.

7. *Basic principles of planning malaria control* (Jacob Williams, RTI International)
   An introduction was given to the general principles for planning vector control programs, including the concept of integrated vector management, competences and human resource capacities, health system issues, monitoring and evaluation.

8. *Diversity of malaria vectors* (João Pinto, IHMT-Lisbon)
   This lecture focused on basic concepts of biological species and sibling species, identification, methods and the relevance of mosquito biodiversity for malaria epidemiology and control.

9. *Vector incrimination* (Nelson Cuamba, INS-Maputo)
   In this lecture, the main entomological indicators relevant to malaria transmission and vector incrimination were introduced.

10. *Survey of adult mosquitoes* (Cani Pedro, PNCM)
    This lecture detailed the several types of entomological surveys and sampling methods of adult mosquitoes.

11. *Survey of immature mosquitoes* (Nelson Cuamba, INS-Maputo)
    This lecture described methods and techniques for breeding site characterization and appropriated sampling methods for immature mosquitoes.

12. *Estimation of malaria transmission parameters* (João Pinto, IHMT-Lisbon)
    This lecture described the methodological approaches used to calculate estimates of entomological parameters of malaria transmission.

13. *Handling and processing of mosquito samples* (João Pinto, IHMT-Lisbon)
    Materials and procedures of dissection and preparation of individual mosquito samples for different types of analysis (*e.g.* ELISA, PCR, and chromosome analysis) were described.

14. *Rationale for determining insecticide susceptibility & bioassays* (João Pinto, IHMT-Lisbon)
    This lecture introduced mechanisms of insecticide resistance, methods for determining mosquito insecticide susceptibility and bioassays to evaluate insecticide residual effect in walls and netting.

15. *Standard operating procedures for colony maintenance* (Nelson Cuamba, INS-Maputo)
    The role of insectaries and mosquito colonies in malaria control activities was presented, the main characteristics of an insectary and basic conditions for mosquito rearing were introduced.

16. *Establishment and maintenance of mosquito colonies* (Nelson Cuamba, INS-Maputo)
    This lecture focused on the methods and procedures to establish temporary mosquito colonies in improvised insectaries in the field.

Theoretical classes were carried out in the facilities of Restaurante Açude, in Caxito

Week 2

This week was essentially dedicated to field word, practical classes and demonstrations. Before field collections, students were taught on how to assemble field materials (*e.g.* WHO tubes, paper cups). Students were also briefed on the importance of material checking lists, general procedures for field collections and contacts with community leaders and household owners. The following collections, practical classes and demonstrations were conducted:

1. *Larval collections* (all facilitators)
   Two larval collections were done. The first (20th Feb) took place in the city of Caxito and in the village of Porto Quipiri and was devoted mainly to recognize positive breeding sites in the area. A total of 32 breeding sites were surveyed, of which 3 (8.1%) were positive for anophelines. In the second collection (22nd Feb), the students were divided into two groups and each group surveyed a different locality: Paranhos-Caxito and Barra do Dande. Anopheline larvae were collected in 3 breeding sites along an irrigation ditch in Paranhos. No *Anopheles* larva was found in 9 sites surveyed in Barra do Dande.

Collected larvae were transported from the field and reared until the adult stage inside mosquito cages in an improvised insectary that was set up in the premises of the venue (Restaurante Açude). Emerged mosquitoes were used for the classes on mosquito identification and insecticide resistance assays.

N. Cuamba demonstrating larval sampling in Barra do Dande.

2. *Human baited landing catches* (all facilitators)
   Two landing collections were carried out during the course, in the nights of 23-24 Feb and 25-26 Feb, respectively. In the first night, collections were done in the village of Porto Quipiri, from 21.00 to 02.00 (5 hours).

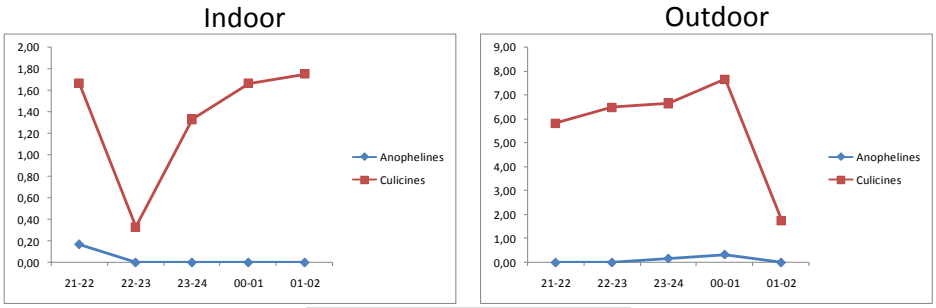
Human baited landing captures carried out in Porto Quipiri

Students were divided into three groups and each group was placed in a household that served as a collection station. In each station two subgroups of two collectors each were placed indoors and outdoors, respectively. Each subgroup collected for two hours and collectors changed places (indoor-outdoor) hourly. In the second night, collections took place in the installations of the venue, from 18.00 to 00.00 (6 hours). Students were again divided into 3 groups and each group collected for 2 hours, occupying one indoor collection site (a pavilion) and one outdoor site (the garden). Collectors changed indoor-outdoor positions every hour.

Collected mosquitoes were kept in paper-cups. One paper-cup was used per collection hour and indoor/outdoor site. Mosquitoes were transported to the premises of the venue and kept for mosquito identification and demonstrations of insecticide resistance tests (CDC bottle assays and WHO susceptibility tests). Data from landing captures were used for calculation of entomological parameters (biting rates and endophagic indices). Results are shown in figure 1.

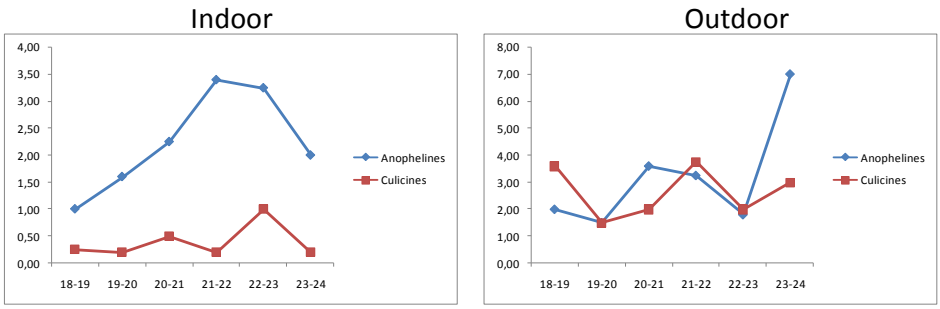
Figure 1. Biting rates and endophagic indices from landing captures (*N*: nº of mosquitoes; I_{end}: endophagic index)

Porto Quipiri



	Anophelines	Culicines
N	4	204
I_{end}	0,25	0,18

Restaurante



	Anophelines	Culicines
N	145	81
I_{end}	0,42	0,12

3. *Pyrethrum spray catches* (all facilitators)
Pyrethrum spray collections (PSC) were performed in the area of Açucareira-Caxito, between 07.00 and 09.00 hours on the 25th Feb. Students were divided into three groups and each group performed spray catches in 4 houses (total 12 houses surveyed). Commercial insecticide spray-cans were used in the collections (New Super Tox®). One bedroom of each house was covered with blank sheets, sprayed for 1-2 min and kept close for 10 min.

Pyrethrum spray catches in Açucareira

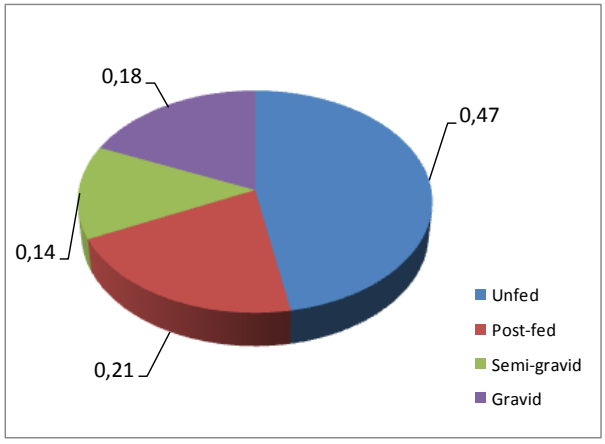
Sheets were then removed from the room and inspected for knockdown insects. Collected mosquitoes were kept in plastic containers and used in the practical classes for mosquito identification and determination of the gonotrophic state.

A total of 306 culicine mosquitoes were collected, of which 206 were females and 100 were males. Figure 2 depicts the relative proportion of females according to their abdominal condition. Of the 206 females, 43 (20.8%) were freshly blood fed (post-fed). Given that a total of 37 persons had slept during the previous night in the rooms sampled, a biting rate of 1.16 bites/person/night can be retrieved for the culicine population. No anophelines were collected.

Based on the abdominal condition of culicine females, a simple endophilic index of 0.32 was calculated as:

$$\frac{\text{(Nº semi-gravid + Nº gravid)}}{\text{Total of females caught}}$$

Figure 2. Proportions of culicine females collected by PSC, according to abdominal condition



4. *Mosquito identification* (all facilitators)
   Practical classes for mosquito identification were made in four days (23-26 Feb) of the 2nd week. Mosquito samples obtained from immature and adult collections were used in these practicals. The students were able to learn how to distinguish culicine and anopheline mosquitoes at both the larval and adult stages. Distinction between female and male culicine/anopheline specimens was also taught. Students worked in groups to produce mosquito counts for the landing and PSC collections performed.

5. *Calculation of entomological parameters* (all facilitators)
   Four practical classes were carried out focusing on the estimation of entomological parameters, namely biting rates, endophagy/endophily indices and entomological inoculation rates. Calculations were based on the mosquito yields from field collections these purpose. In addition, practical exercises were also done based on simulated datasets.

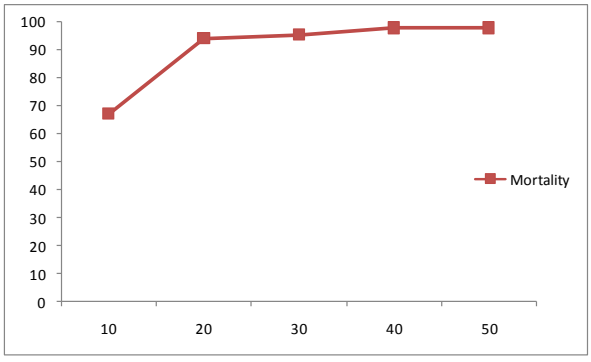
Practical classes on mosquito identification and calculation of entomological parameters

6. *Demonstration of CDC Bottle assays* (Chouaibou Mouhamadou, Vestergaard-Frandsen, Abidjan)
   Two demonstrations of CDC bottle assays were performed (24 and 26 Feb) with culicine mosquitoes and with the insecticide deltamethrin as an example.

   A total of 67 mosquitoes were exposed to deltamethrin at a diagnostic dose of 12.5µg/bottle for 30 min. Partial knockdown readings were done at 10 min intervals. In the first test, readings were prolonged until 50 min of exposure. The second test was terminated at the diagnostic time (30 min). Students were able to determine mortality rates and curves based on the readings of each test. The combined results for both tests are shown in figure 3.

C. Mouhamadou demonstrating CDC bottle assays

Figure 3. Results of CDC bottle assays using culicine mosquito females (X-axis: reading times in minutes; Y-axis: percent mortality)



7. *Demonstration of WHO insecticide susceptibility tests* (Nelson Cuamba, INS-Maputo & Carla Sousa, IHMT-Lisbon)

N. Cuamba and C.A. Sousa demonstrating WHO susceptibility tests

The procedure for insecticide susceptibility determination by WHO tests of adult mosquitoes was performed for the insecticide deltamethrin (0.05%) as an example. A total of 59 mosquitoes were exposed to deltamethrin and 25 mosquitoes were used as a control. Knock down was examined after 60 min of exposure and mortality was assessed on the next day (*i.e.* 24 hours after exposure). A mixture of culicine and anopheline mosquitoes was used in this demonstration.

Calculations done by the students to determine mortality rates were based both on the real data (assuming that the test had been performed with mosquitoes of a single species and of the same age) and on simulated data as an exercise. Calculations included corrections of mortality using Abbot's formula.

8. *Demonstration of WHO cone bioassays* (Nelson Cuamba, INS-Maputo)

A demonstration of the WHO cone tests was performed with culicine mosquitoes on an untreated bed net. It was explained to the students that bioassays of nets and walls used same equipment and procedures but with differences in exposure time and nº of mosquitoes per cone. The rationale and procedures of the test including climatic conditions of the room, the type of mosquitoes used were revised. The concept and utility of mortality and functional mortality were also briefed. The final calculations for the estimation of mortality and the correction of mortality were also explained.

Demonstration of WHO cone tests on a bed net

Week 3

James Titelman and Glen Sikosana, Vestergaard-Frandsen agents, provided demonstrations for the new long-lasting insecticide-treated bed net Permanet® 3.0 and long-lasting insecticide-treated wall lining ZeroFly®. The LLINs provided by both Sumitomo and Vestergaard-Frandsen were used by the students in their dormitories against malaria. Together with the second week demonstration of the knock down effect on mosquitoes, the students had first hand demonstration of the effectiveness of LLINs in preventing human vector contact.

G. Sikosana and J. Titelman demonstration of Permanet® 3.0

Unfortunately, due to an accidental death by a Bayer staff member who was designated to attend the workshop, Bayer was unable to demonstrate indoor residual spraying techniques. An additional theoretical lesson on "Indoors Residual Spraying" was conducted (1st Mar.) by J. Williams, that focused on the operational aspects of establishing an IRS program, with emphasis on biosafety and quality control issues. This week also included classes for revision of theory and discussion of practicals. Two tests and a questionnaire were given to the students (annex 3) as means of evaluation.

The closing session took place on the morning of Mar. 4th and had the participation of the Minister of Health of Angola, The Vice-Governor of the Bengo Province and the representatives of RTI International, CAMA, PMI, Chevron, CONSAÚDE and PNCM. Students and trainers received the course Diplomas during the ceremony.

Honor table of the closing ceremony and delivery of Diplomas

Evaluation

Student's evaluation

Students were evaluated by means of three written tests (annex 3). The pre-test was carried out at the start of the course as a means to assess the previous knowledge of the students in aspects of malaria entomology and vector control. The pre-test was composed by 10 questions, of which two were of

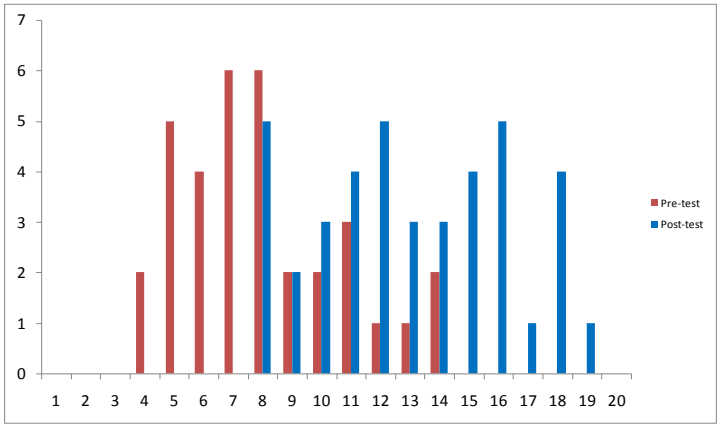
multiple option reply. In the third week of the course the students were subjected to a post-test that was divided into two parts (Part-1 and Part-2). Part-1 was given to the students on Mar. 1st without prior notice and included two development questions and one exercise of simulated data on insecticide susceptibility tests. Part-2 was made on Mar. 3rd and comprised 10 questions of multiple option reply. Students had the afternoon of Mar. 2nd to prepare for Part-2 of the test. A last session of revisions and discussion took place in the morning that preceded Part-2 of the test. Both parts were classified using a 0-20 scale and the final classification of the Post-test was obtained using the formula:

$$\text{Classif. Post-Test} = (\text{classif. Part-1})*0.4 + (\text{classif. Part-2})*0.6$$

The classifications of the post-test, rated from 0-20, were compared to those of the pre-test (also rated by a 0-20 scale) to assess the degree of acquisition of new knowledge by the students. Summary statistics for the student's evaluation are shown in Figure 4.

Results depicted in Figure 4 clearly indicate an improvement in the performance of the students between pre- and post-tests, suggesting a satisfactory acquisition of the concepts given during the course.

Figure 4. Summary statistics for the student's evaluation by pre- and post-tests (X-axis: classification grades from 0 to 20; Y-axis: number of tests classified according to grade)



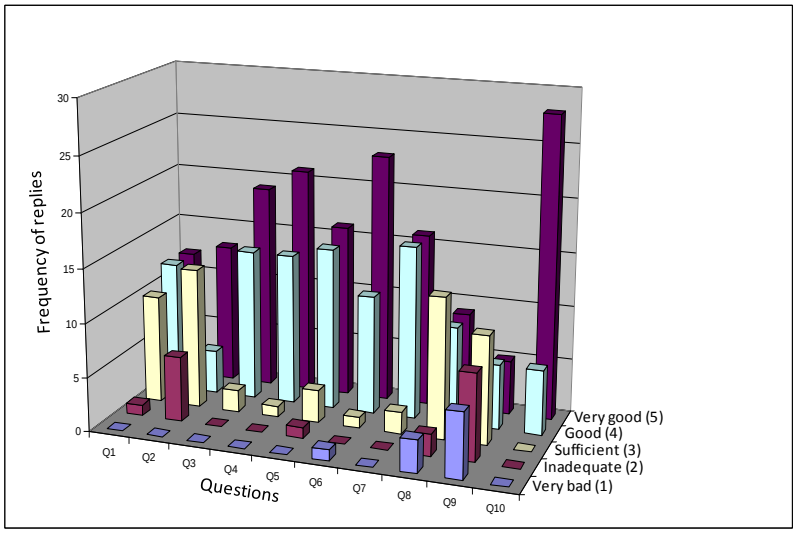
	Pre-test	Post-test
Nº of tests	34	40
% tests with classification ≥ 10	26,5	77,5
Average classification	7,9	12,9

Feedback on the course

Feedback on the quality of the course was obtained from an anonymous questionnaire with 10 questions concerning the different components of the course (*e.g.* theoretical practical classes, length of the course, logistics and organization; see annex 3). Students were asked to rank each question from 1 (very bad) to 5 (very good). The results, shown in figure 5, indicate an overall positive evaluation of the course in every component. In particular, questions Q4 (*How would you grade the practical classes in terms of educational value?*), Q6 (*Exercises solving*) and Q10 (*Usefulness of the course for your intended*

role as malaria vector control official) received the best evaluations. Q10 (*organization and logistics*) was the question that performed less well.

Figure 5. Results of the questionnaire on the course performance



Conclusions and Critical Assessment

All thematic areas originally planned in the course program were covered. In week 1 a few adjustments were done, namely: i) some lectures were fused into a single one (*e.g. Rationale for determining insecticide susceptibility & bioassays* and *Instructions on insecticide susceptibility and bioassays*); ii) demonstration on susceptibility assays and mosquito identification were moved to week 2; iii) since the National Larviciding Program of PNCM was unable to attend the course, classes on larval biology and control were assured by the team of trainers.

The students faced a few logistic difficulties at the onset of the course. These mainly concern the initial conditions of the residence where the students were accommodated that lacked water and electricity. These difficulties were promptly overcome during the first week by the logistics facilitator with the acquisition of a power generator and with regular water supplies to the residence. Also, adjustments to the students' per diems were done to cope with issues related to kwanza/USD exchange rates.

The venue of the course was originally the Escola Média de Saúde do Bengo. However, due to the lack o electricity, the venue was transferred to "Restaurant Açude" where power was available all the time. The Restaurant had some disadvantages mainly due to its physical structure and furniture that were conceived for a restaurant. Nevertheless, the fact that all meals were served in same place proved to be more practical in terms of transportation and also allowed much more time for interaction between the trainees and trainers in a less formal environment. Some important questions and clarifications were done during this period.

Overall, the materials and equipments available for the course were adequate and sufficient for classes and demonstrations. On the other hand, fewer than expected mosquitoes were obtained in the field collections. While this did not affect most subsequent classes (in particular those based on data analysis), it precluded students to perform more insecticide susceptibility assays to gain more practice. Therefore, in future editions of a similar course it would be desirable that an anopheline colony is available in order to overcome eventual shortages in mosquito samples to conduct practical classes. This issue would be even more important for the case of an intermediate level course that involves processing of larger number of mosquitoes to train some techniques (*e.g.* dissections).

Recommendations

From the course evaluation it was clear that the students acquired sufficient knowledge to be capable of conducting basic entomological procedures required for effective mosquito surveillance activities in areas where vector control is being implemented. To achieve this purpose, a few steps need to be performed, namely: i) to create sentinel sites at each Province and equip the entomological teams with basic instruments and logistics (priority could be given to those provinces with already ongoing insecticide-based vector control actions); ii) to implement a regular follow-up of the entomology teams in the field, in order to assess and improve skills and data reporting; iii) building of an insectary and a central entomology laboratory to support training and vector monitoring activities (insecticide resistance monitoring in particular); iv) There will be the need to conduct and intermediate level entomology course. This course would focus on more elaborated aspects such as vector incrimination (sporozoite detection by dissections and ELISA), mosquito age grading (dissections to determine parity), morphological species identification and establishment of field insectaries and management of mosquito colonies. The success of this course will ultimately depend on the short-term conditions that will be made available for the technicians to put in practice the acquired knowledge.

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ANNEXES

ANNEX 1: List of Participants

Nº	PROVINCE	NAME	PARTICIPATION	INSTITUTION	PHONE	E-MAIL
1	Bengo	Alberto Kalupeteca Sandombe	Trainee	DPS-Bengo	924-478-112	Tecas5@yahoo.es
2	Bengo	André Manuel Pedro	Trainee	DPS-Bengo	923-440-792	
3	Bengo	Bernardino Assunção Gabriel	Trainee	DPS-Bengo	925-393-337	
4	Bengo	Jocelino Fernando	Trainee	DPS-Bengo	927-927-785	
5	Bengo	Martins António Paulo	Trainee	PPCM-Caxito	923-597-608	
6	Benguela	Feliciana Paula Lumbungululo	Trainee	PPCM-Lobito	929-286-272	
7	Benguela	Paulo Jorge da Silva Ventura	Trainee	PPCM-Lobito	924-720-657	
8	Bié	Idalina Silepo Sinjapo Yonguma	Trainee	PPCM-Kuito	923-250-068	
9	Bié	Isilda Dulce de Carvalho Mendes	Trainee	PPCM-Kuito	923-226-319	
10	Cabinda	Francisco José Piúla Kaka	Trainee		926-873-232	
11	Cunene	Abílio dos Santos Nogueira	Trainee		934-228-941	
12	Huambo	Inácio Pedro Chilala	Trainee		923-094-475	
13	Huambo	Júlia Nazaré de Campos	Trainee		924-443-657	
14	Huambo	Maria da Conceição Sapuile Satanha	Trainee		926-498-397	
15	Huambo	Luís Manuel Gonçalves	Trainee	RTI	926-629-959	
16	Huila	Francisco Alberto Candongo	Trainee	PPCM-Quipungo	934-161-661	
17	Huila	Henriques Nascimento Rufino	Trainee	PPCM-Matala	924-052-049	
18	Huila	José Handanga	Trainee	PPCM-Lubango	921-920-097	
19	K.Kubango	Duarte Braz Simão Pimentel	Trainee	MINSA	929-847-160	
20	Kuanza-norte	Osmar Kiti Luís Bernardo	Trainee		912-221-527	
21	Kuanza-sul	Jerónimo Amaro Laurindo Tchitue	Trainee	PPCM-Sumbe	924-638-919	
22	Luanda	Alberto Bunga	Trainee		924-500-613	
23	Luanda	André Francisco Sebastião	Trainee		923-598-028	
24	Luanda	Arlete Dina Troco	Moderadora	PNCM	923-447-367	dinatroco@gmail.com
25	Luanda	Catarina Sebastião Diniz Cardoso	Trainee	DPSL	923-511-785	caty-60@hotmail.com
26	Luanda	Cristina Martins Vunda	Trainee	PPCM-Luanda	912-767-943	
27	Luanda	Dionísio António	Secretariat	Consaúde/FNPM	923-977-877	saodioniisio@yahoo.com
28	Luanda	Emanuel de Jesus Leonardo Marques Ferreira	Trainee	Projecto LAV	925-261-790	femanuel80@yahoo.com.br
29	Luanda	Engrácia Francisco Lopes	Trainee	DPSL	912-664-570	
30	Luanda	Kidimbu Lusakueno	Trainee		934-364-701	
31	Luanda	Manzambi Ferreira	Moderator	PNCM	929-090-424	phernzambi@yahoo.com.br
32	Luanda	Mpova Zambote	Trainee	PNCM	912-354-948	
33	Luanda	Pedro Rafael Dimbu	Trainee	PNCM	923-317-364	
34	Luanda	Rogério Vicente Filipe	Trainee	Consaúde	923-328-406	rogeriofilipe@yahoo.com.br
35	Luanda	Silvestre Fernando	Trainee	RTI	924-505-518	sfernando@nb.rti.org silvestrefer@hotmail.com
36	Luanda	Baiano J. Miranda	Driver	Equador	924-976-039	
37	Luanda	Teixeira Kapapa	Driver	Equador	922-389-729	

38	Luanda	António Santos Covilhão de Almeida	Driver	Equador	923-050-575	
39	Lunda-norte	Paulo Dias	Trainee		921-282-838	
40	Lunda-sul	Upale Miji Muatchimbundo Cacambo	Trainee		934-440-335	
41	Malanje	Inglês Morais Gomes da Silva	Trainee		924-678-027	
42	Malanje	Manuel António Cristóvão	Trainee		933-449948/ 915-156076	
43	Moxico	Paulo Tchinhama Tchiteta	Trainee		922-605-265	
44	Namibe	Nunes Caunda	Trainee		924-858-596	
45	Uíge	Nzonzi Ibanda	Trainee		924-445-738	
50	Zaire	Kiakanua Kizeyedioko	Trainee	PPCM-Mbanza Congo	924-671-567	
51	Luanda	Cani Pedro Jorge	Trainer	PNCM	924-775-374	
49	Cote d'voire	Chouaibou Mouhamadou	Trainer	Vesrtergaard	+22540200032	mcs@vestergaard-frandsen.com
46	E.U.A	Jacob Williams	Trainer	RTI	1-202-728-2474	jacobwilliams@rti.org
48	Portugal	João Pinto	Trainer	CMDT/IHMT	+351 21 265 26 00	jpinto@ihmt.unl.pt
47	Moçambique	Nelson Cuamba	Trainer			ncuamba@hotmail.com
52	Luanda	Nilton Saraiva	Trainer	PNCM	923-425-708	niltonsar@yahoo.com.br
53	África do Sul	Sihle KaPhila Zulu	Invited	GBC	+27(0) 827446737	szulu@gbcimpact.org
54	Luanda	James Titelman	Invited	PERMANET/CICCI	923-302-457	jt@cicci.com

ANNEX 2: Program of the course

Week 1

Time	Day 1	Day 2	Day 3	Day 4	Day 5
9:00 AM	Opening Ceremony and Welcome	Major Vector Control Interventions	Vector Incrimination	Handling and Processing of Mosquitoes	Data and Interpretation
9:30 AM					
10:00 AM	Pre-Assessment of Participants				
10:30 AM		*Coffee Break*	*Coffee Break*	*Coffee Break*	*Coffee Break*
11:00 AM	*Coffee Break*	Basic Principles of Planning Malaria Control	Mosquito Survey (Adults)	Rationale for Determining Insecticide Suscp. & Bioassays	Establishment & Maintenance of Mosquito Colonies
11:30 AM	Course Objectives				
12:00 PM	*Lunch*	*Lunch*	*Lunch*	*Lunch*	
12:30 PM					*Lunch*
1:00 PM	History of Malaria Vector Ctrl in Angola	Mosquito Identification (theory)	Mosquito Survey (Adults cont'd)	Type of Tests Available from WHO & CDC	
1:30 PM					Collection and Transportation of Larvae & Adult Mosquitoes for Insectary
2:00 PM	Biology of Malaria Vectors		Mosquito Survey (Larvae)	Practical Demo. Of WHO Bioassay, Cone Test and CDC Bottel Assay	
2:30 PM	Role of Entomology	Diversity of Malaria Vectors			
3:00 PM					*Coffee Break*
3:30 PM	*Coffe Break*	*Coffee Break*	*Coffee Break*	*Coffee Break*	Standard Operating Procedures for Colony Maintenance
4:00 PM	Principles of Malaria Control	Diversity of Malaria Vectors	Estimation of Malaria Transmission Parameters	Instructions on Insecticide Susceptibility and Bioassay	
4:30 PM					
5:00 PM					

Week 2

Time	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
6:00 AM				Pyrethrum Spray Collection		
8:00 AM					Leaving for Field Site	
8:30 AM				Processing of Mosquitoes		
9:00 AM	Organizing field activities & the essentials	Field Trip (Identify breeding Places)	Processing of Samples from NBC and LTC		Larval Survey & Identification	Processing of Samples from NBC and LTC
9:30 AM						
10:00AM				ORC Collection		
10:30AM	*Coffee Break*					*Coffee Break*
11:00 AM	Breeding Habits and Larval Control	mosquito identification (larvae con'td)				Processing of Samples from NBC and LTC
11:30 AM				Lunch		
12:00 PM	*Lunch*		*Lunch*		Leaving for Lunch	
12:30 PM		*Lunch*			*Lunch*	*Lunch*
1:00 PM	Data Reporting, Mgmt, and Utilization		Calculation of Malaria Transmission Parameters	Processing of Mosquitoes	Data Handling	Calculation of Malaria Transmission Parameters
1:30 PM		Mosquito identification (adult cont'd)				
2:00 PM						
2:30 PM						
3:00 PM	*Coffee Break*					
3:30 PM	Mosquito Identification		*Coffee Break*	*Coffee Break*	*Coffee Break*	
4:00 PM		*Coffee Break*	Calculation of Malaria Transmission Parameters	Data Analysis & Handling	Data Handling	*Coffee Break*
4:30 PM		Prepare for Night Biting & Light Trap Collection			Prepare for Night Biting & Light Trap Collection	Calculation of Malaria Transmission Parameters
5:00 PM			Preparations for PSC (next morning)			
5:30 PM	Dinner	Dinner	Dinner		Dinner	
Skip to 7:00 PM		Night Biting & Light Trap Collection			Night Biting & Light Trap Collection	

Week 3

Time	Day 1	Day 2	Day 3	Day 4
9:00 AM 9:30 AM 10:00 AM	Bayer- Practical Demonstration & Use of Malaria Products	Vestergard- Practical Demonstration & Use of Malaria Products	Review of Theory Part I	General Discussion
10:30 AM	*Coffee Break*	*Coffee Break*	*Coffee Break*	*Coffee Break*
11:00 AM 11:30 AM 12:00 PM	Bayer- Practical Demonstration & Use of Malaria Products	Vestergaard- Practical Demonstration & Use of Malaria Products	Review of Theory Part II	Final Assessment
12:30 PM 1:00 PM	*Lunch*	*Lunch*	*Lunch*	*Lunch*
1:30 PM 2:00 PM	Sumitomo- Practical Demonstration & Use of Malaria Products	CDC bottle assays	Discussion on Practicals	Post- Course Assessment
2:30 PM 3:00 PM 3:30 PM				Closing Ceremony & Reception
4:00 PM	*Coffee Break*	*Coffee Break*	*Coffee Break*	
4:30 PM 5:00 PM	Sumitomo- Practical Demonstn/Use of Malaria Products	Wall Bioassay	Discussion on Practicals	

ANNEX 3. Evaluation materials

PRE-TRAINING TEST

1. What type of mosquito causes malaria?

(a) *Culex*
(b) *Anopheles*
(c) Male mosquito
(f) Female mosquito

Which of the above is/are correct?

2. **Malaria is transmitted through……..of a mosquito**

(a) The saliva
(b) The bite
(c) The sting
(d) The Scratch

Select as many as you think are correct

3. Why does the mosquito feed on blood? ……

……..

4. Name two important vector control methods used to control malaria……..

……..

5. Name the various stages of the mosquito as it develops ……

……..

6. Why are pesticides sprayed on the walls in indoor residual spraying? ……

……..

7. If a mosquito is "resistant to an insecticide" it means……

……

8. A mosquito lays its eggs in……

9. How do you know if an insecticide is not effective in killing mosquitoes? ……

……

10. Why am I taking part in this training? ……

……..

POST-TEST – PART 1

1. Why is it important to have entomological information in vector control?.....
.....

2. Below are hypothetical examples of results obtained from WHO susceptibility assays of vectors collected from four Angola cities to deltamethrin

Test 1: Bengo

	Dead	Alive
Tube 1	22	3
Tube 2	19	6
Tube 3	21	4
Tube 4	20	5
Control	5	20

Test 2: Luanda

	Dead	Alive
Tube 1	23	2
Tube 2	20	5
Tube 3	22	3
Tube 4	19	7
Control	20	5

Test 3: Huila

	Dead	Alive
Tube 1	10	15
Tube 2	16	9
Tube 3	15	10
Tube 4	11	14
Control	4	21

Test 4: Huambo

	Dead	Alive
Tube 1	10	15
Tube 2	17	8
Tube 3	19	6
Tube 4	20	5
Control	1	24

Another test from Huila (Test 5) using Bendiocarb gave the following results:

Test 5: Huila

	Dead	Alive
Tube 1	22	3
Tube 2	21	4
Tube 3	23	2
Tube 4	21	4
Control	3	22

Question 2a: Are all the results from the five tests acceptable? If they are, then indicate why. If they are not, then indicate why?

Question 2b: Calculate the corrected exposure mortality for the various tests that you think are acceptable indicating in the vectors are susceptible of not.

Question 2c: If you are made in charge of vector control operations, which insecticide will you select for adult vector control in Huila and why?

POST-TEST – PART 2

NAME: …… CLASSIFICATION: ……..

Please, answer the following questions by marking the correct options

1. Why do mosquitoes feed upon blood?

(a) To grow better

(b) To develop eggs

(c) To fly better

(d) To obtain sugar

(e) Because are vampires

2. The development stages of mosquitoes are

(a) Egg, larva and adult,

(b) Egg, larva, pupa, adult

(c) Egg, larva, nymph, pupa, adult

(d) Egg, pupa and adult

3. Female mosquitoes of the Genus *Anopheles* and *Culex* are easily distinguished by

(a) Wing size

(b) Length of legs

(c) Resting position

(d) size of the siphon

4. The following entomological indicators can be generated by human landing collections:

(a) Mosquito density in relation to humans

(b) Endophilic index

(c) Anthropophilic index

(d) Endophagic index

(Indicate all correct answers)

5. The following mosquito sampling methods can produce entomological indicators

(a) Human landing captures

(b) Pyrethrum spray catches

(c) ELISA

(d) Indoors residual spraying

(Indicate all correct answers)

6. Major interventions like LLIN and IRS are more effective if the mosquito vector is

(a) Indoor biting and indoor resting

(b) Indoor biting and outdoor resting

(c) Outdoor biting and indoor resting

(d) Outdoor biting and outdoor resting

(e) Human biting preference

(Indicate all correct answers)

7. The results of CDC bottle assays and WHO susceptibility tests are not considered valid if

(a) Mortality in the control is below 5%

(e) Mortality in the control is between 5 and 20%

(c) Mortality in the control is above 20%

(d) None of the above

8. A mosquito population is considered resistant to an insecticide if mortality in WHO susceptibility test is

(a) Above 98%

(e) Between 80% and 98%

(c) Below 80%

(d) all of the above

9. The most widely used vector control methods in Angola are

(a) Indoors residual spraying

(b) LLIN

(c) Larval control with *Bti*

(d) all of the above

(e) None of the above

(Indicate all correct answers)

10. Which method is currently used to evaluate the durability of a residual insecticide on a wall?

(a) WHO susceptibility tests

(b) Cone bioassays

(c) CDC bottle assays

(d) Biochemical assays

(e) Molecular assays

COURSE EVALUATION: QUESTIONNAIRE

Please answer the questions below, indicating by a score (1-5) on the various aspects of the training. The mean of each score is provided bellow.

Thanks for your collaboration

Questions	**Score**				
	1	2	3	4	5
1. Was the length of the course appropriate for the subjects to be covered					
2. Course material adequate					
3. How would you grade the theoretical classes in terms of educational value					
4. How would you grade the practical classes in terms of educational value					
5. Were the demonstrations classes useful					
6. Exercises solving					
7. How would you grade the field work					
8. Adequacy of venue of the course					
9. Organization and Logistics					
10. Usefulness of the course for your intended role as malaria vector control official					

1. Very bad 2. Inadequate 3. Sufficient

4. Good 5. Very good (Excellent)

Comments:

News about the event

Private Sector and PMI Join Forces, Strengthen Angola's Capacity to Control Mosquitoes

Date: 15th February 2010. Source: http://www.wwarn.org/node/169

Luanda, Angola - Top global companies and the President's Malaria Initiative are working with the Government of Angola on an intensive technical training program to arm the country's malaria fighters with state-of-the-art mosquito surveillance and vector control techniques. By aiding the sharing of these comprehensive technical skills and best practices in mosquito monitoring and evaluation, as well as providing training on how to use the latest malaria control products, the private sector will help Angola, which reported more than 3.1 million cases of malaria in 2009, move more quickly toward reducing the disease's deadly impact. Public and private sector health technicians from the provincial and district level will acquire basic capabilities and skills that are needed to determine the impact of malaria control efforts around the country, a gap which hampers decision-making on resource deployment at the national level. When completed, the technicians will be able to monitor and evaluate mosquitoes, before sending them to senior scientists for further entomological analysis. The senior entomologists and malaria program officers will be empowered with critical information to ensure the success of sustainable malaria control programs and the ability to deploy limited resources more effectively and efficiently. Company representatives also will train the participants in techniques for using a variety of state-of-the-art malaria intervention products, such as long-lasting, insecticide-treated malaria nets and indoor residual sprays. The workshop, which kicks off February 15 in Bengo, is organized by the Corporate Alliance on Malaria in Africa (CAMA), President's Malaria Initiative, the Government of Angola, USAID's implementing partner Research Triangle Institute International (RTI) and the Global Business Coalition on HIV/AIDS, TB and Malaria. It is part of the Angola National Malaria Control Program's overall effort to scale-up malaria prevention and treatment services to reduce the health, social and economic burden resulting from the disease. Other partners in the effort include the World Health Organization African Regional Office. Lead corporate sponsorship is by the Chevron Corporation, with additional private sector support from Halliburton, Bayer, Sumitomo Chemical, Cameron International and Vestergaard Frandsen. The Ministry of Health, through the National Malaria Control Program, has utilized integrated vector control as one of the country's main malaria control interventions, including prevention programs such as the widespread use of insecticide treated nets, indoor and outdoor residual spraying, and larviciding. At present the country is implementing a nation wide program for larval control- including all the cities in the country. This program is integrated with a massive distribution program of insecticide treated nets and localized indoor and outdoor spraying in a selective and sustainable manner, making these valuable actions in the fight against malaria in Angola. With this training, the National Malaria Control Program will create institutional capacity for vector control at the local level and create conditions for Angola to develop a pilot project in Africa for Integrated control of vector borne diseases. (Nilton Saraiva, Angola National Malaria Control Program) "Malaria remains the main cause of mortality in Angola," said Alan Kleier, Chevron Managing Director for Southern Africa Business Unit. "As part of Chevron's core community investment strategies, we will continue to work closely with the Angolan Government and partners in order to meet the goal of a malaria-free Angola. I firmly believe that our investment in this capacity building training program in entomology is equally important as our contribution of $5 million made in 2008 through the Global Fund against Malaria for Angola. It will help create a group of Angolan experts who will be better prepared to fight this disease." "This unique partnership between the private sector, Government of Angola and PMI provides an opportunity to build in country capacity to monitor malaria control interventions in Angola," said Rick Wilkins, Vice President, Corporate Alliance on Malaria in Africa and General Manager Health & Medical Services, Chevron. "It builds a foundation to develop an effective resistance management and monitoring strategy in Angola- areas in which the private sectors expertise can be leveraged." "This training will provide robust knowledge for Angola's entomologist technicians," said Jules Mihigo, PMI/Angola. "Health staff will be trained to monitor resistance to insecticides used for bed nets and indoor residual spraying, and will also be able to detect morphological distinction between a culex and anopheles. These skills will contribute to reduce the burden of malaria in Angola."

Health minister reiterates Government's malaria fight commitment

Date: 5th March 2010. Source: http://www.portalangop.co.ao/motix/en_us/noticias/saude/2010/2/9/Health-minister-reiterates-Government-malaria-fight-commitment,91dcbb89-4ba2-4535-8c70-716efb61f598.html

Caxito – The Health minister, José Van-Dúnem, Thursday in Caxito, northern Bengo province, reiterated Angolan Government's effort towards fighting malaria, a disease responsible for the country's high death rate. José Van-Dúnem said so during the closing of the first entomology course that was aimed at equipping health personnel from the country's 18 provinces with the essential skills in the fight of malaria. During his address, the health minister highlighted the importance of the course, underlining that the upgrading of the personnel will contribute to the efforts of the Government and its partners in reducing the rate of maternal and infant mortality in Angola. During 17 days, at least 45 basic health technicians from around the country were upgraded in basic entomological skills. The course was lectured by Angolan and foreign specialists from Portugal, United State of America, Mozambique and Cameroon.

Over 40 health professionals upgraded in entomology

Date: 4th March 2010. Source: http://www.portalangop.co.ao/motix/en_us/noticias/saude/2010/2/9/Over

Luanda - At least 41 Angolan health professionals ended Thursday in northern Bengo province, an intensive entomology course, aimed at providing the professionals engaged in the fight against malaria with recent techniques for surveillance and control of mosquitoes. A note from the National Malaria Control Programme made available Wednesday to Angop, says that the programme that started on February 15, was sponsored by the Business Alliance "Corporate Alliance on Malaria in Africa" and counts on support from Angolan Government , the US President's Malaria Initiative and other partners. The upgrading course also aimed to upgrade professionals in the use of the latest products on the market, which will enable to control the disease nationwide. The ceremony of formal closing of the course will be chaired by the Health Minister, José Van-Dúnem, attended by the US ambassador to Angola, Dan Mozena, the governor of northern Bengo province, João Bernardo de Miranda and other officials.