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Report on the

**Fifth meeting of the  
regional Scientific and  
Technical Advisory  
Committee of the  
WHO/UNEP project  
supported by the Global  
Environmental Facility**

Cairo, Egypt  
10–12 July 2012



**World Health  
Organization**

Regional Office for the Eastern Mediterranean

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## 1. INTRODUCTION

A project entitled “Demonstration of sustainable alternatives to DDT and strengthening of vector control capabilities in Middle East and North Africa” is being implemented by the WHO Regional Office for the Eastern Mediterranean and the United Nations Environment Programme (UNEP), with financial support from the Global Environmental Facility (GEF). This regional project (2009–2014) covers the following countries of the WHO Eastern Mediterranean Region: Djibouti, Egypt, Jordan, Islamic Republic of Iran, Morocco, Sudan, Syrian Arab Republic and Yemen. A total of US\$3.9 million has been made available to support the five components of the project at national and regional level.

The fifth meeting of the regional Scientific and Technical Advisory Committee (STAC) of the WHO/UNEP/GEF project was held in Cairo, Egypt from 10–12 July 2012. The fifth STAC meeting aimed to build on the recommendations of the previous STAC meetings held in: Amman, Jordan in November 2008; Cairo, Egypt, in July 2009; Damascus, Syrian Arab Republic in July 2010; and Marrakesh, Morocco in July 2011. The objectives of the meeting were to:

- present and review the status of the project activities on the demonstration of alternative vector control interventions to DDT;
- report on the status of the cost-effectiveness tools and data collected to date;
- report on the status of the disposal of obsolete DDT and other pesticides in Morocco, Jordan and the Islamic Republic of Iran;
- identify challenges and constraints in the overall implementation of the project in countries of the Region; and
- recommend the way forward for timely implementation of the project.

Five members of the STAC were in attendance; the remaining members were unable to attend. Representatives from the seven project countries were in attendance; one country (Islamic Republic of Iran) was represented by the WHO national officer.

The meeting was opened by Dr Hoda Atta, who delivered a message from Dr Ala Alwan, WHO Regional Director for the Eastern Mediterranean. In his message, Dr Alwan acknowledged the support of UNEP/GEF and the collaboration between WHO and other United Nations agencies. He drew attention to the achievements made by countries of the Region in scaling up use of long-lasting insecticidal nets for vector control, as a potential alternative to DDT. He reminded the participants of the global plan for insecticide resistance management that was launched on 15 May 2012 in Geneva by WHO. Governments, donor organizations, United Nations agencies, research and industry partners all had important roles to play in implementing the five pillar strategy to tackle the growing threat of resistance and to facilitate the development of innovative vector control tools and strategies, which was in line with GEF project objectives.

Dr Alwan called upon project countries and STAC members to develop relevant policy and strategies strengthen national capacities to implement sound management of public health pesticides as per the recent resolution adopted by the Regional Committee for the

Eastern Mediterranean in October 2011 (EM/RC58/R.10). He acknowledged the political challenges that some of the project countries were facing that had resulted in hampering the implementation of demonstration activities in the Syrian Arab Republic and delayed the progress in Yemen. He concluded by requesting the STAC to review the GEF plan and to recommend measures to speed up the implementation.

On behalf of UNEP/GEF, Mr Jan Betlem, Head Monitoring, Quality Assurance Section, UNEP, made a statement underscoring the goals of the project regarding the safe and sound management of public health pesticides. He pointed out that India is phasing out the production of DDT and that UNEP is interested in finding long term, lasting alternatives to the use of DDT in vector control for public health. The countries of the Eastern Mediterranean Region who were engaged in the GEF supported projects were making an important contribution to the evidence for controlling vector-borne diseases in a cost effective way without the use of DDT.

The participants elected Dr Khalil Kanani (Jordan) Chair of the meeting. Dr Immo Kleinschmidt was elected Rapporteur.

The programme and list of participants are given in Annexes 1 and 2, respectively.

## **2. REGIONAL PROJECT PROGRESS REPORT**

*Dr H. Atta and Dr S. Elkhalifa, WHO Regional Office for the Eastern Mediterranean*

The regional activities conducted in the year ending June 2012 were presented in relation to each outcome, while details in each country are covered in the country presentations.

Outcome 1 (Sustainable and cost-effective DDT alternatives demonstrated): Country support missions were provided for cost analysis to Sudan and Morocco by the Regional Office and external WHO project expert. Support was provided to the Islamic Republic of Iran and Yemen through email communications by WHO experts.

Outcome 2 (Capacity built to implement DDT alternatives based on principles of integrated vector management): A mission was conducted to Djibouti by the GEF focal from Morocco and staff of the regional Office to review the project and assist in development of a plan of action. Support was provided to Jordan for insecticide resistance. A Regional Office team conducted a mission to Egypt to revive the national steering committee and assist with development and implementation of the plan of action.

Outcome 3 (repackaging and disposal of persistent organic pollutants): covered by the summary from the Food and Agriculture Organization of the United Nations (FAO).

Outcome 4 (Good practices on sustainable alternatives are shared): Managing the use of public health pesticides in the face of increasing burden of vector-borne diseases was discussed by the WHO Regional Committee for the Eastern Mediterranean in October 2011.

A consultation on sound management of public health pesticides was held in Muscat, Oman in December 2011. The Framework for Action on the Sound Management of Public Health Pesticides in the Eastern Mediterranean Region 2012–2016 was developed and published in four languages. The three activities were fully funded by WHO funds.

Outcome 5 (Trans-boundary and national coordination, information sharing to promote integrated vector management without the use of DDT): collection of available data on insecticide resistance has been initiated; the fifth STAC meeting was organized; a WHO national staff person was recruited to support the GEF project in Djibouti.

The implementation rate is around 60% and the balance is about \$16 million.

During the period July 2011–June 2012, the project demonstration activities proceeded with success in Morocco and Sudan. However, nothing was conducted at all in the Syrian Arab Republic due to the security problem. A complete turnover of Ministry of Health staff in Djibouti has resulted in lengthy delays and the plan of action was submitted very late, after the mission in March 2012. The sociopolitical unrest in Yemen hindered the travel of external experts to Yemen to oversee demonstration activities. To date communication and response by GEF focal points has been poor, with only two countries submitting timely progress reports. In view of the above, it is requested to extend the project and to consider reprogramming of allocated funds to cover the increasing cost of disposal the obsolete persistent organic pollutants (POPs) (component 3), STAC meetings, regional activities, especially insecticide resistance activities (database, country activities), regional training courses on integrated vector management, sound management of public health pesticides and insecticide resistance. It was noted that STAC meetings cost more than initially budgeted. In addition, it has been necessary to support insecticide resistance management in all countries.

During the discussions, participants were reminded that countries should send progress reports on time. It was noted that security difficulties delayed production of reports in some countries. Work already done in countries with security difficulties should be preserved so that it can be built on in future. It was suggested to review composition of the STAC in view of non-attendance of some members.

### **3. UPDATE ON COLLECTION, REPACKING AND DISPOSAL OF PERSISTENT ORGANIC POLLUTANTS**

*Dr Richard Thompson, Food and Agriculture Organization of the United Nations*

Good progress has been made on Component 3 of the GEF project since the previous STAC meeting in Marrakech in 2012. The inventory of the five remaining stores in the Islamic Republic of Iran has been completed and the data for all stores implemented in the pesticide stock management system database. The full inventory of each country was categorized for the tender for safeguarding and disposal, as shown below.



Country	Pesticide (kg nett)			Contaminated containers (kg)	Liquid contaminated waste (wash water) (kg)	Total
	DDT	Other solid	Other liquid			
Islamic Republic of Iran	22 599	2118	530	5918	1335	32 500
Jordan	22 277	280	175	1800	1500	26 032
Morocco	48 081			11 566	2000	61 647
Total	92 957	2398	705	19 284	4835	120 179

In compliance with the request of the country teams, a tender process was initiated for the repackaging, transportation and disposal of all the stocks and contaminated wastes. The total quantity was 40 tonnes greater than in the original agreement with FAO. Following publication on the United Nations Global Marketplace, 8 companies competed in the tender process which was completed on 4 July. The bid requested quotations for two options: A, in which the government would provide labour for repackaging; and B, in which a contractor would be responsible for all services. Due to the greater quantities and increases in transport costs, the total cost of the contract is more than double the provision in the project document. Six companies met the criteria and four submitted bids, of which three were valid. The lowest bidder was Tredi, with a total of \$554 353 for three countries, with the highest unit price for the Islamic Republic of Iran.

Correspondence has reconfirmed the co-financing commitment by the Islamic Republic of Iran for Component 3. It may be possible to negotiate with the contractor to reduce the cost of the contract on the basis of this co-finance. In the event that this is possible, the Islamic Republic of Iran should be persuaded to divert these co-financing funds to support the demonstration activities.

In discussions, it was pointed out that the tonnage of pesticide had increased by 30% compared to initial assumptions, and hence an increase in costs was to be expected. However, the overall funding needs for all components of the project would be taken into consideration. It was agreed that funding be made available to support the full "Option B" turn-key operations for disposal of all identified obsolete pesticide stocks in each country (Component 3). This is expected to cost about US\$336 000. It was recognized that such activities cannot be conducted without country support, and that such support should be counted as in-kind contributions. Further, efforts should be made for disposal activities to contribute to in-country capacity-building where possible. Where co-financing is available, the committed co-finance should be used for other activities outside Component 3

## 4. COUNTRY REPORTS: DEMONSTRATION OF ALTERNATIVES TO DDT IN VECTOR CONTROL

### 4.1 Djibouti

The state institutions, which have responsibility for POPs and other chemicals in Djibouti are the Ministries of Environment, Agriculture, Health, Labour, Commerce and Industry. However, the institutions suffer from a fragmentation and compartmentalization of skills. Currently, the Ministry of Environment has no administrative procedure for chemical management. Most departments are not legally empowered to intervene in the management and control of chemicals. There is no appropriate structure for managing pollution in the Ministry of Environment.

After conducting training for entomological surveillance, an entomological survey was carried out in June 2012. *Aedes aegypti* was identified as the predominant vector in Einguella, Heron and Cite Saoudi. Man-made water bodies, such as uncovered water containers and puddles formed from air conditioner condensate, were identified as possible larval habitat for mosquitoes.

It was reported that a pesticide survey carried out by the Ministry of Health found that its entire stock of pesticides may be obsolete; however further inspection is required to determine whether stocks have actually expired. Unknown quantities of pesticide had been buried at depths of about 1 metre.

The integrated vector management (IVM) steering committee recommended the following.

- Capacity should be strengthened within the Ministry of Health and Ministry of Environment to better identify challenges and constraints in the overall implementation of the GEF project.
- The committee should be expanded to include: City Hall, the Regional Council, and the Directorate of waste management.
- A system of information exchange and monitoring within the Ministry of Health and other relevant ministries should be set up.

Major challenges that were experienced were: high turnover of staff within the Ministry of Health; absence of a system of information and data exchange and monitoring; high dependence on international aid to fulfil tasks; and lack of logistics resources.

The STAC welcomed the fact that Djibouti in principle supported the project's objectives.

## 4.2 Egypt

Egypt is affected by at least seven vector-borne diseases of public health concern, of which lymphatic filariasis and Rift Valley fever are the most important. Cases of schistosomiasis, leishmaniasis, and malaria are also reported. In order to strengthen sustainable national capacity in IVM, a statutory steering committee of IVM was re-established. A national laboratory for detecting insecticide resistance mechanisms and monitoring resistance genes in different vectors, especially mosquitoes, was also set up.

A training programme was held including 47 training workshops for a total of 905 staff members (20% of the total vector control staff) in the vector control units from 18 governorates. Three advanced training courses in vector surveillance were held for 41 specialists and 30 assistants from the sentinel governorates and vector control units. A one-day workshop was held to discuss the burden of vector-borne diseases in relation to national vector control strategies and challenges and the mission and functions of the steering committee as an overseeing body to all vector control activities.

Vector surveillance including insecticide resistance monitoring was carried out in sentinel sites in each of the following eight governorates: Qena, Sharqiya, Kafr El Sheikh, North Sinai, Suez, El Fayoum, Alexandria and Damietta. Entomological data were georeferenced to facilitate temporal and spatial modelling.

## 4.3 Islamic Republic of Iran

The main objective of the project in Iran was to compare the effectiveness and cost effectiveness of covering domestic water reservoirs with solid lids versus treating reservoirs using biological larvicide (BTI), to reduce densities of malaria vector larvae.

The project is to be implemented in Chabahar, the southern district in the Sistan and Baluchestan province. In this urban area 99 malaria cases were reported in 2011. About 3000 water reservoirs in the locality were identified as breeding places for mosquitoes.

Baseline studies had been conducted in the area including population, serological and entomological surveys. The dominant species found was *An. stephensi*. Six types of water reservoir lids were constructed and compared assessing feasibility, affordability(cost), acceptability, sustainability, effectiveness (larval density measurement). Eventually the selected lid type is expected to be constructed in the area. A preliminary community assessment was done to develop a guide to promote community participation and acceptance of the intervention. The study design envisaged a randomized allocation of residential blocks to one of the two interventions. The main outcome will be the assessment of larval densities, as described in the protocol.

The STAC noted that this was the first study based on covering water tanks, using local materials, and that it was also relevant to other vector-borne diseases such as dengue.

#### **4.4 Jordan**

Vector-borne diseases of major importance in Jordan are malaria, urinary schistosomiasis and cutaneous leishmaniasis. Most reported malaria and schistosomiasis cases in Jordan are imported from abroad, while cutaneous leishmaniasis is endemic with an average of 207 cases per year during the past 5 years.

A WHO consultant visited Jordan from 22 to 28 October 2011 to conduct training on insecticide susceptibility and IVM principles which was attended by 24 participants from different sectors. A high level national meeting to raise awareness and support for IVM and pesticide management policies and regulations was conducted in March 2012. The meeting was attended by decision makers and participants from different sectors including health, agriculture, environment, Royal Scientific Society and Jordan University.

New insecticide test-kits for mosquito susceptibility were procured and insecticide susceptibility tests were conducted on mosquitoes. Tests showed that field mosquito larvae are 100% susceptible to temephos.

A technical committee was established and a draft national plan on IVM was developed along with pesticide management legislation and regulations.

In the year ahead, it is planned that the pending activities under component no. 2 (capacity building) will be implemented during September and October 2012. The Food and Agriculture Organization of the United Nations (FAO) has been invited to undertake the necessary steps for the disposal of obsolete pesticides in Jordan. Jordan will provide available resources and facilities for the completion of obsolete pesticides disposal.

In discussion it was suggested that a regional IVM short course should be facilitated.

#### **4.5 Morocco**

Morocco is conducting a study to demonstrate the feasibility and effectiveness of vector control methods alternative to DDT as a part of the IVM approach to reduce transmission of cutaneous leishmaniasis.

The study is undertaken in a total of 43 localities in 8 provinces with a total population of 27 277 people. The average population per locality is 634 people. Each locality was randomly allocated to one of the three study arms: indoor residual spraying (IRS) with a pyrethroid combined with environmental sanitation (14 localities); distribution of long-lasting insecticidal nets (LLINs) in combination with environmental sanitation (15 localities); and environmental sanitation alone (14 localities).

In 2010, a total of 652 203 m<sup>2</sup> in 1765 households had been sprayed with insecticide which represents a coverage 94% of households and 98% of the population in this study arm.

It was planned originally to introduce LLINs in all localities designated to the LLIN study arm, but as there were delays in their delivery, the 2356 available LLINs were supplemented by 4083 insecticide-treated nets (ITNs) impregnated with deltamethrine at 55 mg/m<sup>2</sup> during the first intervention year. Hence, a total of 6439 insecticide-treated nets (LLINs and other treated nets) were distributed to a population of 10 608 inhabitants

During 2011, all ITNs were replaced by LLINs in all the localities in the LLIN study arm. A total of 5221 LLINs were distributed to the 12 026 inhabitants in this study arm (93% of the target population).

During 2011, a total of 9873 inhabitants (97% of the target population) in 1870 households (95 % of target households) have been protected by IRS operations covering a spray area of 662 595m<sup>2</sup>.

Compliance with interventions was supported by awareness raising campaigns including the general improvement of hygiene and environmental sanitation. Monitoring and evaluation consisted of active and passive case detection and entomological surveillance of vectors. Resistance monitoring of *Phlebotomus sergenti* was conducted in 4 provinces of the study area: Azilal (Ait Chribou), Chichaoua (Lalla Aziza), Tinghir (Boumalne) and Boulemane (Bouassem and Ait Oublal). Results showed that this species is still susceptible to the 3 insecticides tested (lambda-cyhalothrin 0.05%, DDT 4% and malathion 5%).

Data related to costs of interventions have been collected for the years 2010 and 2011. Preliminary results showed that after the first year of operations, leishmaniasis incidence was significantly lower in the IRS arm of the study, compared to the control arm of the study. Further details are given in section 5 below.

Regarding the DDT elimination component, all the activities done at national level were conducted in the framework of the project “Strengthening national capacity in safe management of public health pesticides in Morocco”. This included: training of trainers in pesticide management (4–15 October 2010 for 35 persons); practical training on pesticide repackaging and cleaning up of contaminated soil (November 2010); training in data stock management (March 2011); and centralization of all DDT quantities (about 5 tonnes) in UN-approved drums for shipment out of the country.

There was discussion about the correct timing of IRS, the detection of cases by smear, and how migration of the population within and between clusters may affect the results. Overall the STAC commended Morocco for the progress made with this study.

#### **4.6 Sudan**

The demonstration study in Sudan has two primary objectives: 1) to determine whether combining LLINs and IRS provides additional protection compared to one method alone; and 2) to determine whether insecticide resistance has an impact on the effectiveness of vector control interventions. The study was therefore designed with two arms, one providing LLINs

plus IRS, the other LLINs alone. The background and study design has been previously reported. Taking into account baseline factors including resistance markers, a restricted randomization was carried out allocating all 140 clusters randomly to one of the two study arms.

All clusters received universal coverage LLINs (April 2011). 70 clusters (chosen by the randomization process) received high coverage IRS (57 with two rounds of bendiocarb and 13 with two rounds of deltamethrin during 2011). A household survey carried out in all study clusters in October 2011 showed that the interventions had been implemented at high coverage and according to the study arm to which clusters had been allocated, i.e. IRS in the IRS arm of the study, LLINs in both study arms. LLIN ownership was high with an average of three nets per household. The nets were generally in good condition with only 6% of nets showing any damage (holes).

66 clusters (33 in each study arm) had been randomly selected as sentinel clusters for collecting phenotypic insecticide resistance and other entomological indicators. Cohorts of 200 children 6 months to 10 years were recruited in all clusters, following written informed consent procedures (28 000 in total). Community health workers had been trained in each cluster to visit each cohort household at weekly intervals during the malaria season (every 2 weeks outside the malaria season). At each visit, current and recent fevers are recorded. In case of observed or reported fever, parasitaemia status is determined by rapid diagnostic test and/or microscopy at the nearest health facility. A high quality case recording, computer entry and database system for the cohort data had been developed by the team. However, field visits showed that the case data recorded by community health workers appeared to be untrustworthy, since community health workers were recording self-reported episodes of malaria and clinically diagnosed cases, instead of inspecting patient and laboratory registers for confirmed cases only.

Two strategies were proposed to overcome this challenge: 1) malaria prevalence surveys are to be carried out during the peak of the transmission season in each of the remaining years of the study; and 2) to improve the documentation of malaria diagnosis, rapid diagnostic test (RDT) and microscopy result forms will be filled in by laboratories of health facilities and given to patients as proof of diagnosis; community health workers will collect these forms and attach them to register books, so that only confirmed cases are entered into the database.

In the 66 sentinel clusters WHO susceptibility tests were carried out for phenotypic assessment of insecticide resistance. Mosquito larvae and pupae were collected during October 2011, transported to laboratories and reared to adults in the 3 entomological laboratories. Prior to testing sex separations were made. Susceptibility tests were carried out on 2–3 day old female adult mosquitoes. The tests were performed using deltamethrin (0.05%), DDT (4%) and bendiocarb (0.1%). Tests were carried out in 49/66 clusters in which larvae could be found. Percentages mortality after 24 hours was recorded and part of the materials collected was molecularly analysed to determine the resistance mechanism status.

The results showed high levels of deltamethrin and DDT resistance throughout the study area. Molecular analysis showed that there was an increase in *kdr* frequency from 2010 to 2011.

The quality of case reporting was discussed by the STAC, and the need for polymerase chain reaction (PCR) based cross-sectional surveys was acknowledged. As a consequence, prevalence of infection will be used as a secondary indicator, with malaria incidence remaining as the main outcome indicator. The STAC noted that overall this study had made good progress despite the difficulties that have been encountered.

#### **4.7 Syrian Arab Republic**

Syria has a high incidence of cutaneous leishmaniasis, particularly in the Aleppo district. Under the GEF project, a cluster randomized trial on the use of LLINs and IRS for leishmaniasis vector control had been initiated. This showed promising early results, but no proper surveillance has been possible since March 2011 due to the security situation in the country. There were therefore no new results to report since the STAC meeting in 2011. The meeting concluded, albeit reluctantly, that the demonstration project in the Syrian Arab Republic has had to be abandoned. The country will however continue to receive support to participate in training and capacity development initiatives in the region.

#### **4.8 Yemen**

The study area is Wadi Sukhmal in Wusab As Safil district, Dhamar governorate. The area is at an altitude of 600 to 1000 metres above sea level and has a perennial water flow in the wadi (valley). Through a cluster randomized trial, the GEF-supported demonstration project in Yemen will compare the efficacy of LLINs alone and the combination of LLINs and IRS on the malaria burden measured by malaria prevalence and passive case detection at health facilities. Secondary indicators include the vector density and sporozoite rate. The insecticide resistance measured by standard WHO susceptibility testing and the frequency of resistance associated allele mutations (*kdr* mutation) in the main malaria vector, *An. arabiensis*, are also part of the expected study outcomes.

A total of 12 clusters have been formed in the Wadi Sukhmal area for the random allocation of the two study arms. Prior to allocation, baseline assessment through a malaria survey was carried out during the peak of the transmission season in October 2011 to determine the malaria prevalence in the formed clusters. Based on the malaria survey results, the 12 clusters, with an overall prevalence of 19.7%, were randomly allocated to the two study arms (LLINs alone; LLINs plus IRS).

To date, three malaria surveys (October 2011, March 2012, and July 2012), mosquito collection (April and June 2012) and insecticide susceptibility/resistance testing (July 2012, in progress) have been carried out as pre-intervention activities. In addition, health staff located at health facilities within the vicinity of the study area have been trained to record all diagnosed malaria cases presenting at these health facilities which will be monitored on a

weekly basis. A third mosquito collection and mapping of the breeding sites are planned for August 2012.

Blood meal source and sporozoite infection (ELISA) of the mosquito specimens will be carried out for further testing to provide results for the entomological indicators (pre-and post-intervention). Training on ELISA testing has been planned to be carried out at the Naval Medical Research Unit no. 3 (NAMRU-3) in Cairo, as part of capacity-building during this project. Collaboration with the U.S. Centers for Disease Control and Prevention, Atlanta, will provide the reagents for the ELISA testing during the study.

The distribution of LLINs will cover all study clusters, including villages outside the clusters located in Wadi Sukhmal. 'Keep up' distribution has started and will continue throughout the entire study period. IRS has been planned to be carried out at the end of August or early September, and will cover only the clusters allocated to the combined LLINs and IRS study arm. All villages, even outside the demarcated clusters, are to be included as part of the intervention of the closest cluster to ensure everywhere has one of the two interventions. The surveillance area of each cluster must be such that the boundary of the surveillance is always at least 1 kilometre from the intervention boundary of any other cluster. Post-intervention activities (malaria surveys, mosquito collection, and insecticide resistance) will be implemented for monitoring the impact of the two study arms. ITN usage and net condition will also be monitored. IRS coverage and quality of spraying will be evaluated through cone bioassays.

The main challenges and constraints has been the political turmoil during 2011 which hindered the activities, restricted free movement to the study area including travel of international consultants to Yemen and increased operational costs.

The STAC congratulated the Yemen team for the good work done in spite of the local challenges such as the security situation.

## **5. ANALYSIS AND INTERPRETATION OF DEMONSTRATION ACTIVITY DATA**

*Dr Immo Kleinschmidt, London School of Hygiene and Tropical Medicine*

Epidemiological efficacy data for the cluster randomized trials in Morocco and Sudan, and serological baseline data from Yemen, were presented.

In Morocco good routine surveillance of leishmaniasis cases simplifies the study considerably. However, the absence of active cohorts means that only limited information is available on the households from which the cases arise (e.g. actual compliance with interventions). The study design including a control arm makes interpretation of the results straightforward. There is a need to integrate the epidemiological and entomological data.

Results for the first year after the start of interventions shows that the incidence of leishmaniasis, relative to the control (environmental management) arm is 79% lower in the



IRS study arm of the study (incidence rate ratio 0.21; 95% CI 0.08 to 0.51,  $P = 0.001$ ), and 50% lower in the LLIN arm of the study (incidence rate ratio 0.50; 95% CI 0.17 to 1.44,  $P = 0.192$ ), although the evidence for the LLIN effect is weak.

The Sudan study is complex due to its size, dispersed multiple study sites, presence of varying levels of insecticide resistance, absence of reliable passive case detection, and the resulting supervision of 140 community health workers and regular visits to about 30 000 cohort members. The restricted randomization into study arms was described, thus ensuring balance in factors that may be associated with malaria incidence. The currently available data on follow-up covering the period from August to December 2011 shows that 379 935 follow-up visits on 31 435 cohort members were collected, representing 9834 person years. 104 confirmed cases had been recorded, resulting in an average incidence of 10.6 per 1000 person years. This is about half of the incidence that was anticipated at the time the study was designed. It is likely that the difficulties experienced with the reporting system have resulted in considerable under-reporting of malaria cases. The study arm with LLINs and IRS experienced a significantly higher incidence of cases than the LLIN only arm (Incidence rate ratio 3.01; 95% CI 1.24 to 7.30,  $P = 0.015$ ), after allowing for variation in incidence between clusters. In the 49/140 clusters for which deltamethrin phenotypic resistance data were available, the clusters with high resistance had a higher incidence rate than clusters with lower resistance, but this finding was based on only 18 cases and hence on very weak evidence (incidence rate ratio 2.5; 95% CI 0.3 to 21,  $P = 0.4$ ). The quality of epidemiological data remains a key challenge for Sudan, which can only be addressed through frequent (twice monthly) inspection of community health worker registers.

Sero prevalence data from Yemen, which had recently been analysed by Chris Drakeley at the London School of Hygiene and Tropical Medicine were presented. These showed high antibody sero-conversion rates in the study area indicating high levels of exposure to *P. falciparum* antigens, and considerable heterogeneity between study clusters. The sero-prevalence showed good correlation with rapid diagnostic test and microscopy prevalence of parasite infection.

The meeting discussed at some length the results from Sudan, which were currently inexplicable. Insufficient diagnostic quality was highlighted as the likely source of the problem. Sudan had put in place measures to correct this in the study sites, and to conduct cross-sectional prevalence surveys as a back-up strategy.

## **5. PRELIMINARY REPORT ON COST ANALYSIS STUDIES IN SUDAN AND MOROCCO**

*Dr. J. Yukich, STAC member*

In order to reduce the potential for 111-trichloro-22-bis (4-chlorophenyl) (p,p'-DDT) use for residual spraying in the control of either disease, demonstration of effective and cost-effective alternatives is necessary. The presentation discussed the methods and results of an early analysis of the cost of interventions delivered in each study – in Morocco the (use of LLINs) plus standard of care (environmental management) and residual spraying with  $\alpha$ -

cypermethrin plus standard of care (environmental management (SoC-EM)), alongside the trial and in Sudan the use of LLINs and one using IRS with bendiocarb or deltamethrin plus LLINs.

A standardized cost collection instrument was developed for each of three administrative levels of the country-National, State and locality (or central, provincial and local in Morocco). The instrument was designed to capture all types of resource use and quantify resource use for all activities related to the provision of the two interventions, LLINs and IRS. The instrument was used by staff of the Ministry of Health, Sudan or the Ministry of Health, Morocco to collect resource use and price information for all identified resources in all study locations. The results were compiled and supplemented with information from the WHO-CHOICE database, where local information was not available, to create estimates of cost and cost per person protected during the first year of the trial.

Cost per person protected was estimated to be lower with LLINs than with the alternative LLINs plus IRS intervention (LLIN = US\$ 1.48 per person protected per year versus LLINs + IRS US\$ 3.74 per person protected per year). The costs of both intervention arms were largely capital and tended to be heavily related to the cost of commodities (LLINs or residual insecticide) themselves. The results appear to be relatively robust to most major assumptions built into the cost model. These results suggest that LLINs are likely to be a more efficient way to provide vector control coverage in Sudan than LLINs plus IRS.

In Morocco, cost per person protected was estimated to be lower with LLINs than with the alternative IRS intervention (LLIN=US\$ 6.56 per person protected per year versus residual spraying US\$ 7.91 per person protected per year). The costs of the intervention were largely recurrent and tended to be heavily related to the cost of intervention delivery as compared to the costs of the commodities (LLINs or residual insecticide) themselves. Though some assumptions built into the cost model could change the ordering of the two interventions, the results appear to be relatively robust to most major assumptions built into the cost model. These results suggest that LLINs are likely to be a more efficient way to provide vector control coverage in Morocco than residual spraying. However, no information on the relative efficacy of the two interventions for the prevention of cutaneous leishmaniasis is available currently. Therefore, no conclusions as to which intervention is likely to be the best by in terms of health effects can be made until the results of the trial in terms of efficacy are available.

LLIN and IRS costs were roughly similar during the first year.

## **6. REGIONAL VECTORS AND INSECTICIDE RESISTANCE DATABASE**

*Dr Ali Hassan, WHO Temporary Adviser*

The WHO Eastern Mediterranean Region, with only 8% of the global population, contributes some 11% of the global burden of vector-borne diseases. Vector control is an essential component of the strategies for the control of vector-borne disease in the Region within the overall umbrella of IVM. Judicious use of pesticides is a key component of IVM,

however, widening vector resistance to pesticides can compromise control efforts. Successful implementation of IVM activities relies heavily on evidence-based and up-to-date information.

In response to this situation and to support member countries strengthen their capabilities in IVM, the Regional Office has started an initiative to build regional databases for vector distribution and insecticide resistance.

The purpose of this is to:

- Document historical and update current vector occurrence events and insecticide resistance status at regional and country levels
- Avail data and publications to programme managers and the scientific community at regional and global levels
- Assist in establishing national and regional benchmarks in a spatial context
- Assist in planning of evidence-based insecticide resistance management strategies and building capacities in the Region
- Support in-country capabilities to implement IVM.

A total of 152 published research articles were collected as full text through electronic search and contacts with authors and WHO support. The Islamic Republic of Iran has the highest number of articles (81) followed by Egypt (17). Bahrain, Lebanon, Libya, Kuwait, United Arab Emirates, Qatar, Djibouti and Oman have between zero and one article. Resistance studies for the Region covered mosquitoes, sand flies, flies, bed bugs, head lice, roaches and ticks.

Work is under way to finalize the database design in cooperation with WHO IT staff, assigning country focal points, collect data existing in vector control programs and start work on the vector distribution database which is anticipated to include a much higher number of articles.

Next steps are:

1. Geo-referencing of previously collected data
2. Finalize data base design for insecticide resistance
3. Assign country focal points to complete data gathering
4. Collect data from vector control programmes
5. Finalize data inputs
6. Test data base functioning
7. Launch regional insecticide resistance database
8. In parallel, start the regional vector distribution database.

The STAC discussed the importance of a focal person for IR in each country. Insecticide resistance was increasing in most countries and there was a need to implement

GPIRM, at country and at regional level. The database needed to include mapping, and will be web-searchable. Sudan had a large database to contribute including mapping (GIS).

## **7. REGIONAL CONSULTATION ON INSECTICIDE RESISTANCE MANAGEMENT**

*Dr Hoda Atta, WHO Regional Office for the Eastern Mediterranean*

A consultative meeting will be held in Casablanca in September to discuss how to implement the Global Plan for Insecticide Resistance Management (GPIRM) in the Region. Participants will include country focal points, local and international experts, and focal points from other regions.

## **9. RECOMMENDATIONS**

1. Two members of the STAC have been unable to regularly attend meetings. The STAC recommends that these members be replaced with new members. Recommendations for specific names are welcomed from existing STAC members and others, though final appointments will be made only by the WHO Regional Director for the Eastern Mediterranean.
2. WHO is expected to formally request a no-cost extension of the project from UNEP. The expected end date would then be the end of 2014. This is to accommodate the extension of demonstration activities in selected countries where this is necessary to fulfil project objectives. It is anticipated that final reporting and dissemination will be concluded by mid-2015.
3. The STAC noted that two important opportunities for dissemination of findings at scientific conferences will coincide with the later stages of the project. The Multilateral Initiative on Malaria conference to be held in Durban, South Africa 6–11 October 2013, and the Fifth World Congress on Leishmaniasis, to be held in Pernambuco, Brazil, 13–17 May 2013. These opportunities should be taken advantage of to help disseminate the results of the project. STAC members and consultants will be available to help countries prepare documentation/presentations and abstracts for these meetings.
4. The STAC recommends that there should be a continuation of multi-country annual STAC meetings to coincide with the extension of the project including a final STAC meeting at the close out of the project in Nairobi in the final quarter of 2014 to coincide with the launch of the GEF-supported AFRO-2 project in 2015.
5. The STAC noted that there is a need for a supportive mid-term project review and that the WHO Regional Office for the Eastern Mediterranean in consultation with UNEP should lead in the identification of two additional experts, to conduct a desk review and possible country visits if needed.

6. The STAC concluded that given the current political situation in the Syrian Arab Republic it will be impossible to continue demonstration activities in this country. There is a desire to reprogram funds that were intended to support the demonstration activity in Syria into another area, conditional that a suitable and achievable activity can be identified given the context.
7. The STAC recommends that Morocco make an effort to document the specific environmental management activities that have been conducted in the study demonstration areas in all study arms, including those by the local and municipal governments.
8. The STAC recommended that FAO negotiate with the selected contractor to agree their best offer for a full service contract, taking into consideration the co-finance to be provided by the Ministry of Health and Medical Education in Iran (provision of safeguarding equipment plus funds for the payment of national transport and centralization). The STAC recommends WHO to increase the budget for component 3 by a maximum of \$336 000 to cover the full service safeguarding and disposal contract. FAO should issue the contract as soon as possible to allow the safeguarding in all three countries to be completed within seven months of contract signature and disposal within nine months.
9. The STAC recommends that countries with extended demonstration projects, prepare a budget and justification to account for any additional funding that may be needed to continue the activity for an additional year.

#### **10. STAC DECISIONS ON BUDGET ALLOCATIONS TO EACH COUNTRY**

- Syrian Arab Republic: The current situation in the country is not conducive to conducting field activities. Syria will be included in regional capacity-building activities, and the situation will be reviewed at the next STAC or as conditions change.
- Islamic Republic of Iran: The intervention should be paid by the government, but the project can support US\$50 000 and the Islamic Republic of Iran should revise the plan to indicate what will be undertaken and where co-finance from other sources can be identified. The project will significantly contribute to component 3 by funding disposal of obsolete pesticides in the amount of US\$285 000. If this is part funded by the government, funds can be diverted to the demonstration project.
- Egypt: Capacity building activities are recommended to be the focus of activities in Egypt for which US\$ 40 000 will be provided to focus on insecticide susceptibility testing and vector surveillance. Egypt will also be supported to participate in regional capacity building initiatives.
- Djibouti: US\$ 60 000 to be provided including support of one position plus development and implementation of a short term demonstration activity for awareness

raising about vector borne disease with an evaluation based on entomological surveillance related to domestic water reservoirs.

- Morocco: US\$ 69 500 will be provided which constitutes approval of what was proposed plus US\$ 157 000 for disposal of obsolete stocks under component 3.
- Jordan: US\$ 30 000 to be provided as well as US\$ 149 000 for disposal of obsolete stocks under component 3.
- Sudan will be funded for US\$ 180 000 under the prioritized plan to support the cross-sectional PCR-based prevalence survey, and additional supervision.
- Yemen will be funded for US\$ 200 000 for continuation of the demonstration project which has now got off to a good start.

**Annex 1****PROGRAMME****Tuesday, 10 July 2012**

08:30–09:30	Opening session Message from Dr Ala Alwa, Regional Director, WHO EMRO Speech by Dr Jan Betlem, Task Manager, United Nations Environment Programme (UNEP) Nomination of Officers Objectives of the meeting and methods of work	<i>Dr H. Atta</i> <i>Dr H. Atta</i>
09:30–10:00	Project progress report	<i>Dr H. Atta and Dr S. ElKhalifa</i>
10:00–10:30	Discussion	
11:00–11:30	Update on collection, repacking and disposal of POPs	<i>Dr R. Thompson</i>
11:30–12:00	Discussion	
12:00–13:00	Sudan: Combination of interventions n the face of resistance Morocco: Comparison of vector control interventions for control of cutaneous leishmaniasis Islamic Republic of Iran: Cost effective, sustainable and alternative larval control method in urban setting in Chabahar, Sistan and Baluchistan	
14:00–14:30	Discussion	
14:30–15:00	Yemen: Comparison of IRS and LLINs for malaria vector control Syrian Arab Republic: Comparison of vector control interventions for the control of cutaneous leishmaniasis	
15:00–15:30	Discussion	
16:00–17:00	Djibouti (English–French) Egypt Jordan	

**Wednesday, 11 July 2012**

08:30–09:00	Analysis and interpretation of demonstration activity data	<i>Dr I. Kleinschmidte</i>
09:00–09:30	Discussion	
09:30–10:00	Preliminary report on cost analysis studies in Morocco and Sudan	<i>Dr J. Yukich</i>
10:00–10:30	Discussion	
11:00–11:30	Regional vectors and insecticide resistance database	<i>Dr A. Hassan</i>

11:30–12:00	Regional consultation on insecticide resistance management	<i>Dr H. Atta</i>
12:00–17:00	Group work for developing countries' planned activities (July 2012 – July 2013)	
14:00–18:00	STAC Members meeting parallel to group work	
<b>Thursday, 12 July 2012</b>		
08:30–12:00	Presentation of planned activities (July 2012 – July 2013)	
12:00–13:00	Feedback from STAC Members	
14:00–15:00	Conclusion and recommendations	
15:00	Closing session	



**Annex**

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