WHO-EM/VBC/111/E

Report on the

Third meeting of the Regional Scientific and Technical Advisory Committee of the WHO/UNEP project supported by the Global Environmental Facility

Damascus, Syrian Arab Republic
12–13 July 2010

World Health Organization
Regional Office for the Eastern Mediterranean

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EXECUTIVE SUMMARY

A project entitled “Demonstration of sustainable alternatives to DDT and strengthening of vector control capabilities in Middle East and North Africa” is implemented by the World Health Organization’s Regional Office for the Eastern Mediterranean (WHO/EMRO) 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 third meeting of the Scientific and Technical Advisory Committee (STAC) of the WHO/UNEP project was held in Damascus, Syrian Arab Republic from 12 to 13 July 2010. The meeting aimed to build on the recommendations of the first and second STAC meetings held in Amman, Jordan in November 2008 and in Cairo, Egypt in July 2009, respectively. The objectives of the meeting were to:

- Present and review the status of the regional demonstration project on DDT alternatives;
- Identify challenges and constraints in the implementation of the demonstration activities in selected project countries;
- Review draft tools on cost-effectiveness analysis of DDT alternative interventions;
- Propose recommendations and the way forward on the timely implementation of the project on DDT alternatives

Six members of the STAC were in attendance; 7 members were unable to attend. Ten representatives from 7 of the 8 project countries were in attendance; only the project coordinator from Djibouti was unable to attend. Following the opening, the participants elected Dr Lama Jalouk (Syrian Arab Republic) as Chair. Dr Immo Kleinschmidt, WHO Temporary Adviser, was elected Rapporteur.

The regional STAC reviewed the implementation of the project activities, output by output. Despite the administrative challenges experienced at the beginning of 2010, the STAC was pleased with the progress achieved thus far. While implementing the recommendations proposed below, project countries would need to strictly adhere to the timelines agreed during this meeting.

The STAC also appreciated that the implementation of the project in countries of the Region has provided opportunity for increased co-financing (e.g. the Bill and Melinda Gates Foundation support on pesticide management in Sudan and Morocco; additional resources through the Strategic Approach to International Chemicals Management [SAICM] in Morocco, additional resources for insecticide resistance in Sudan); strengthened coordination at country level through the establishment of integrated vector managemnt (IVM) steering committees; strengthened capacity in

entomology and vector control – through the regional MSc and postgraduate diploma in Sudan and Pakistan, respectively; and the spillover effect in neighbouring/non-project countries – benefiting especially through the regional courses (Afghanistan, Somalia and Palestine).

RECOMMENDATIONS

1. Capacity should be further strengthened to ensure evidence-based decision making for optimum and efficient use of resources and tools for vector control interventions through proper monitoring and evaluation, operational research and coordination.

2. The subject of capacity strengthening for regulation and sound management of public health pesticides should be brought to the attention of the Regional Committee for its advice and WHO to organize a meeting with potential donors and stakeholders for resource mobilization. Further coordination with FAO and UNEP in this regard is important and is highly recommended.

3. Recognizing the significance of the shipment and disposal costs to the overall budget of Component 3 of the project:

    3.1 Efforts should be made early in its execution to identify the most efficient and economic logistics routes to Europe.
    3.2 Each country involved in the Component should identify a central collection centre close to the port of export to be used to store the repackaged DDT.
    3.3 FAO should undertake an international tender for the shipment and disposal of repackaged DDT as early as possible to define the disposal costs.
    3.4 The budget and activities in the countries should be confirmed or revised depending on the availability of remaining funds.

4. The STAC noted that some countries implementing demonstration activities had implemented interventions at different times. It was recommended that such countries should ensure as much as possible that planned interventions are implemented at the same time in order to allow appropriate comparison of the impact of each intervention. In this regard, WHO must ensure the timely provision of supplies, equipment and funds for project activities

5. The STAC also noted the importance of country teams in drawing up analysis plans to determine outcomes, effects and effectiveness and in ensuring that good data are collected to enable such analysis. It is recommended that each study should also have proper written ethics approval from an appropriate ethics committee, and a procedure for obtaining community consent for the randomization of interventions. Study proposals should be submitted to the WHO ethics committee. As this requires urgent action, WHO is to follow up on the submission of such documents. Furthermore, each study should be registered

on the clinical trials website, by the responsible organization (http://register.clinicaltrials.gov) otherwise results from these studies cannot be published in peer reviewed journals

6. Countries should provide sixth-monthly progress report to WHO EMRO to be shared with STAC members for their input. WHO should provide a format for such reports

7. The Regional Office should continuously inform and update the country offices on the day-to-day running of the respective projects. This is particularly important in those countries without technical staff in the relevant area of communicable disease and control.

8. Recognizing the importance of the activity on cost-effectiveness analysis of DDT alternatives and following the successful completion of the training workshop, the STAC recommended that:

   8.1 The draft tools should be finalized by the beginning of September
   8.2 The draft tools should be circulated to project coordinators and to STAC members for their input by September/October
   8.3 In consultation with the secretariat, Dr Yukich should plan to visit countries implementing demonstration activities for field-testing of tools before the end of June 2011

9. Noting that exchange of information and experiences with other DDT projects in the WHO regions of Africa and the Americas is part of the approved project activities, the STAC recommended that this should include also exchange of information and experiences between project countries in the Eastern Mediterranean Region.

1. INTRODUCTION

A project entitled “Demonstration of sustainable alternatives to DDT and strengthening of vector control capabilities in Middle East and North Africa” is implemented by the World Health Organization’s Regional Office for the Eastern Mediterranean (WHO/EMRO) 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 third meeting of the Scientific and Technical Advisory Committee (STAC) of the WHO/UNEP project was held in Damascus, Syrian Arab Republic from 12 to 13 July 2010. The meeting was followed by a training workshop on cost-effectiveness analysis of DDT alternatives from 14–16 July 2010. The third meeting aimed to build on the recommendations of the first and second STAC meetings held in Amman, Jordan in November 2008 and in Cairo, Egypt in July 2009, respectively. The objectives of the meeting were to:

- Present and review the status of the regional demonstration project on DDT alternatives;
- Identify challenges and constraints in the implementation of the demonstration activities in selected project countries;
- Review draft tools on cost-effectiveness analysis of DDT alternative interventions;
- Propose recommendations and the way forward on the timely implementation of the project on DDT alternatives.

Six members of the STAC were in attendance; 7 members were unable to attend. Ten representatives from 7 of the 8 project countries were in attendance; only the project coordinator from Djibouti was unable to attend.

The meeting was opened by Dr Ibrahim Betelmal, WHO Representative, Syrian Arab Republic, who delivered a message from Dr Hussein A. Gezairy, WHO Regional Director for the Eastern Mediterranean. In his message, the Regional Director acknowledged the support of UNEP/GEF and the collaboration between WHO and other United Nations agencies (UNEP and FAO) and partners (Stockholm Secretariat). Dr Gezairy also pointed to the achievements made by countries of the Region in translating integrated vector management to action at country level and in scaling up of vector control interventions. As a potential alternative to DDT, approximately 36 million people in the Region were protected with long-lasting insecticidal nets. He expressed his concern over the problem of vector resistance to insecticides – to pyrethroids in particular in Sudan and possibly in Afghanistan. Dr Gezairy called upon project countries and STAC members to address this problem

cooperatively. He also recognized the progress made in the area of capacity strengthening in entomology and vector control in the Region as one of the ways to empower countries to face this problem head on.

Dr Ousama El Samagh, Deputy Minister for Technical Affairs, Ministry of Health, Syrian Arab Republic welcomed STAC members and participants on behalf of the Minister of Health. He reiterated the support of his government in addressing disease vector problems in the country – especially the increasing number of leishmaniasis cases in the country every year. Dr El Samagh acknowledged the support of WHO at all levels of the organization and that of other UN agencies and partners to the Government of the Syrian Arab Republic. The implementation of the WHO/UNEP project in three governorates of Allepo and Hamma is seen as an opportunity that will contribute to the control and prevention of leishmaniasis in the country.

Mr Ismail Ould Cheikh Ahmad, UN Resident Coordinator, Syrian Arab Republic in his welcoming remarks expressed his satisfaction in seeing three UN agencies working closely together to address issues of mutual concern – health, agriculture and environment. He confirmed his agency's commitment to support this initiative in the Syrian Arab Republic.

On behalf of UNEP/GEF, Mr Jan Betlem, Task Manager, Division of GEF Coordination, UNEP Nairobi, made a statement that underlined the continued support of GEF to activities related to the implementation of the Stockholm Convention, with possible increases for the next GEF funding period. Noting the need for additional funding to project countries – especially those looking at the management of vector resistance as part of their demonstration activities for DDT alternative interventions – Mr Betlem suggested that WHO/EMRO and Member States could consider submitting a phase II project proposal. The condition for this was that the phase II project would have new activities.

The opening was followed by a round of introductions of the participants. The participants elected Dr Lama Jalouk (Syrian Arab Republic) as Chair. Dr Immo Kleinschmidt, WHO Temporary Adviser, was elected Rapporteur. The programme and list of participants are attached as Annexes 1 and 2, respectively. The meeting was followed by a training workshop on cost-effectiveness analysis of DDT alternatives from 14–16 July 2010. A summary of the training workshop is included as Annex 3.

2. PROJECT MANAGEMENT AND COORDINATION – PROGRESS OF IMPLEMENTATION

Dr A. Mnzava, WHO EMRO

The objective of the project is to reduce reliance on DDT during vector-borne disease outbreaks by minimizing the potential to revert to DDT for prevention and control of vector-borne diseases through the use of sustainable, cost-effective and environmentally friendly alternatives. This would be achieved through: establishing

an IVM framework, criteria and procedures for optimization of vector control resources/tools/interventions; strengthened inter- and intrasectoral coordination, partnerships and community empowerment; and building national capacities for IVM and for sound management of pesticides in line with the Stockholm Convention. He also summarized the project outcomes as follows: sustainable and cost-effective DDT alternatives are demonstrated; capacity built to implement DDT alternatives based on IVM principles; POPs pesticides are collected, repackaged and disposed; good practices on sustainable alternatives are shared; and trans-boundary and national coordination and information are shared to promote IVM without the use of DDT.

As a departure point, some of the outcomes of the last STAC meeting which was held in Cairo, Egypt in July 2009 were highlighted as follows: Reviewed progress of project implementation in countries; made key changes in the project implementation as follows: 5 countries to implement demonstration activities (Islamic Republic of Iran, Morocco, Sudan, Syrian Arab Republic and Yemen), 3 countries to focus on IVM capacity strengthening (Djibouti, Egypt an Jordan), with FAO 3 countries to safeguard and eliminate their DDT stocks (Islamic Republic of Iran, Jordan and Morocco) and 1 country to include insecticide resistance as a component of demonstration studies (Sudan); and all these changes were reflected in the approved work plans and budgets for 2009 and 2010.

In line with the reporting format to UNEP/GEF, the progress of the project implementation was given output by output and activity by activity – based on the approved regional workplan for each project component. Most activities with a time-frame of completion before or by June 2010 had achieved 100% implementation status with the exception of the delay in the start of the demonstration activities as well as component 3 (collection, repackaging and disposal). However with the recent signing of the MoU between WHO and FAO and the planned fast tracking in the implementation of this component in the Islamic Republic of Iran, Jordan and Morocco, it will be achieved by end of 2012 – much earlier than was planned.

The approved project budget by component, following the budget revision during the second STAC meeting in relation to actual expenses to-date were presented. As of 30 June 2010, out of a total of US$ 1 117 000 received from UNEP/GEF through two instalments, US$ 762 017 had been used (obligated and actually spent) with a balance of US$ 407 983. The actual balance will be known once expenses related to the holding of the current meeting and the back-to-back training workshop on cost-effectiveness analysis of DDT alternative interventions in demonstration sites is included.

The challenges and constraints faced in the implementation of the project during the reporting period were mentioned. These include: delay in financial/administrative procedures within WHO which coincided with the period in which the Regional Office went live on its new Global Management System as well as coinciding with a new biennium; delay in the implementation of component 3 due to the introduction of

a new system of working with other UN agencies – leading to the delay in developing an LoA between WHO and FAO; in some countries – there was lack of thrust and leadership to take the project forward; and in some, it was very apparent that allocated project funds are inadequate unless co-financing is raised. This is the case with Sudan where demonstration activities have been linked to monitoring and management of insecticide resistance – including pyrethroids.

On a positive note, it was reported that, despite the above challenges and constraints, the implementation of the project in countries of the Region has provided opportunity for increased co-financing (e.g. the Bill and Melinda Gates Foundation support on pesticide management in Sudan and Morocco; additional resources through SAICM in Morocco, additional resources for insecticide resistance in Sudan); strengthened coordination at country level through the establishment of IVM steering committees; strengthened capacity in entomology and vector control – through the Regional MSc and postgraduate diploma in Sudan and Pakistan respectively; and the spillover effect in neighbouring/non-project countries – benefiting especially through the regional courses (Afghanistan, Somalia and Palestine).

3. ADVOCACY AND CAPACITY BUILDING FOR PESTICIDE MANAGEMENT IN THE RFRAMEWORK OF IVM

Dr M. Zaim, WHO HQ

There is a close link between IVM and sound management of pesticides. IVM is a key strategy for judicious use of public health pesticides, and judicious use and sound management of these chemicals is one of the key principles of IVM. He also noted the critical role and the need for close collaboration of different sectors, especially health, agriculture and environment for life-cycle management of pesticides.

A joint programme has been established with FAO on sound management of pesticides, based on a Memorandum of Understanding signed between the two Organizations in March 2007. The FAO/WHO Joint Meeting on Pesticide Management (JMPM) meets annually and advises on matters pertaining to pesticide regulation, management and use, and alerts to new developments, problems or issues that otherwise merit attention from one or both Organizations. FAO/WHO Guidelines for the registration of pesticides has been published and it is hoped the Regional Office will support its translation into Arabic and its wide dissemination. Three key guiding documents are under development by JMPM: Guidelines for pesticide legislation; Guidelines for quality control of pesticides; and Guidelines on pesticide data requirement. National workshops were needed for review and adoption of the guidelines.

Dr Zaim recalled the recommendations of the previous meetings of STAC and the gaps and inadequate capacity identified in all participating countries for sound management of public health pesticides. He informed the meeting of development by

AFRO and SEARO, in collaboration with WHOPES, of Guidelines on public health pesticide management policy and advised EMRO to consider the same under the activities of the project. The guidelines provide critical elements to develop and/or strengthen national policy for the management of public health pesticides; discuss issues and driving forces that may instigate national policy development; and provide guidance on the process of policy formulation, implementation and evaluation.

Three new guidelines for efficacy testing and evaluation of public health pesticides and 3 generic risk assessment models have been published. These are guidelines for laboratory and field testing and evaluation of: 1) mosquito insect repellents for human skin; 2) insecticides for indoor and outdoor, ground-applied space spray applications; and 3) household insecticide products (mosquito coils, vaporizer mats, liquid vaporizers and aerosols) and generic risk assessment models for i) indoor residual spraying of insecticides, ii) indoor and outdoor space spray application of insecticides for public health, and iii) mosquito larviciding.

The 4th edition of *Global use of insecticides for vector-borne disease control* has been published, and much credit is due participating countries for their continued support in this important activity. It is vital to include reporting on use of public health pesticides as an integral part of annual reporting on vector-borne disease to WHO.

A workshop jointly organized by WHOPES and WHO AFRO on capacity strengthening for sound management of pesticides was held in Nairobi, Kenya, 25–29 January 2010. The workshop was part of activities undertaken by the WHOPES Project on reducing health risks through sound management of pesticides, funded by the Bill and Melinda Gates Foundation. Of the 12 countries participating in the Project, 6 were represented at the workshop (Cambodia, Kenya, Mozambique, Sudan, Thailand and United Republic of Tanzania). The meeting was also represented by FAO, UNEP Chemicals and CropLife International as well as WHO consultants and a Secretariat from WHO headquarters, regional offices and country offices. A similar workshop is planned to be held in Morocco in November 2010, in collaboration with WHO EMRO, for 5 other participating countries of the project.

The Health Assembly in resolution WHA63.26 Improvement of health through sound management of obsolete pesticides and other obsolete chemicals urged Member States to establish or strengthen capacity for the regulation of the sound management of pesticides throughout their lifecycle, as a preventive measure to avoid accumulation of obsolete chemicals. There is urgent need for expansion of support to Member States on this priority subject as well as further political advocacy and resource mobilization for this purpose.

Dr Zaim reiterated the commitment of WHO to support Member States on safe and judicious use of public health pesticides and their life-cycle management and informed the meeting of WHO celebration of the 50th anniversary of the WHO Pesticide Evaluation Scheme (WHOPES) in June 2010. WHOPES serves as the focal

point for management of public health pesticides in WHO and was established in 1960 with the approval of the World Health Assembly. Dr Zaim noted the invaluable support and close collaboration of the Vector Biology and Control Unit of WHO EMRO with the scheme on sound management of public health pesticides, and handed over a commemorative plaque which has been prepared for the 50th anniversary of WHOPES to Dr Abraham Mnzava, Regional Adviser for Vector Control, WHO/EMRO.

4. COLLECTION, REPACKAGING AND DISPOSAL OF POPS IN COLLABORATION WITH FAO

Dr R. Thompson, FAO

The UN system introduced a new standardized format for Letters of Agreement (LoA) between UN agencies at the beginning of 2010. This delayed the preparation of the LoA between WHO and FAO, which was eventually signed on 3 July 2010. The LoA sets out the outcomes, activities, budget and work plan for the execution of component 3. As agreed during the second STAC meeting in Cairo, component 3 focuses solely on disposal activities in the Islamic Republic of Iran, Jordan and Morocco. The approach aims to build capacity in the national teams to allow them to undertake the inventory, data-management, environmental assessments and repackaging activities, where necessary under expert supervision. The shipment and disposal activities will be undertaken by a hazardous waste disposal contractor engaged through an international tender. The specific objectives of the component are as follows.

- Islamic Republic of Iran:inventory, safeguarding and disposal of 17.8 tonnes of DDT held in 10 stores distributed through 9 regions.
- Jordan: inventory, safeguarding and disposal of 22 tonnes of DDT and up to 1 tonne of POPs pesticides held by the Ministry of Agriculture.
- Morocco: shipping and disposal of 50 tonnes of already repackaged DDT. The safeguarding of 40 tonnes of Ministry of Health stock will be funded under a SAICM QSP project. The private sector company holding 10 tonnes will be requested to fund its repackaging.

Two tonnes of DDT from the Syrian Arab Republic that were safeguarded in 2005 were destroyed by the French hazardous waste management contractor, Tredi SA in June 2010 under the FAO project “Prevention and Disposal of Obsolete Pesticides in Syria”.

The cost of shipping and disposal represent the most significant cost of the component. To eliminate the risks of future rises in disposal prices, FAO will undertake a tender as soon as possible to contract for the shipping and disposal of the stocks from all three countries.

During the group work discussions with each of the countries to review the detailed action plans, it was agreed that the country teams would review the stock records to reconfirm the indicative inventories. As part of their contributions to the project the Countries will also identify equipment, vehicles, offices, and staff that could be made available for the project. FAO will provide an indicative list of equipment required for inventory. At the request of the Iranian team, the work plan was amended such that the procurement will be undertaken at the outset to allow inception workshop and inventory training to be undertaken during a single mission. This revision will speed implementation and reduce costs but will restrict the flexibility of the inventory. The country teams will invite the Ministries of Agriculture and Environment to participate in the trainings and inventory activities in order to build capacity such that inventories can be initiated in other sectors.

For Morocco, it is estimated that the safeguarding of the 40 tonnes of Ministry of Health stocks will be completed by the SAICM QSP in the fourth quarter of 2010. During discussions with Dr Btissam Ameur it was agreed that the Moroccan team would contact the private sector company to organize the repackaging of their DDT to the same standards as the Ministry of Health stocks to allow for the international shipment in accordance with International Maritime Dangerous Goods regulations. The shipment and disposal is expected to be completed in the first quarter of 2011. The shipment and disposal of the DDT stocks from the Islamic Republic of Iran and Jordan is expected to be completed by the end of 2011.

It was agreed by the STAC that improvement in pesticide management along with sustainable vector management will be crucial avoiding the re-accumulation of obsolete stocks. Jordan identified the need to strengthen its pesticides legislation. In the last quarter of 2010 FAO is planning to undertake a review and revision of pesticides legislation in Lebanon and Syrian Arab Republic. It was agreed that WHO would fund a similar review for Jordan using the same consultants. This approach will facilitate future harmonization of registration or legislation if that becomes a political priority for the countries.

5. MEASURING THE COST-EFFECTIVENESS OF DDT ALTERNATIVES IN DEMONSTRATION ACTIVITIES IN PROJECT COUNTRIES

Dr J. Yukich, STAC Member

IVM can be defined as a rational use of integrated measures to combat multiple vector borne diseases using multiple methods. This approach calls for the economic and effectiveness assessment of combinations of vector control interventions in representative settings. For this reason the project has developed demonstration activities which are planned to be carried out in four countries: Islamic Republic of Iran, Morocco, Sudan and Syrian Arab Republic. Each of these activities has taken the form of a cluster randomized controlled trial and will be evaluated both for their effects on the incidence of either malaria or leishmaniasis, as well as on the relative cost-effectiveness of the intervention alternatives used in the trials. The presentation

summarized the main cost-effectiveness results which will result from each of the trials.

In Sudan a three-armed cluster RCT (CRCT) will measure the relative effectiveness of combinations of ITNs and IRS versus ITNs or IRS alone stratified by differing levels and types of insecticide resistance. The main outcome of the economic analysis will be the incremental cost effectiveness ratio (ICER) of a combination of LLINs and IRS versus either intervention alone per incident malaria case averted. These ratios can be calculated for varying levels of effect stratified by insecticide resistance level. In the Islamic Republic of Iran a two-armed CRCT will test the relative effectiveness of multiple interventions (LLINS, IRS, larviciding and space spraying) versus LLINs alone, essentially a full combination of vector control measures in a low transmission setting – a potential approach towards malaria elimination. The main cost effectiveness measure will be the ICER between the two arms per incident malaria case averted. In the Syrian Arab Republic and Morocco both demonstration activities will focus on the incidence of leishmaniasis. The Syrian demonstration activity will be a two-armed CRCT focusing on a comparison of LLINs and IRS for the prevention of cutaneous leishmaniasis. The main outcome of the economic analysis will be the ICER of LLINs versus IRS per case of cutaneous leishmaniasis averted. Finally, In Morocco, a three-armed CRCT design will be used to measure the effectiveness of combinations of IRS and environmental management, or LLINs and environmental management versus environmental management alone. The final economic outcome will be the ICER for IRS or LLINs plus environmental management versus environmental management alone per case of cutaneous leishmaniasis averted.

The remainder of the presentation covered potential sources of information and data collection methods and tools for the economic analysis of demonstration activities. Additionally the ides of economic analysis as a method for evidence synthesis in health evaluation was covered. Potential data sources for economic information about the demonstration projects include, but are not limited to, invoices, budgets, expenditure databases, surveys, and interviews with mangers or other project implementers or stakeholders. Finally, the presentation gave several examples of data collection forms so that project managers can see the type and level of information that will be necessary to collect for an economic evaluation.

6. MEASURING EFFECTIVENESS OF ALTERNATIVE INTERVENTIONS TO DDT IN PROJECT COUNTRIES

Dr I. Kleinschmidt, WHO Temporary Adviser

The GEF-EMRO demonstration studies all aim to demonstrate superiority of one method over another, or non-inferiority of one method compared to another. All but one of the studies have adopted the cluster randomized trial (CRT) approach, using incidence rate of malaria or leishmaniasis cases as the primary outcome indicator. The reference (control) arm in these trials receives the ‘standard of care’

intervention, which is either IRS or LLIN or environmental management. Treatment groups receive standard of care plus one or more additional interventions. The additional intervention may be a novel method, or a standard intervention which is normally used alone but evaluated here in combination.

Protective effectiveness (PE) is estimated as 1 minus the rate ratio of incidence in the intervention group, relative to incidence in the reference group (PE=1-RR). This is to be distinguished from impact of an intervention in a programmatic setting.

In vector control, as in other infectious disease interventions, there are direct effects as well as indirect effects. Direct effects are the reduction in risk to those who received the intervention, e.g. who sleep under an LLIN. Indirect effect is the reduction in risk to those not receiving the intervention, but who live in close proximity of those who receive the intervention. With some interventions most or all of the effect of the intervention is indirect, and very little or none is direct e.g. IRS with no repellent effect. Therefore vector control studies must be designed so that the overall intervention effect consisting of direct and indirect effects can be assessed which is achieved if treatments are assigned to groups (clusters/villages) rather than to individuals or houses.

In observational studies the effect of combining IRS+ITN versus IRS alone has previously been assessed. This was done using prevalence of infection data from malaria indicator surveys, by comparing infection in those using both interventions, those using one intervention and those receiving neither of the two interventions. Effectiveness was therefore based on a (non-randomised) intervention group comprised of those receiving both interventions and comparison groups (controls) comprising those not receiving one or both interventions. The controls are therefore non-compliers living side by side with compliers. These studies showed a strong additional benefit for those using both interventions, compared to those receiving only one of the two interventions, with no evidence of effect modification (interaction) between the IRS and the ITN effects.

However, the deficiency with these observational studies using cross-sectional surveys is that there is no genuine control group because even the non-compliers receive an indirect benefit due to the community effect of the interventions. As a result the protective effectiveness may well be underestimated. This is a further reason why CRTs are needed to assess the overall effectiveness comprising of both direct and indirect effects that the combined intervention may provide. However, it is important to note that the estimate of overall effectiveness will depend on the level of coverage achieved in the treatment arms of the study. Doing an as per protocol analysis of the incidence rates will provide an estimate of the total (direct plus indirect) effect of the dual intervention; on the other hand an ‘intention to treat’ analysis will provide an estimate of the overall effect which would approximate the effectiveness in a programmatic setting where some individuals and groups do not receive the intended intervention.

In assessing effectiveness of alternative interventions, one may want to know whether these are better than standard interventions, or alternatively, whether they are as good as the reference intervention (but possibly easier to use, or with less environmental impact). For example durable wall linings may be easier to use and hence would be worth using if this intervention is non-inferior to traditional IRS. This is assessed through non-inferiority trials. In such a study the null hypothesis is that the new intervention is inferior to the existing one that it will be compared with. The alternative hypothesis is that incidence in the study arm with the new intervention is no more than that in the reference arm by a pre-specified difference (and it may well be lower than the reference arm). A one sided significance test can then be used to assess the strength of evidence against the null hypothesis. Required sample sizes for such a trials will depend heavily on the margin of inferiority that is specified and sample size requirements may be very large if it is necessary to show non-inferiority by a small margin.

Some important final points to remember for the demo studies are as follows:

- Country teams should draw up analysis plans for determining outcomes, effects and effectiveness and to ensure that data are collected to enable such analysis.
- Each study should have proper written ethics approval from an appropriate ethics committee, and a procedure for obtaining community consent for the randomization of interventions. Study proposals should be submitted to WHO ethics committee. This requires urgent action.
- Each study should be registered on the clinical trials website, by the responsible organization (http://register.clinicaltrials.gov).

7. PROGRESS ON PROJECT IMPLEMENTATION AND PLANNED ACTIVITIES BY COUNTRIES

Egypt

Like Jordan and Djibouti, the STAC had recommended that Egypt focus on capacity strengthening for IVM implementation as part of the WHO/UNEP project. Details of this recommendation are found in the report of the second STAC meeting. Engineer Osama El Sherief presented general vector control activities undertaken by the control programme of Egypt – including planned activities for 2010–2011. In the discussions that followed, the STAC recommended that the following activities be implemented in Egypt: revival of country coordination mechanisms by having functional IVM steering committees; development of IVM advocacy materials – including mass media and press; updating of the distribution of vectors and the disease they transmit through surveys, analysis of data and production of distribution maps.

Islamic Republic of Iran

The Islamic Republic of Iran has adopted the strategy for malaria elimination and the EMRO/GEF supported demonstration Project in the country includes two separate studies with the following objectives: (1) to compare the cost-effectiveness of combined vector control interventions to long lasting insecticidal nets alone on malaria incidence in rural areas; and (2) to demonstrate effectiveness and acceptability of larval control measures in household water reservoirs in urban areas.

The rural district of Bashagard (Hormozgan Province) has been selected for the implementation of the Objective 1. The district has a population of about 30 000 inhabitants, who live in 174 small villages ranging in size from 5 to 944. Malaria incidence in this area has been higher than in most other malaria-affected districts of Iran with a mean incidence of 105 per 1000 over the years 2004 to 2008. Annual incidence rose steadily up to 2006, but declined sharply thereafter with incidence having fallen to 28 per 1000 in 2008. The total population of the district will be included in the study, in a three arms cluster randomized design, stratified by low and high incidence areas, in which one arm will receive IRS (2 rounds using a pyrethroid insecticide) and the second arm will receive LLINs and IRS (same as the other arm) and the third arm will receive IRS + LLINs and larvciding. The following indicators will be monitored: Incidence of all malaria cases (*P. vivax* and *P. falciparum*) through epidemiological indicators (i.e., passive and active (every two weeks) surveillance; sero-conversion prevalence in children under 5 years of age after 3 years); entomological indicators (density of adult vectors (geometric mean by study arm) by light trap in random sample of houses; and sporozoite rate in vector mosquitoes, by species); as well as indicators to assess the coverage of the intervention, i.e. proportion of people having access to LLINs out of those targeted, proportion of persons sleeping under LLIN the night before the survey and proportion of houses treated with IRS.

The second study will be carried out in the city of Chabahar (about 6000 households) and through a two arm cluster randomised trial, with the residential sectors stratified into the east and west areas of the city and randomly allocated to one of the two study arms, namely environmental management (covering of water reservoirs) and larviciding (bi-weekly application of *Bti*). Entomological and epidemiological indicators will be monitored as above where appropriate.

The following progress in the implementation of the study was reported: collection of baseline data in target areas started in June 2009; design of standard format for reporting and external evaluation of the study started; the procedure for selection of an eligible external evaluator initiated; a consultant recruited to design the detailed budgeted action plan of the study; procured the required LLINs for the study and will be cleared from the custom in July 2009; and early detection system for malaria epidemic in target areas established.

The planned activities for July 2010 to June 2011 include finalizing the comprehensive implementation plan by end July 2010; training and orientation workshop for stakeholders and implementing partners; gathering baseline epidemiological and entomological data including sero-prevalence during August 2010); active face to face community education sessions on alternative measures in selected sites during September 2010; starting the implementation of the study in rural arm in September 2010 and the intervention in the urban setting in October 2010.

Jordan

Following the recommendations of the second STAC meeting held in Cairo in July 2009, Jordan was requested to focus on two of the project components as follows: strengthening capacity for IVM implementation; and collection, repackaging of obsolete pesticides in collaboration with FAO. During the meeting Dr K. Khalil reported that using the WHO/UNEP Jordan was able to send a staff member of the control programme to undertake an MSc degree at the WHO regional MSc course in medical entomology and vector control at the University of Gezira, Sudan. The control programme also continued to conduct routine entomological surveillance (including monitoring of insecticide resistance) for disease vectors.

In terms of implementing component 3 of the project with FAO, details of theses planned activities are found in the relevant section of the FAO presentation by Dr Richard Thomson. During the discussions of the Jordan presentation, it was recommended that the country also undertake the following activities during 2010–2011 and report back to STAC during the next meeting in July 2011: review of pesticide legislation; procurement of test kits/papers to strengthen routine entomological surveillance of disease vectors; conduct of national training on IVM principles for decision-making; and request of a WHO consultant to facilitate in the training.

Morocco

The progress on the implementation of the WHO/UNEP project in Morocco was presented. The presentation highlighted on the objectives of demonstration activities for effective DDT alternatives for leishmaniasis vector control in Morocco. It was reported that Dr Immo Kleinschmidt from the London School of Hygiene and Tropical Medicine helped the control programme of Morocco to finalize the study design following the recommendation of the second STAC meeting. A cluster randomized control study is being implemented in 45 localities endemic for leishmaniasis, with a total population of 27 277 people and an incidence of 5 cases per 1000 population with three study arms – IRS, LLINs and environmental management (waste disposal and hygiene).

It was also reported that after the second STAC meeting in Cairo, the control programme: was able to finalize the study protocol; has conducted intensive information, education and awareness campaigns; conducted entomological surveillance in the 45 localities; distributed insecticide treated nets in 15 localities; sprayed all houses in the IRS-earmarked localities; and is routinely implementing waste disposal and hygiene practices with communities and with the support of the local government in the remaining 15 localities. The following were some of the challenges the control programme was facing in implementing the demonstration activities in Morocco: delay in budget release through the WHO country office; delay in the delivery of procured LLINs by the supplier; case detection; and weak capacities in entomological surveillance – requiring training.

The following were among the planned activities for 2010–2011: 4 meetings of the national steering committee of IVM (May, September, December 2010, February 2011); 16 meetings of the local committees in the demonstration sites (October 2010, February 2011); implementation of the demonstration activities (case detection and routine entomological surveillance) (2010–2011); training in community advocacy; training in *Phlebotomus* identification and resistance monitoring (February, March and December 2010); training in epidemiological surveillance for leishmaniasis (specimen collection and microscopy identification) (January 2011); and conducting 2 project evaluations (September 2010 and September 2011). The activities related to cleaning of obsolete pesticides are addressed separately in FAO's presentation by Dr Richard Thompson.

During the discussion on the implementation of the project in Morocco, the control programme was requested to develop a standard operating procedure/protocol on the environmental management for the control of leishmaniasis in the demonstration sites. Overall, it was concluded that the implementation of demonstration activities as part of the WHO/UNEP project in Morocco will provide the opportunity and lessons learnt in the control of leishmaniasis in the country.

Sudan

The objective of the study is to assess the cost-effectiveness of the combined use of LLINs and indoor residual spraying (IRS) with long-lasting insecticidal mosquito nets (LLINs) alone and with IRS, in areas with or without pyrethroid resistance in *Anopheles arabiensis*. This will allow the promotion of cost-effective and sustainable DDT alternatives for vector control.

Through a cluster randomized trial design, four study areas comprised of 1,080,853 inhabitants, living in 204,732 households (distributed in 587 villages) have been divided into three study arms comprising of IRS only, LLINs only and the combination of LLINs plus IRS. Study arms are stratified by the presence/absence of vector resistance. IRS and LLIN alone interventions consists 39 clusters in three areas

each, while combination of IRS+LLIN consists 65 clusters in four study areas. IRS will be conducted in all target clusters twice a year.

In LLIN clusters the targeted coverage will be 1 LLIN per 2 persons and replaced after 3 years. Intensive information, education and communication (IEC) campaigns will be conducted for all interventions. Interventions coverage will be assessed using standard questionnaires based on RBM indicator survey (MIS). Incidence of confirmed cases of malaria in children under 5, entomological inoculation rates and cost of interventions will be compared between research arms of the study. The impact of the vector control interventions will be assessed through the comparison of the proportions of *An. Arabiensis* genotypes resistant to pyrethroids between the study arm using LLINs (pyrethroid insecticidal net) combined with bendiocarb IRS, and the study arm using LLINs alone.

The following progress in the implementation of the study was reported: nomination of the state and site coordinators with specific terms of reference; recruitment of 143 community health workers (CHWs) for active case detection and for the assessment of intervention coverage; training manual of the CHWs drafted; data collection tools (registration forms and questionnaire) and computer for data entry in place; outline of the training of the entomological teams prepared; selection of 567 study villages in the 4 areas; 143 detailed maps prepared; standards of practice of the project implementation finalized; maintenance of Sennar training centre; baseline survey preparation under way and will be finalized by August 2010; baseline survey start date set on mid September 2010; rehabilitation of Sennar entomological laboratory; and susceptible colony established at Sennar centre.

The planned activities for July 2010 to June 2011 include baseline household and entomological surveys and capacity building (e.g. training of the entomological teams, community health workers and preparation of insectary in Galabat and New Halfa and rehabilitation of Sennar entomological laboratory). The planned activities also include the procurement of insecticides, IRS campaign one round in 2011; procurement and distribution of 425 601 LLINs; IEC campaign; procurement of drugs and rapid diagnostic test kits. The total budget planned and the expected contribution from the UNEP/GEF Project was proposed. The following technical support was also requested: an international consultant (entomologist) to participate in training of entomological team (6 September 2010); 2 international consultants (epidemiologist and entomologist) to finalize the baseline survey process (20 August 2010); and 2 International consultants (epidemiologist and entomologist) to facilitate the baseline survey (19 September 2010); international consultant for cost effectiveness analysis (December 2010) and International consultant to facilitate the starting of the intervention (January 2011).

Syrian Arab Republic

Following the technical expertise provided by Dr Abolhassan Nadim, a STAC member, the Syrian Arab Republic was able to finalize the study on the comparison of the effectiveness of the use of IRS and LLINs for the control of anthroponotic cutaneous leishmaniasis. Dr Bakour informed participants that a total of approximately 60 villages or suburbans from two districts in Aleppo and Hama governorates have been randomly selected and allocated either IRS – (498 cases in 2008; population of 12 678; and incidence of 3.9 cases/1000) or LLINs – 325 cases in 2008; 9089 population; and incidence of 3.6 cases/1000).

The progress to-date include: the planning and preparation of activities to be implemented in the study design; preparation and finalization of questionnaires; selection and recruitment of field workers; training of project teams and communities; mapped and numbered units of household and houses; collected information on the number of active CL cases – as part of the baseline survey; conducted health education campaigns (accompanied by the distribution of bednets or the spraying of homes – where applicable) through schools, meeting in mosques and also face to face contact with communities to clarify how to use and take care of bednets.

These activities have been followed by routine collection of both entomological and epidemiological data on leishmaniasis as follows: epidemiological: determine the number of new cases of CL once every two months; entomological: putting sticky traps in two units in each group of intervention once every two weeks during the whole sandfly active season in sentinel sites – followed by establishing densities and identification of sandfly species; environmental: some meetings with local authorities and health education of communities to address waste disposal of garbage and sewage; cleaning of floor of stables and animal shelters at least once a week; construction materials and animal droppings taken out of houses and should not remain for more than three weeks; and training of field technicians, nurses, health educators and part time workers. It is planned that these activities will be continued in 2010–2011 coupled with data entry and preliminary data analysis.

The following challenges/constraints in implementing the study were highlighted: the delays in starting of the project activities following the recommendations of the second meeting in Cairo – these activities only began in March; delay in receiving supplies (insecticides) and equipment (Hudson spray pumps) and funds for the project. In view of the delay in receiving the insecticide (delay in sending request to WHO/EMRO), the control programme was forced to use available insecticides – which happened not to be the ones recommended by WHO as they have short residual effect.

It was at this point that STAC members recommended their discontinuation and requested WHO country office to expedite the clearance of these supplies through customs. The STAC also felt that unless the Government of the Syrian Arab Republic

was committed to investing in capacity strengthening in medical entomology and vector control, its capacity for routine entomological surveillance and implementation of vector control interventions – including capacity for pesticide management (procurement, registration, legislation, selection and application of pesticides and their disposal etc.) would always be inadequate.

Yemen

The objective of the demonstration project is to monitor and evaluate the implementation of the main malaria vector control interventions in the newly developed strategic plan for malaria control and elimination, i.e. the universal coverage with IRS and LLINs, alone and in combination, in each of the three altitude-based epidemiological strata. The project will also include building /strengthening the national capacity for planning, implementing quality IRS, LLINs campaigns with proper monitoring and evaluation of each intervention.

The three strata as per national strategic plan are as follows: 1) below 600 meters: population 56 137 in 299 villages; two rounds of IRS; 2) 600–1000 metres: population 57 141 in 640 villages; universal coverage with LLINs plus one round of IRS; and 3) 1000–2000 metres: population 60 237 in 617 villages; universal coverage with LLINs. However, with the support of a WHO consultant in September, Yemen should be in a position the evaluation is more likely to be done in stratum 1 and possibly 2, with cluster randomised to IRS with universal LLIN coverage.

The following activities are therefore planned for July 2010 to June 2011: demographic surveys in the three strata (July 2010); social mobilization for IRS and LLINs in strata 1 and 2 (July 2010); recruitment of a WHO consultant to assist in the detailed study design and implementation plan (September 2010); entomological & parasitological base-line surveys in strata 1 and 2 (September 2010); IRS campaigns in stratum 1 (first round) and distribution of LLINs in Stratum 2 (October 2010); second round of IRS in stratum 1 (February 2011); entomological and parasitological surveys to establish baselines for strata 3 (May 2011); distribution of LLIN (universal coverage) accompanied by social mobilization campaign (COMBI) in stratum 3 (June 2011).

Owing to capacity and logistical constraints, it is unlikely that a cluster randomized trial could be undertaken successfully in Yemen. A simpler evaluation based on a case-control approaches either through passive case detection at clinics or active case detection through cross sectional prevalence surveys, with supplementary questions asked of respondents, has in countries like Afghanistan been shown to yield useful and reliable information on LLIN coverage and protection among users.

8. CONCLUSIONS

The Regional STAC reviewed the implementation of the project activities, output by output. Despite the administrative challenges experienced at the beginning of 2010, the STAC was pleased with the progress achieved thus far. While implementing the recommendations proposed below, project countries would need to strictly adhere to the timelines agreed during this meeting.

The STAC also appreciated that the implementation of the project in countries of the Region has: provided opportunity for increased co-financing (e.g. the Bill and Melinda Gates Foundation support on pesticide management in Sudan and Morocco, additional resources through SAICM in Morocco, additional resources for insecticide resistance in Sudan); strengthened coordination at country level through the establishment of IVM steering committees; strengthened capacity in entomology and vector control – through the regional MSc and postgraduate diploma in Sudan and Pakistan respectively and the spillover effect in neighbouring/non-project countries benefiting especially through the regional courses (Afghanistan, Somalia and Palestine).

9. RECOMMENDATIONS

1. Capacity should be further strengthened to ensure evidence-based decision making for optimum and efficient use of resources and tools for vector control interventions through proper monitoring and evaluation, operational research and coordination.

2. The subject of capacity strengthening for regulation and sound management of public health pesticides should be brought to the attention of the Regional Committee for its advice and WHO to organize a meeting with potential donors and stakeholders for resource mobilization. Further coordination with FAO and UNEP in this regard is important and is highly recommended.

3. Recognizing the significance of the shipment and disposal costs to the overall budget of Component 3 of the project:
    - 3.1 Efforts should be made early in its execution to identify the most efficient and economic logistics routes to Europe.
    - 3.2 Each country involved in the Component should identify a central collection centre close to the port of export to be used to store the repackaged DDT.
    - 3.3 FAO should undertake an international tender for the shipment and disposal of repackaged DDT as early as possible to define the disposal costs.
    - 3.4 The budget and activities in the countries should be confirmed or revised depending on the availability of remaining funds.

4. The STAC noted that some countries implementing demonstration activities had implemented interventions at different times. It was recommended that such countries should ensure as much as possible that planned interventions are implemented at the same time in order to allow appropriate comparison of the impact of each intervention. In this regard, WHO must ensure the timely provision of supplies, equipment and funds for project activities

5. The STAC also noted the importance of country teams in drawing up analysis plans to determine outcomes, effects and effectiveness and in ensuring that good data are collected to enable such analysis. It is recommended that each study should also have proper written ethics approval from an appropriate ethics committee, and a procedure for obtaining community consent for the randomization of interventions. Study proposals should be submitted to the WHO ethics committee. As this requires urgent action, WHO is to follow up on the submission of such documents. Furthermore, each study should be registered on the clinical trials website, by the responsible organization (http://register.clinicaltrials.gov) otherwise results from these studies cannot be published in peer reviewed journals

6. Countries should provide sixth-monthly progress report to WHO EMRO to be shared with STAC members for their input. WHO should provide a format for such reports

7. The Regional Office should continuously inform and update the country offices on the day-to-day running of the respective projects. This is particularly important in those countries without technical staff in the relevant area of communicable disease and control.

8. Recognizing the importance of the activity on cost-effectiveness analysis of DDT alternatives and following the successful completion of the training workshop, the STAC recommended that:
   8.1 The draft tools should be finalized by the beginning of September
   8.2 The draft tools should be circulated to project coordinators and to STAC members for their input by September/October
   8.3 In consultation with the secretariat, Dr Yukich should plan to visit countries implementing demonstration activities for field-testing of tools before the end of June 2011

9. Noting that exchange of information and experiences with other DDT projects in the WHO regions of Africa and the Americas is part of the approved project activities, the STAC recommended that this should include also exchange of information and experiences between project countries in the Eastern Mediterranean Region.

Annex 1

PROGRAMME

Monday, 12 July 2010

08:30 –09:00	Registration	
09:00 –10:00	Opening Session	
	Message from Dr Hussein A. Gezairy, Regional Director, WHO/EMRO	Dr I. Betelmal, WR/Syria
	Message from H.E. The Minister of Health, Syrian Arab Republic	
	Message from Dr Jan Betlem, UNEP/GEF	
	Objectives of the workshop, method of work and nomination of officers	
10:30–11:00	Project progress report	Dr A. Mnzava
11:00–11:30	Advocacy for pesticide management in the framework of IVM and project	
11:30–12:00	Discussion	
12:00–12:30	Collection, repackaging and disposal of POPs	Dr M. Zaim
12:30–13:30	Discussion	
14:00–15:30	Country reports	
	Sudan	
	Morocco	
	Syrian Arab Republic	
16:00–17:00	Discussions	

Tuesday, 13 July 2010

08:30–10:00	One-year planned activities and support needed
	Islamic Republic of Iran
	Yemen
	Jordan
	Egypt
10:30–11:15	Measuring impact of alternative interventions in demonstration studies
11:15–12:00	Introduction to tools for measuring cost-effectiveness analysis of alternative vector control interventions
12:00–12:30	Discussions
12:30–13:00	Group work on country planned activities and support needed
14:00–15:00	Presentation of country plans
15:30–16:00	Conclusions and recommendations
16:00	Closing session

Annex 2

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Ms Heidi Rizk, Secretary, Division of Communicable Disease Control, WHO/EMRO

Annex 3

SUMMARY OF THE TRAINING WORKSHOP ON COST-EFFECTIVENESS MEASUREMENT OF ALTERNATIVE VECTOR CONTROL INTERVENTIONS TO DDT

The workshop included participants from multiple organizations, including the vector biology and control unit of the WHO Regional Office for the Eastern Mediterranean, programmemanagers of vector control programmes from Egypt, Islamic Republic of Iran, Jordan, Morocco, Sudan, Syrian Arab Republic and Yemen, country representatives for vector control from the WHO from several project countries as well as WHO headquarters, technical experts from Tulane University and the London School of Hygiene and Tropical Medicine (LSHTM) and representatives of the Global Environmental Facility and UNEP. The workshop was led by Dr Joshua Yukich from Tulane University. Participants were taught skills in understanding economic analysis and cost-effectiveness analysis through open discussion, lectures, individual exercises, monitored group work, and joint group methodological exercises. Work and discussion on costing methods and cost-effectiveness measurement was led by Dr Yukich while a session on effectiveness measurement and methods was led by Dr Immo Kleinschmidt from the LSHTM. The final day of the 3-day workshop focused on developing tools for data collection in demonstration activities of the larger GEF supported project, and involved a full group session seeking to define the primary activity content of each of the interventions as well as the inputs necessary for the conduct of each of these activities.

The workshop began with a brief introduction to economics and economic analysis which covered the idea of scarcity as the fundamental concept of economics. In the context of scarcity economic analysis can be used to aid in the process of rational decision making. The main components of economic evaluation are the measurement and valuation of the resource inputs, outputs and outcomes of a project, programme or intervention and such and assessment always includes a comparison of alternatives. Such comparisons are typically conducted to inform decision makers of the most efficient ways of allocating scarce resources to maximize health gains under a budget constraint or to reduce resource usage while still achieving desired health outcomes. Economic analyses of programs fall into three main categories, cost-minimization, cost-effectiveness and cost-benefit analysis. Cost minimization analysis involves only the comparison of the cost of two alternatives which are assumed to have the same outcomes. Cost effectiveness analysis (which also includes cost-utility analysis) involves measurement of both costs and consequences of alternatives which may differ in their effectiveness or utility outcomes. Finally cost–benefit analysis involves not only measurement of costs and consequences, but requires that benefits (consequences) be valued in monetary terms. The introductory presentation covered the basic concepts of perspective and time frame as they are used in economic evaluation.

A session on costing methods followed. The details of common perspectives taken in economic evaluations including societal, provider, patient, and household were covered. Additional more detail on the timeframe of an evaluation was given and how it can affect the conclusions of the comparison based on the differential timing of the accrual of costs and consequences. The concepts of economic (opportunity costs) as opposed to financial costs was covered as well as the concepts of average costs, marginal costs, incremental costs, recurrent capital, fixed and variable cost were covered. The participants were then given information on the concepts and methods used for discounting, annualization, calculation of net present value (NPV), Currency conversion, inflation adjustment, working with price indices, and purchasing power parity. The plenary session was followed by group discussion and practice utilizing the concepts of perspective and time frame applied to examples of vector control intervention economic assessments related to alternative intervention choices in vector control or health generally. Finally individual and group work utilizing cost adjustment methods was undertaken to gain familiarity with both the formula and methods as well as a familiarity with the types of data used in economic evaluations.

Dr Immo Kleinschmidt led a session during day 2 on the measurement and analysis of effectiveness data in intervention trials. The session covered the concepts of the null hypothesis, means, standard deviation, and the calculation of 95% confidence intervals, risk, relative risk, odds, odds ratios and how to calculate confidence intervals around these measures in cross-sectional studies. Then the session proceeded to measurement of effectiveness in cohort studies, where the concept of rate and rate ratio were introduced. Finally the concept of protective effectiveness was introduced as well as the methods of measurement of effectiveness, indirect and direct effects in cluster randomized trials.Finally the workshop participants were led through the calculation of the effectiveness, PE, mortality rates and confidence intervals around these using data from a trial of ITNs conducted in Ghana.

The following section of the workshop illustrated details of cost-effectiveness analysis including the potential types of effect measures which are commonly used in vector control economic evaluations as well as detail on Utility measures with a focus on disability-adjusted life years (DALYs) including brief details on the methods of measurement of health state preferences and life expectancy. The DALY formula was presented. Methods for calculating cost-effectiveness were introduced including the incremental cost-effectiveness ratio and the concept of the cost effectiveness plane. The notion of dominance was covered as well as that of extended dominance in the context of an expansion path for interventions. Finally the concept of sensitivity analysis was covered from one way to scenario analysis and probabilistic sensitivity analysis. The plenary session was followed by a group exercise where participants used economic data from the Ghana bed net trial to calculate the financial costs, economic costs and present value of the intervention, followed by calculation of the ICER for the trial using previously calculated PE. Participants then participated in one and two way sensitivity analysis of this data.

Finally, the workshop concluded with a one day session which began with a brief presentation on planning an economic evaluation which focused on defining the activity content as well as the boundaries of the evaluation, hierarchical, temporal and geographic. The session that followed was conducted as a whole group and completed establishing activity content and specific inputs for both ITN and IRS interventions.

Discussions during the workshop were lengthy and varied, they covered topics including the following.

- Uses of cost effectiveness analysis
- The importance of the inclusion of the full life cycle costs including pesticide disposal in the measurement of IRS and ITN costs
- How to differentiate between research and intervention costs in the demonstration activities
- The level at which costs or resource inputs can be ignored due to small size or difficulty of measurement

The workshop produced the following products.

- Spreadsheet for use in calculation of effectiveness from the trial data resulting from the Ghana bed net trial
- Spreadsheet for calculating the cost and ICER from the Ghana bednet trial
- Presentations covering cost effectiveness analysis, costing methods, effectiveness measurement, and sensitivity analysis, and planning an economic evaluation.
- A rough draft of the tools for data collection in the demonstration sites.
- Next steps include the following.
- Dr Yukich should finalize the first draft of tools for data collection - before end of September 2010
- Draft tools to be circulated to all countries undertaking demonstration activities (Sudan, Iran, Morocco, Syria and Yemen) for comments and adaptation to each demonstration study – September/October 2010
- Dr Yukich to visit each of the four countries with demonstration activities (Sudan, Iran, Syria, Morocco) to finalize adaptation of tools to each country programme and initiate data collection. – before end of June 2011