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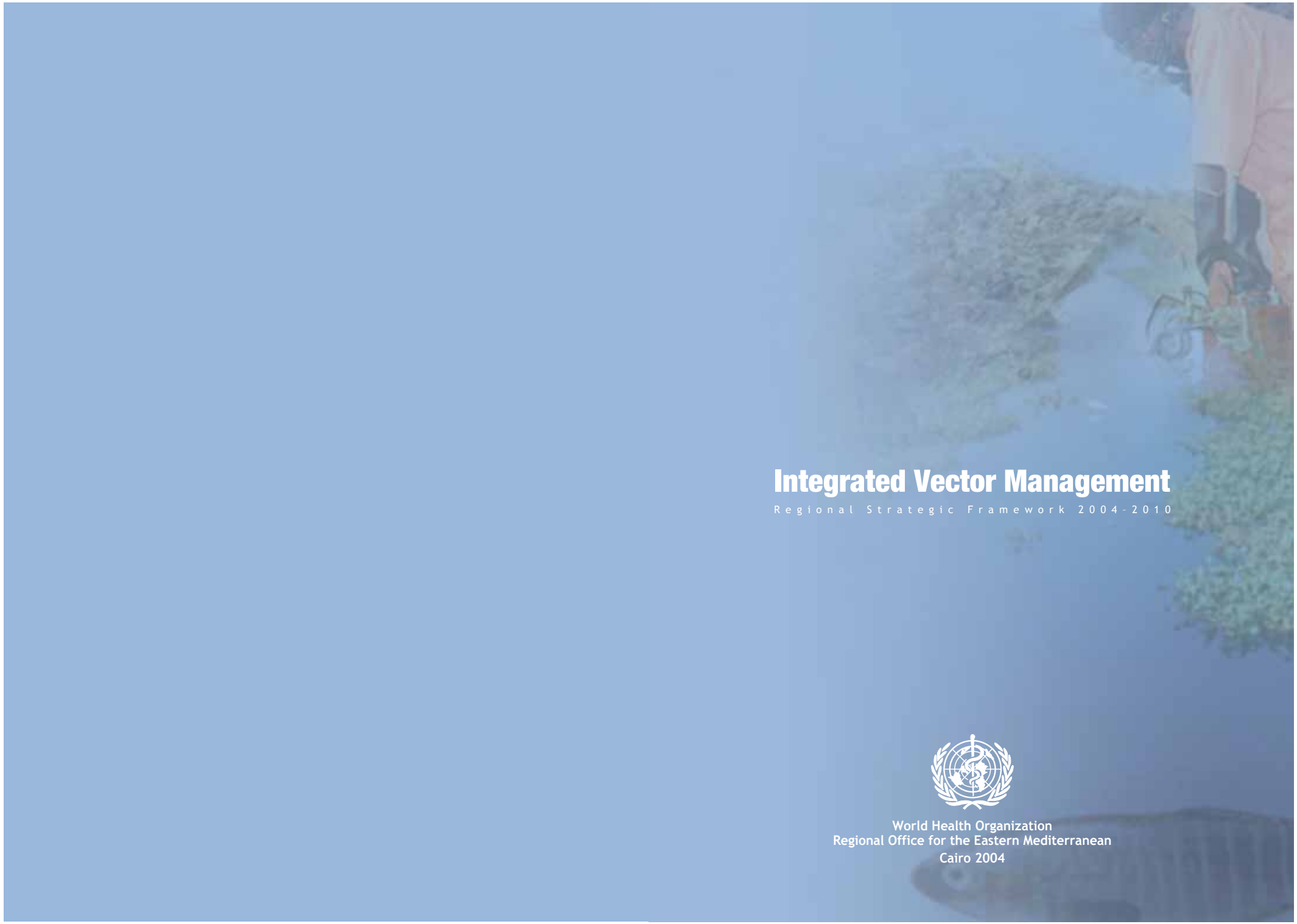
Integrated Vector Management

Strategic Framework for the Eastern Mediterranean Region 2004-2010

World Health Organization
Regional Office for the Eastern Mediterranean



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Regional Strategic Framework 2004-2010

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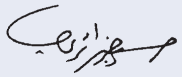
Foreword by the Regional Director

Vector-borne diseases are a significant source of morbidity and mortality in the WHO Eastern Mediterranean Region, which suffers a disproportionate share of the global burden of vector-borne disease. The distribution of such diseases, and their burden, varies greatly within and between the countries of the Region.

The situation is further complicated by the emergence and potential spread of insect-borne arboviruses. The Region has also seen considerable success with vector control programmes, initially developed to target malaria vectors but found also to have an impact on other vector-borne diseases such as leishmaniasis.

In the past such programmes were implemented exclusively through the vertical structures of ministries of health. However, the time has come to take advantage of the potential to target vector-borne diseases through intersectoral action for health. To do this, we must harness the existing high levels of political commitment in countries of the Region to enhance intersectoral collaboration. We also encourage countries to use the available tools to maximize the impact of each intervention with a view to reducing vector-borne disease risks. Since such tools will inevitably include, for the time being, the use of insecticides, the protection of human health and the environment must be our prime concern.

The Regional Strategic Framework for Integrated Vector Management has come at an opportune moment. It provides long-range vision and guidance for planning and undertaking vector control activities in countries of the Eastern Mediterranean Region in the coming years. It once again reflects our continued commitment, and that of our partners, to addressing the control of vector-borne diseases in a sustainable and cost-effective manner.



Hussein A. Gezairy
MD, FRCS

Message from the Director, Communicable Disease Control

The Division of Communicable Disease Control in the WHO Regional Office for the Eastern Mediterranean strongly believes in the best utilization of available resources, interventions and services at all levels of health care delivery. It is for this reason that the Divison is actively promoting integrated disease management as a cornerstone of regional and national strategies to control communicable diseases.

Well-planned and coordinated vector control interventions contribute significantly to reduction of the incidence of vector-borne diseases. Effective vector control methods exist, but their implementation as part of integrated disease management is limited. The potential to use one or several of these interventions to address more than one vector-borne disease exists and should be promoted. There is also a need to scale up some of these interventions in a cost-effective manner. For example, realistic methods must be sought

to finance, distribute and target insecticide-treated bednets (ITNs) equitably in order to ensure high coverage rates for the reduction in the incidence of vector-borne diseases in countries of the Region. Such methods will inevitably have to rely on meaningful public–private partnerships, including untapped community resources.

The process of developing the Regional Strategic Framework for Integrated Vector Management (IVM) involved a series of correspondence with international experts, relevant national representatives and partners. This process was followed by an intercountry meeting in Khartoum, Sudan in January 2003, in which a draft strategy was reviewed and finalized. It is in the same spirit of inclusiveness and openness that countries are expected to make use of this important policy framework to develop national IVM plans of action that reflect existing local situations.

Introduction

Background

Globally, vector-borne diseases are responsible for almost 20% of the estimated burden of infectious diseases affecting humanity, largely due to malaria and other parasitic diseases in developing countries. In the 22 countries of the WHO Eastern Mediterranean Region, vector-borne diseases contribute to over 2% of the total estimated burden of disease. While 8% of the world population lives in the Region (2001), almost 11% of the global burden of vector-borne diseases is found here (Annex 1). Regionally, vector-borne diseases represent about 17% of the burden of all infectious disease and are disproportionately distributed to only a few countries. These countries suffer most from the vector-borne disease burden and its socioeconomic consequences.

As detailed in Annex 1, the most important vector-borne diseases harming human health in the Region are malaria and lymphatic filariasis transmitted by mosquitoes, leishmaniases transmitted by sandflies, schistosomiasis from aquatic snails and diarrhoeal diseases and trachoma transmitted by flies. Also present, but of more limited importance as vector-borne diseases, are trypanosomiasis carried by tsetse flies, onchocerciasis carried by blackflies and several mosquito-borne arboviruses: notably Rift Valley fever, dengue and Crimean–Congo haemorrhagic fever. The potential for spread of West Nile fever and yellow fever in the Region is very high. Other arthropod pests and potential vectors include fleas, ticks, cockroaches and rodents of many species. These pests, vectors and vector-borne diseases are unevenly distributed within the Region and have patchy foci within individual countries. The dynamics of vector populations, the level of transmission risks and the incidence of diseases fluctuate seasonally.

The everyday reality of this widespread burden makes the control of vector-borne disease a key component of health sector activities to protect and promote health. Moreover, due to the complexities of ecology, epidemiology and risks of exposure, these diseases are particularly important targets for intersectoral action for health.

The Eastern Mediterranean Region comprises various zoogeographical zones, Afrotropical, Oriental and Palaearctic (Figure 1). Each of these zones has a specific cluster of dominant vector species. At the margins of their distribution within each zone, vector populations may be less stable and therefore easily controlled by vector control interventions; however, at the core of their distribution area, they are likely to be well-entrenched and will require a more powerful package of interventions to control them to a degree sufficient to have a significant impact on transmission risk. Within each zone, different species will have different ecological requirements. Knowledge of these requirements is fundamental to the development of integrated vector management, which bases itself on an ecosystems approach. An imbalance, caused by extreme weather conditions, floods or drought, or by human actions that change the hydrology or land-use patterns, can lead to explosive increases in vector populations with dire consequences for vector-borne disease transmission risks. Chemical interventions in agro-ecosystems, for example, can have similar adverse impacts. Strategies aimed at reducing disease transmission while maintaining or restoring ecosystem integrity are therefore needed.

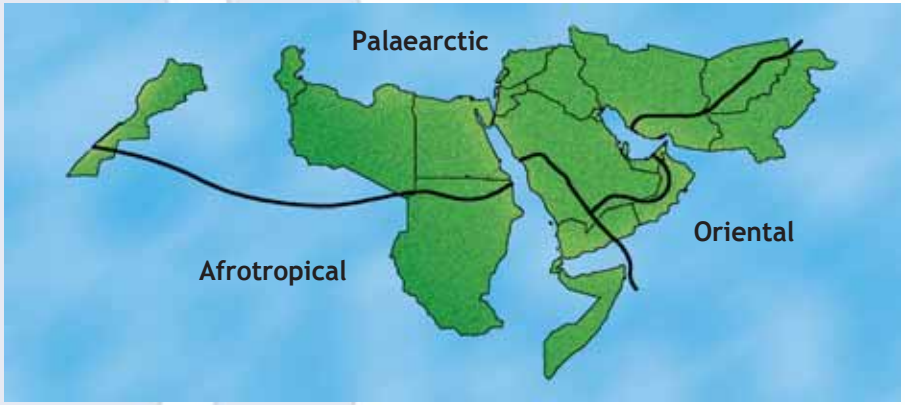


Figure 1. Zoogeographical zones in the Eastern Mediterranean Region

Vector control interventions

Historically the main vector control measures in the majority of countries in the Region have been indoor residual spraying and larval control using insecticides and larvivorous fish. These interventions, combined with environmental management and improved housing, have reduced and eliminated malaria and, incidentally, other vector-borne diseases in most countries.

During the past decade, insecticide-treated nets (ITNs) have been introduced for protection against the transmission of malaria and leishmaniasis. Space spraying is part of the vector control programmes in some countries, but is often over-employed.

Bacterial larvicides are preferred because they specifically control mosquito larvae, whereas chemical larvicides also affect a wider range of non-target organisms. More attention should be given to cost–effectiveness analysis of vector control operations to ensure the most judicious and beneficial application of insecticides and other potential interventions.

One of the problems countries are facing is the limited choice of safe insecticides because of widespread insecticide resistance. In most countries of the Region, resistance has been reported in several vectors, apparently resulting from exposure to agricultural insecticide usage in some cases. More effort is needed to monitor the extent and effects of insecticide resistance using the latest methods and criteria.

For vector control programmes, guidance is needed for countries to show how, what, when, and where, each precaution and intervention should be selected and used; especially the synergies that may be derived from combining several methods. Merging different control programmes is a priority so that more than one vector-borne disease can be jointly targeted where the vectors occur together and have similar behaviour or ecology (Annex 1). The strategic framework for integrated vector management has been developed to provide the necessary guidance to countries.

Reasons for employing integrated vector management

The key reason for employing an IVM strategy is to strengthen impact through complementary methods of vector control with operational flexibility, while respecting ecosystem integrity. Ideally IVM should reduce vectorial capacity (Annex 2) to the point of preventing transmission risks. IVM programmes usually involve:

- carrying out a sound ecosystem and eco-epidemiological analysis to reveal the critical points in disease transmission that can be targeted for maximum impact on disease interruption;
- designing a series of incremental interventions, whereby each additional intervention yields maximum health gains at the least additional cost;
- coordinating and re-focusing pre-existing resources for IVM against multiple vectors, through both intersectoral and intrasectoral cooperation to maximize benefits and cost-efficient use of available resources;
- using alternate and/or multiple interventions, so as to reduce dependence on the use of pesticides;
- achieving sustainable long-term prevention of vector-borne diseases at minimal cost.

In the short term, IVM should multiply the impact of individual interventions to achieve critical reduction of risks. This may mean that the resources required for IVM are greater than for any single intervention, but if properly implemented the effectiveness of interrupting transmission through IVM will be proportionally greater than the increase in overall costs.

In the long term, IVM should also help to prevent and overcome costly setbacks, such as those that may arise due to changes of vector behaviour or development of insecticide resistance.

Justification and guiding principles

Institutional justification

In 1989, the World Health Assembly issued resolution WHA 42.31, which urged Member States to reinforce capacity so that effective vector control measures are taken for the control of disease vectors, and to develop and maintain adequate human resources for this purpose. The Director-General is requested to ensure that input in the development of safe and effective methods for the control of disease vectors continues to be based on sound ecological considerations, in accordance with the principles of sustainable development.

Resolution WHA 50.13 (1997) called upon Member States take steps to reduce reliance on insecticides for control of vector-borne diseases through promotion of integrated pest management approaches. It also called upon them to ensure that the use of dichlorodiphenyltrichloroethane (DDT) is authorized by governments for public health purposes only, and that such use is limited to government-authorized programmes that take an integrated approach.

During an informal consultation on the integrated approach to control communicable diseases in 2002, the Division of Communicable Diseases in the Regional Office for the Eastern Mediterranean Regional adopted IVM as one of its strategies to control communicable diseases.

Technical justification

Well-planned and coordinated vector control interventions can help reduce the incidence and burden of vector-borne disease. Although effective vector control methods exist, in the past they have only addressed one disease at a time, so that their implementation as part of integrated disease management packages has been limited.

In many countries, decentralization is providing opportunities for vector control with community participation, using focal persons at the community level and outreach services to implement IVM. Limited financial resources of vector-borne disease control programmes and the limited number of safe, cost-effective pesticides require selective and careful application of pesticides within integrated vector management.

The IVM approach builds on the concept of selective vector control with the targeted use of different vector control methods, alone or in combination, to prevent or reduce human–vector contact. In addition, IVM should be cost-effective and sustainable, involve intersectoral cooperation and have no adverse side effects for people or the environment.

Guiding principles for the development and implementation of IVM interventions

- IVM is an essential element of vector-borne disease control.
- IVM should be economically feasible, cost-effective, sustainable, environmentally sound and socially acceptable.
- Vector control interventions are components of integrated vector-borne disease control programmes, which are in line with national health sector reform.
- Wherever and whenever possible, vector control interventions should be planned for multiple vector-borne disease prevention and control.
- Incentives and regulatory or institutional arrangements need to be designed and employed to ensure effective intersectoral collaboration.
- Programme management can be optimized by enabling decision-making at local levels. This should be considered in the context of health sector decentralization and the need for active community participation.

Objectives of the strategic framework

The general objective of the strategic framework for IVM is to provide countries of the Region with guidance on the optimal use of resources (financial, human and technical, including insecticides) for IVM programmes. Using the strategic framework, each country is expected to prepare, adopt and implement a national plan of action for IVM by 2004.

Specific objectives of the framework are to:

- promote regional implementation of IVM principles
- promote efficient allocation of resources to vector control
- foster strengthening of the capacity for IVM
- promote the use of non-chemical vector control interventions and appropriate management of pesticides
- promote integrated disease control
- promote intersectoral and intrasectoral collaboration and partnership, including community participation.

The aim is for all countries of the Region to adopt and implement well integrated and cost-effective programmes for vector management and control in order to prevent, reduce or interrupt transmission of vector-borne diseases and prevent the re-establishment of local transmission.

Priority actions for implementation of integrated vector management

- Incorporating IVM principles into national health policies.
- Strengthening vector control capability within the national health system.
- Establishing or strengthening national capacity to implement IVM, including providing training, promoting career opportunities, enhancing collaboration, guiding re-orientation of vector control activities and ensuring availability of skilled staff.
- Engaging in advocacy to ensure political commitment for IVM as an important component of communicable disease control (CDC), and developing policies and legislation to increase community participation, empowerment and mobilization of human and financial resources.
- Promoting intersectoral and intrasectoral cooperation to optimize allocation of resources within the health sector (e.g. environmental health and different vector-borne disease programmes) and intersectoral collaboration between different government sectors, (especially agriculture, environment and local government/municipalities) supported by appropriate policies, legislation and impact assessment.
- Establishing partnerships to mobilize public and private sectors, together with civil society, nongovernmental organizations and donors, to optimize allocation of resources and ensure effective implementation of IVM.
- Monitoring and evaluating ongoing vector control activities by employing entomological surveillance and conducting operational research, including post-registration monitoring of pesticide use.

Targets for implementation of integrated vector management

Role of Member States

Depending on the situation in each country, effective implementation of IVM will require the establishment, strengthening or re-organization of vector control services to facilitate multidisciplinary and intersectoral collaboration. The first step for all countries is implementation of a comprehensive needs assessment, to be used as a basis for fulfilling the following targets:

- Identification of the technical, human and financial resources or deficiencies for the implementation of IVM activities.
- Development of a proposal for the establishment of IVM services within the existing framework of national health policies and health systems, and reaching an agreement with relevant authorities.
- Establishment or strengthening of a structure for the planning, implementation, monitoring and evaluation of an IVM programme. A core group will guide, support and when necessary, participate in IVM activities.
- Development of national guidelines for the planning, implementation, monitoring and evaluation of IVM activities.
- Establishment of mechanisms to ensure intersectoral and intrasectoral collaboration, public–private partnership, cross-border coordination and community participation.
- Planning and carrying out of operational research for evidence-based IVM interventions.

Role of WHO

To assist countries in fulfilling the targets listed above, WHO will:

1. Finalize and disseminate the draft regional strategic framework among Member States for comments and suggestions (by June 2003).
2. Obtain endorsement of the regional strategic framework from the Regional Committee for the Eastern Mediterranean in 2003.
3. Prepare and disseminate technical guidelines for conducting the situation analysis and needs assessment of IVM activities (by the end of 2003).
4. Develop and disseminate technical guidelines for the planning, implementation, monitoring and evaluation of vector control interventions based on integrated vector management for communicable disease control (2004).
5. Provide the necessary technical support for Member States to conduct situation analyses, needs assessment, planning, implementation, monitoring and evaluation of vector control interventions based on the IVM approach.

Annex 1

Regional distribution and burden of vector-borne diseases

Regional distribution of vector-borne diseases

Major vector-borne diseases

Malaria

Caused by human infection with *Plasmodium falciparum* and *P. vivax*. Anopheline mosquito vectors of malaria are present in all 22 countries of the Region. Even so, malaria transmission has been effectively interrupted in 9 countries (Bahrain, Egypt, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Tunisia, United Arab Emirates). Active malaria transmission continues in at least the following countries: Afghanistan, Islamic Republic of Iran and Pakistan due to transmission mainly by *Anopheles culicifacies* and *An. stephensi*; Djibouti, Saudi Arabia, Somalia, Sudan and the Republic of Yemen due to transmission mainly by *An. arabiensis*; Iraq and the Syrian Arab Republic due to transmission by *An. sacharovi* and other vectors. Due to the widespread prevalence of competent vectors, most parts of the Region remain vulnerable and receptive to malaria. Irrigation schemes and other water resources projects provide conditions for malaria in what is otherwise a semi-arid to arid region and therefore become foci of intense transmission.

Leishmaniasis

Caused by *Leishmania* protozoa transmitted by phlebotomine sandflies. Three forms of leishmaniasis affect this Region, namely: visceral (VL due to *L. donovani* in Sudan and widespread *L. infantum*), zoonotic cutaneous (ZCL due to *L. major*) and anthroponotic cutaneous (ACL due to *L. tropica*). These diseases have focal distribution in the Islamic Republic of Iran, Iraq, Sudan, Syrian Arab Republic and Tunisia and cause important public health problems in Afghanistan and Pakistan. Leishmaniasis is a lesser problem in Djibouti, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Oman, Saudi Arabia, Somalia and the Republic of Yemen. There are more than 20 vector species of *Phlebotomus* in the Region, with obscure breeding sites. The most widespread and important are *P. papatasi* as vector of *L. major*; *P. sergenti* as vector of *L. tropica*; *P. perniciosus* as vector of *L. infantum* and *P. orientalis* as vector of *L. donovani*.

Lymphatic filariasis

Caused by the nematode *Wuchereria bancrofti* transmitted by mosquitoes. Extreme symptoms are known as elephantiasis. As transmission of the microfilariae requires high humidity, distribution is limited by the generally arid climate of the Region. Foci include the Nile delta of Egypt and probably the Republic of Yemen. Transmission is by mosquitoes of the *Culex pipiens* complex. Lymphatic filariasis across southern Sudan is transmitted by anopheline mosquito vectors, as for malaria. There is a potential risk that expanding practices of wastewater re-use for agriculture may lead to the increased propagation of *Culex* vectors and an intensification of transmission of the disease.

Schistosomiasis

Caused by trematode worms. *Schistosoma haematobium* causes urinary bilharzia and *S. mansoni* causes intestinal bilharzia. The latter occurs in Egypt, Oman, Saudi Arabia, Sudan,

Republic of Yemen, whereas *S. haematobium* is more widespread across North Africa and the Arabian peninsula. Intermediate hosts are aquatic snails of the genus *Bulinus* for *S. haematobium* and *Biomphalaria* for *S. mansoni* living in marshes and irrigation systems where infection is acquired when people bathe or work in infested waters.

Trachoma
Caused by *Chlamydia trachomatis* bacterial infection of the eyes, transmitted mostly by flies *Musca sorbens*. This occurs in most countries of the Region, but has been poorly mapped.

Vector-borne diseases of lesser or more local importance

Onchocerciasis (river blindness)
Caused by the filarial nematode *Onchocerca volvulus*, transmitted by blackflies of the *Simulium damnosum* group that breed in fast-flowing waterways. Largely a disease of tropical Africa, two countries of the Region have endemic onchocerciasis. The Republic of Yemen harbours small foci in a few highland valleys, while Sudan has foci along several river systems.

Loiasis (Calabar swelling)
Caused by the filarial nematode *Loa loa*, transmitted by *Chrysops* flies breeding in muddy areas. The disease is associated with rainforests of tropical Africa and endemic across southern Sudan.

Guinea-worm (dracunculiasis)
Caused by nematode *Dracunculus medinensi*. Ingested with drinking water via the intermediate copepod hosts (*Cyclops*). It was formerly endemic across Africa and Asia, but is now limited to foci in several tropical African countries, mostly in Sudan.

Trypanosomiasis (sleeping sickness)
Caused by trypanosomes transmitted by tsetse flies (*Glossina*). Also mostly a disease of tropical Africa, transmission extends across southern Sudan. Due to the economic importance of trypanosomiasis affecting livestock, a continent-wide campaign is taking shape: the Pan African Tsetse and Trypanosomiasis Eradication Campaign.

Borrelioses
Due to spirochetes transmitted by several types of ectoparasites: body lice (*Pediculus humanus*) vectors of *Borrelia duttoni* causing louse-borne relapsing fever (LBRF); soft ticks (*Ornithodoros*) vectors of *Borrelia recurrentis* causing tick-borne relapsing fever (TBRF); hard ticks (*Ixodidae*) carrying *Borrelia burgdorferi* causing Lyme disease. While these arthropods and infections are probably widespread, little recent information is available on their distributions in each country.

Scrub typhus
Caused by the zoonotic bacterium *Rickettsia tsutsugamushi* transmitted by trombiculid mites, is zoonotic across South-east Asia. In Pakistan the vector is *Leptotrombidium deliae*.

Diarrhoeal diseases
Caused by enteric bacteria (e.g. *E. coli* O157, *Salmonella, Shigella*) and viruses are partly transmitted by houseflies, blowflies, face-flies and cockroaches, widespread throughout the Region. The main transmission pathway is via direct faecal–oral transmission.

Plague
Caused by *Yersinia pestis* bacteria transmitted by *Xenopsylla* fleas. Scattered foci of enzootic plague exist across the Region, with human cases of zoonotic origin recorded occasionally in Iraq, Islamic Republic of Iran, Libyan Arab Jamahiriya, Morocco, Saudi Arabia and Tunisia.

Typhus
Caused by zoonotic bacteria of three types: louse-borne *Rickettsia prowazeki* causing classical typhus, transmitted by *Pediculus humanus*; flea-borne *Rickettsia typhi* causing murine typhus, transmitted by various species of fleas; tick-borne *R. conori* causing boutonneuse fever transmitted by *Haemaphysalis* ticks.

Arboviruses transmitted by mosquitoes

Arboviruses (arthropod-borne viruses) of many types are widespread zoonoses, mostly transmitted by quite specific vectors. Sporadic outbreaks are difficult to foresee and usually pass quickly, for ecological and epidemiological reasons. Some cause serious public health problems if the epidemic is not contained.

Dengue
Causes dengue fever with mild transient symptoms, sometimes progressing to dengue haemorrhagic fever or dengue shock syndrome. No dengue vaccine is available. Dengue viruses are transmitted by *Aedes* (*Stegomyia*) *aegypti*, which is very anthropophilic and breeds in domestic water containers. Another vector spreading around the Mediterranean is *Aedes (Stegomyia) albopictus*, raising the likelihood of dengue outbreaks. Recurrent major epidemics of dengue occur across tropical Asia and the Americas, but so far dengue remains uncommon in the Eastern Mediterranean Region. Cases of dengue have been reported from Pakistan, Saudi Arabia, Somalia and Sudan and recently from Djibouti and the Republic of Yemen.

Japanese encephalitis
Transmitted by many types of mosquitoes, especially *Culex* spp. breeding in irrigated rice fields. Japanese encephalitis virus is disseminated by egrets and other birds associated with irrigation and marshland. Amplifier hosts include domestic livestock, especially pigs. Fortunately Japanese encephalitis vaccines are available: children and pigs are routinely vaccinated in some countries. Cases have been reported in the Indus valley of Pakistan and suspected in Afghanistan, but the incidence remains unclear in the Eastern Mediterranean Region. As the principal vector *Culex tritaeniorhynchus* is widespread from Southeast Asia to West Africa, further spread of Japanese encephalitis across the Region is a real possibility.

Rift Valley fever
Transmitted mostly by various *Culex* spp. during epidemics and carried through dry seasons in dormant eggs of *Aedes* mosquitoes (vertical transovarial transmission) from which the resultant females become infective and transmit to amplifier hosts at the start of the next rainy season. No vaccine is available. Serious outbreaks have occurred recently in Somalia, Saudi Arabia and the Republic of Yemen, causing large-scale mortality of livestock and some human deaths.

West Nile fever
Transmitted by many types of mosquitoes, mostly *Culex* spp. West Nile is disseminated by birds, which often die. Amplifier hosts include horses that often die. Human symptoms vary from mild fever to serious complications with significant mortality rate. No vaccine is available. West Nile outbreaks occur frequently around the Mediterranean but none of the countries of the Region have officially reported cases. The potential for outbreaks exists in Egypt, Jordan, Morocco, Palestine and Tunisia.

Yellow fever
Causes very severe fever and jaundice with a high mortality rate. In tropical Africa, the sylvatic cycle of yellow fever involves monkeys and various aedine mosquito vectors, with *Aedes simpsoni* and other link vectors to villages. Urban epidemics are vectored by *Aedes aegypti* with human-to-human transmission, as for dengue. Vaccination is very effective and compulsory for international travellers from countries such as Sudan and Somalia that lie in the infection zone of yellow fever.

Arboviruses transmitted by other arthropods in the Region

Crimean–Congo haemorrhagic fever
Transmitted by ixodid ticks (mainly *Hyalomma*) and carried by livestock (goats and sheep). It has spread to Afghanistan, Islamic Republic of Iran, Iraq and Pakistan. Cases are reported annually with localized outbreaks from these countries.

Sandfly fever
Causes mild symptoms in humans due to zoonotic phlebovirus and is carried by rodents and transmitted by various phlebotomine sandflies. It is widespread in most countries of the Region.

Other potential vectors occurring in most, probably all, countries of the Region include biting midges (*Culicoides, Leptoconops*), stable flies (*Stomoxys*), horseflies (*Tabanidae*) and hard ticks (*Ixodidae*), which occasionally transmit the bacterium *Francisella tularensis* causing tularaemia. Larvae of some larger flies (e.g. *Chrysomya*, *Lucilia*, *Wohlfahrtia*) cause myiasis when they invade human flesh (by burrowing) or intestines (by ingestion). Despite much speculation and conjecture, all evidence indicates that blood-sucking insects cannot transmit HIV/AIDS. Conversely, there is some experimental evidence for transmission of hepatitis B virus by bedbugs (*Cimex*), although epidemiological evidence indicates no significant role of bedbugs as vectors of any infection.

Rodents are carriers of haemorrhagic fever viruses, poorly known in this Region, and other zoonotic infections such as leptospirosis and those mentioned above, i.e. Lyme disease, typhus and plague.

Extensive and largely successful vector control programmes have influenced the distribution patterns and prevalence of vectors and vector-borne diseases for many years during the past century. Although mainly targeted at malaria, these interventions have also affected other pests and vectors.

Burden of vector-borne diseases in the Eastern Mediterranean Region

Ten vector-borne diseases are sufficiently prevalent in the Region to be listed in *The world health report 2002* as significant contributors to the burden of disease (Table 1).

Table 1. Estimated disability-adjusted life-years (DALYs) lost in 2001 in countries of the Eastern Mediterranean Region due to infections from selected vector-borne diseases

Vector-borne disease	Burden in DALYs*	Endemic	Epidemic-prone	Non-endemic
Diarrhoeal diseases**	10 784 000	All	All	0
Malaria	2 050 000	Afghanistan, Djibouti, Somalia, Sudan, Republic of Yemen	All	17 countries
Trachoma	602 000	Afghanistan, Djibouti, Egypt, Iraq, Islamic Republic of Iran, Libyan Arab Jamahiriya, Morocco, Oman, Pakistan, Somalia, Sudan, United Arab Emirates, Republic of Yemen	–	Bahrain, Jordan, Kuwait, Lebanon, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia
Lymphatic filariasis	489 000	Egypt, Sudan, Republic of Yemen	–	19 countries
Leishmaniasis	278 000	17 countries	Afghanistan, Pakistan, Sudan	Bahrain, Djibouti, Kuwait, Qatar, United Arab Emirates
Schistosomiasis	202 000	Egypt, Iraq, Morocco, Saudi Arabia, Somalia, Sudan, Republic of Yemen	Jordan, Libyan Arab Jamahiriya, Oman, Syrian Arab Republic	Afghanistan, Bahrain, Djibouti, Islamic Republic of Iran, Kuwait, Pakistan, Palestine, Qatar, Tunisia, United Arab Emirates
Dengue	85 000	Djibouti, Pakistan	Republic of Yemen	19 countries
Japanese encephalitis	81 000	–	Afghanistan, Pakistan	20 countries
Onchocerciasis	46 000	Sudan, Republic of Yemen	–	20 countries
Trypanosomiasis	40 000	Sudan	–	21 countries

Top 10 vector-borne diseases are responsible for 14 657 000 DALYs regionally = 11% of DALYs attributed to vector-borne diseases globally = 17% of DALYs attributed to communicable diseases regionally
**Enteric infections causing diarrhoeal diseases are only partly transmitted by vectors, being more often acquired directly from faecal/oral route or via contaminated water and foodstuff
*Source: *World health report 2002*

Annex 2

Terminology and definitions

General terms

Disability-adjusted life years (DALYs)
One DALY can be thought of as one lost year of "healthy" life. DALYs are calculated as the sum of the years of life lost due to premature mortality (YLL) in the population, and the years lost due to disability (YLD) for incident cases of the health condition

Framework
Circumstances surrounding and possibly affecting policies, strategies, programmes

Integration
An approach to overcome fragmentation in policies and programmes, in order to maximize benefits from synergies and economies of scale, and exclude inefficiencies resulting from redundancies and overlap

Integrated vector management (IVM)
A process of evidence-based decision-making procedures aimed to plan, deliver, monitor and evaluate targeted, cost-effective and sustainable combinations of regulatory and operational vector control measures, with a measurable impact on transmission risks, adhering to the principles of subsidiarity, intersectorality and partnership

Intersectoral
Involving two or more sectors, e.g. health and agriculture; public health and military

Intrasectoral
Involving two or more sub-sectors of the same sector, e.g. IEC and IVM; malaria and leishmaniasis; diagnostic and preventive

Management
An orderly and replicable approach to tackling challenges and solving problems

Plan
Defined course of action

Policy
A set of decision-making criteria and procedures to achieve an agreed development goal

Programme
An agreed course of action within the framework provided by the policies

Project
A self-contained building block or module of activities, one unit of a programme

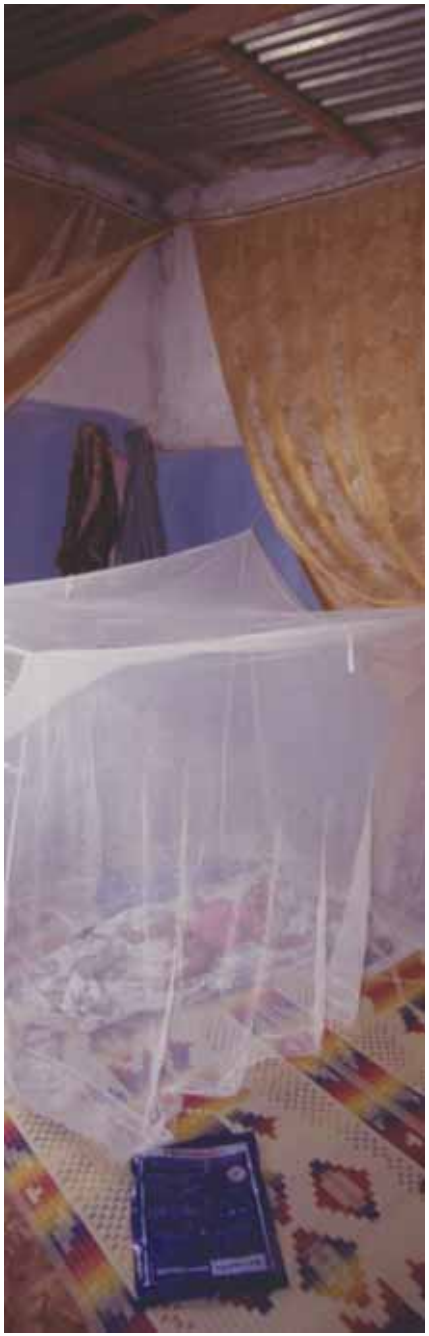
Receptive
Situation (e.g. country) where a particular disease is not currently transmitted, but where conditions are suitable for its transmission (e.g. susceptible hosts and, for vector-borne diseases, competent vectors with adequate vectorial capacity) if introduced

Strategy
The optimal allocation of (limited) financial, human and technical resources to support the most efficient process of achieving the goal

Subsidiarity
The concept of optimizing programme implementation by ensuring decision-making at the lowest possible level in the political or administrative hierarchy

Vulnerable
Situation where infection and/or vectors are likely to be introduced.

Vector
Carrier and transmitter of infection
Vector competence: biological and/or mechanical ability to transmit infection



Potential vector
Species that is competent to transmit infection, but apparently not currently involved

Vector control
Interventions targeting vectors to reduce their vectorial capacity

Vectorial capacity
Mathematical expression to measure vector efficiency, used to assess risk and impact of interventions. Vectorial capacity (C) is expressed as: $C = ma^2p^n/-log_e p$ where:

m = density of vectors in relation to man
a = number of blood meals taken on man per vector per day
p = proportion of vectors surviving per day
n = incubation period in the vector (days) – 8 days

when they survive $(1/-log_e p)$ days. Theoretically, incidence of infection rises when C>1, incidence falls when C<1

Indicators of vector control interventions

Impact indicator
A measurement of the immediate effect of an intervention in achieving its immediate objective (e.g. number of breeding places eliminated)

Outcome indicator
A measurement of the effect in relation to achieving the final goal (e.g. EIP or disease morbidity)

Process indicator
A measurement of the correct implementation of a sequence of essential actions

Economic evaluation

Cost–effectiveness analysis
A comparative economic evaluation which offsets the costs of alternative actions against their effectiveness using agreed effectiveness indicators common to all interventions

Cost–benefit analysis
A comparative economic evaluation which offsets the costs of alternative actions against their benefits, expressed in monetary terms

Cost–utility analysis
A comparative economic evaluation which offsets the costs of alternative actions against their utility as expressed in composite indicators that include a weighting for certain social and demographic factors and take into consideration certain externalities (such as DALYs)