

6. Disease Vector Control

Diseases transmitted by mosquitoes, flies, fleas, lice, ticks, mites, snails and rodents are among the major causes of illness in many refugee settings. The control of disease vectors is an essential activity to protect the population and reduce the impact of vector related diseases.

INTRODUCTION.....	272
The importance of disease vector control in refugee settings.....	272
Vector control as part of a comprehensive public health approach.....	272
The importance of seeking expert professional advice	272
The importance of respecting UNHCR's WASH philosophy and principles	274
PRIORITY ACTIONS	274
An immediate response.....	274
Refugee site selection that limits exposure to disease vectors.....	274
Immediate solid waste interventions	274
Immediate dissemination of disease vector control messages	275
Immediate distribution of basic vector control items.....	275
Disease vector assessments	276
A comprehensive approach	276
Chemical control safety	276
Coordination with local authorities	278
Linkages with behaviour change programming	278
Coordination with the Community Health Programme.	278
CONTROL OF DISEASE VECTORS IN REFUGEE SETTINGS	278
Control of mosquitoes in refugee settings.....	278
Control of flies in refugee settings.....	282
Control of bedbugs in refugee settings	284
Control of fleas in refugee settings	286
Control of lice in refugee settings	288
Control of mites in refugee settings.....	292
Control of rodents in refugee settings	292

Introduction

The importance of disease vector control in refugee settings

1. UNHCR and WASH actors must ensure that the environment inhabited by refugee populations is free from high-risk disease vectors. This is regardless of whether the refugee population are living in camps, collective centres, spontaneous unplanned camps, with host families, in rented accommodation, or they are occupying land or buildings. Inappropriately managed waste can attract rodents and insects that harbour and spread pathogenic organisms. Poorly maintained latrines can provide a breeding site for flies and stagnant water can provide a breeding site for mosquitoes. The presence of disease vectors of public health risk importance is a critical factor when evaluating a site for the settlement of refugees. The psychological benefits of proper disease vector control should not be underestimated. The control of disease vectors of public health importance is an important contribution to lifting the morale of a refugee population.

Vector control as part of a comprehensive public health approach

2. Disease vector control interventions should be planned as part of the larger preventative health strategy for the refugee population. Messages concerning the importance of an environment free from domestic wastes and stagnant water, the importance of proper latrine construction, and the

importance of personal protective measures, must be incorporated into the community health and education programmes. The link between breeding sites, disease vectors, and disease must be clearly understood by all.

The importance of seeking expert professional advice

3. UNHCR and WASH actors should ensure that the advice of an entomologist/environmental disease vector control specialist has been sought when designing a vector control programme. The specialist is essential to help:
 - i). Identify the vectors responsible for local transmission of disease,
 - ii). Determine the factors that influence transmission,
 - iii). Locate breeding grounds, and adult resting habits,
 - iv). Decide which control measures need to be implemented,
 - v). Decide which specific chemical control measures to use,
 - vi). Decide which chemicals to use,
 - vii). Decide the method and interval of application,
 - viii). Decide the time and place of application,
 - ix). Decide the safety precautions necessary in the storage and use of hazardous chemicals.
4. Disease vector control expertise may be available locally from sources such as government departments, the UN system, NGOs, universities, or private consultants. If these cannot meet the need, UNHCR Headquarters assistance should be requested.



The importance of respecting UNHCR's WASH philosophy and principles

5. In addition to the guidance in this chapter, all disease vector control programmes must be designed and carried out in full accordance with UNHCR's general WASH principles including (please click the links below or consult the relevant section in Chapter 2 for more information).

- ◆ Safety and protection
- ◆ A timely and adequate response
- ◆ Participation of stakeholders
- ◆ Universal access
- ◆ Child friendly facilities
- ◆ Designs and construction that meet minimum quality standards
- ◆ Value for money and cost effectiveness
- ◆ Appropriate technology selection
- ◆ Durable solutions
- ◆ Reinforcing the capacity of stakeholders
- ◆ Monitoring the effectiveness of WASH interventions
- ◆ Protecting the environment
- ◆ Planning for contingencies

Priority actions

An immediate response

6. UNHCR and WASH actors must ensure that high-risk disease vector populations are immediately controlled from the outset of a displacement emergency. The speed at which disease vector control programmes are established must be given the same emphasis as provision of safe water supply and sanitation. The provision of basic disease vector control

interventions for example cleaning up festering piles of wastes to reduce fly populations, or improving drainage around water points, are better than delayed provision of improved systems. A risk based approach should be used to prioritise the highest-risk disease vectors first. The presence of vectors does not necessarily imply a public health risk.

Refugee site selection that limits exposure to disease vectors

7. UNHCR and WASH actors must ensure wherever possible that any site selected for the settlement of refugees is free from large numbers of disease vectors. Local knowledge must be sought in all cases and sites within 5km of large bodies of water or marshland must be avoided if possible. While this is an ideal, the selection of sites for refugees is often highly political and very often refugees are often forced to settle on marginal sites that may be at high risk from disease vectors. It is for these reasons that disease vector control programming must be initiated from the start of the emergency.

Immediate solid waste interventions

8. UNHCR and WASH actors must ensure that any dumps of domestic waste, food waste, faeces, or any other potential breeding sites for high risk disease vectors are immediately cleaned up (see [section 5.9](#)). All domestic, market and commercial waste must be collected at least twice a week, or more frequently if required. All wastes at landfill sites must be completely covered every day with at least 10-20cm of soil. Within communal areas the refugees

should be mobilized to keep their living areas free from wastes. Within public areas, a system of employed "street sweepers" may need to be established. The cleanliness of public areas, waste collection points, and toilets should be routinely monitored through the use of observation walks and sanitary surveys.



Figure 6-1 Overflowing solid waste

Immediate dissemination of disease vector control messages

9. UNHCR and WASH actors should ensure that the displaced population has the knowledge to protect themselves from high-risk disease vectors on immediate arrival and consistently throughout the displacement emergency. The messages should ideally be in their own native dialect, and should target the most critical high-risk disease vectors for the context. Messages should raise awareness of the risks and should explain methods to protect the household, and reduce the vector populations. A disease vector communication plan describing WHO, WHAT, WHY, WHEN and HOW in addition to an analysis of seasonal disease vector risks should be included in the site WASH plan/strategy.

Immediate distribution of basic vector control items

10. UNHCR should ensure that all families within the displaced are provided with essential household vector control items on immediate arrival in the displaced setting based on an assessment of disease vector related risks. Distributions of any basic vector control items (for example mosquito nets) must be accompanied with an explanation concerning why the item is important and how to use it safely and effectively. UNHCR should also ensure the population has sufficient quantities of soap, laundry and bathing supplies, to facilitate good personal hygiene and reduce bedbug, flea and body lice populations. Tracking of the coverage of basic vector control items should be included in the site WASH plan/strategy. Post distribution monitoring should be carried out after every distribution of supplies used for disease vector control. This is not only to ensure that the items actually reach their intended beneficiaries but also to ensure that supplies are appropriate for the context and are being used as intended.

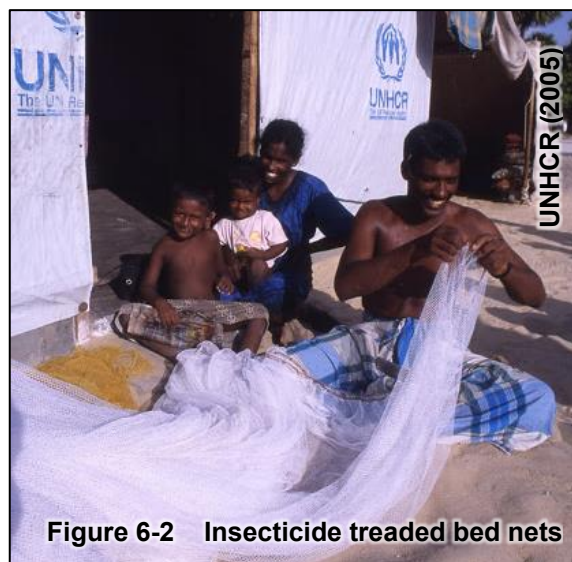


Figure 6-2 Insecticide treated bed nets

Disease vector assessments

11. A rapid assessment of disease vector related risks should be carried out within the first few days of any refugee emergency. This is best achieved using a combination of observation walks, key informant interviews and focus group discussions. Following the rapid assessment a prioritised disease vector control action plan should be developed that includes short, medium and long term strategies to reduce and control key disease vector populations. The disease vector risk assessment should be analysed using a seasonal analytical framework taking into account future risks not just those that are currently present. Mosquito and fly populations in particular are closely linked to seasonal rain, temperature and harvest seasons (particular the fruit season in the case of flies).
12. Copies of the disease vector risk assessment, action plan, disease vector seasonal calendar, and short, medium and long-term strategies for reducing disease vectors should be included in the site WASH plan. The vector control strategy should clearly describe the priority at-risk groups, the targeted disease vectors, the key interventions (in terms of WHO, WHAT, WHERE, WHEN, HOW and WHY) and any indicators to be monitored. The vector control strategic plan should be prepared within the first three months of the displacement emergency and should be revised every six months based on feedback from monitoring mechanisms.

A comprehensive approach

13. UNHCR and WASH actors should plan disease vector control programmes using a complementary balance of environmental control measures, chemical control measures, barrier control measures, breeding site management, traps and behavioural change activities. Programmes that rely on one or two methods alone are highly likely to fail and all other methods must be prioritized before resorting to chemical control measures which are costly and run the risk of increasing chemical resilience. The short, medium and long term strategies for a disease vector control comprehensive approach should be clearly described within the site WASH plan/strategy.

Chemical control safety

14. UNHCR and WASH actors should ensure that any chemical control measures are implemented following expert supervision using only internationally approved vector control chemicals and following internationally approved application protocols. Care must be taken during the transportation, storage, application and disposal of vector control chemicals to ensure there are no risks to refugees, staff, or the environment. UNHCR and WASH actors must ensure that all staff involved in disease vector chemical control application programmes have adequate personal protective equipment and safety training for the tasks they are carrying out. A chemical safety and impact assessment must be included in the site WASH plan/strategy.



Coordination with local authorities

15. In many settings, it is likely that the local health Authorities will have ongoing seasonally planned disease vector control activities planned for the local host population. UNHCR and WASH actors should ensure that any disease vector control programmes planned for the refugees are well coordinated with the local relevant Authorities and that any chemicals, protocols and approaches are locally approved. In some cases it may be possible for qualified National Authorities to expand ongoing disease vector control activities to the refugee setting. National Authorities may have access to expert entomologist /disease vector control specialist that can help with the programme design. Details of joint planning with local authorities should be updated in the site WASH plan/strategy.

Linkages with behaviour change programming

16. UNHCR and WASH actors should not assume that if people are provided with knowledge and resources to avoid disease vector risks this will automatically translate into good practice. Factors related to changing attitudes to disease vectors can be varied and complex and in all settings UNHCR and WASH actors should take time to fully investigate what stops people from protecting themselves against disease vectors and what makes it easier and more convenient. Copies of focus group discussions related to disease vector practises should be included in the site WASH plan/strategy.

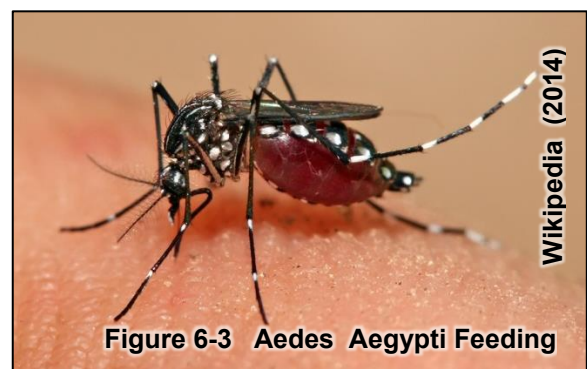
Coordination with the Community Health Programme.

17. UNHCR and WASH actors should ensure that any disease vector related behaviour change activities are organized in full collaboration with the Community Health Programme. It is important that activities not only deliver key disease vector related information but also incorporate messages related to health seeking behaviour and curative health.

Control of disease vectors in refugee settings

Control of mosquitoes in refugee settings

18. The most important mosquitoes in terms of disease transmission in refugee settings include Anopheles (Malaria, Filariasis), Culex (Filariasis, Encephalitis), Aedes (Yellow Fever, Dengue) and Mansonia (Filariasis). Anopheles mosquitoes breed around the edges of unpolluted water bodies. Culex breed in any stagnant dirty water, including latrines. Aedes breed in water receptacles found close to human habitats such as bottles, buckets, tyres etc. Mansoni breed in areas where there are aquatic plants eg. ditches, ponds and swamps.





19. Control and prevention strategies depend upon the type of mosquito but generally include:

- ◆ Educating the refugees on modes of transmission and protection.
- ◆ Controlling larval stages of mosquito development by elimination of mosquito breeding sites.
- ◆ Treat latrines with polystyrene beads or larvicides.
- ◆ Conducting larvae surveys and observation walks to identify the most productive larval habitats and implement plans for their elimination, management, or treatment with appropriate larvicides.
- ◆ Encouraging insecticide treated bednet use.
- ◆ Conducting indoor residual spraying with insecticides (IRS).
- ◆ Encouraging the population to avoid going out between dusk and dawn when anopheline mosquitoes commonly bite.
- ◆ Encouraging the population to wear long sleeved clothing and long trousers when going out at night.
- ◆ Encouraging the population to apply insect repellent to exposed skin at night.
- ◆ Using screens over doors and windows.
- ◆ Using anti-mosquito sprays or pyrethroid mosquito coils in bedrooms at night.

20. Generally it is recommended that sites for settlement are at least 2km upwind from mosquito breeding grounds (SPHERE 2004). On permanent structures, screens (typically a mesh <1.5 mm) can be used on doors, windows, eaves and

other openings to prevent mosquito access.

21. Filling or draining areas of standing water and clearing drains to reduce breeding sites can be locally effective at reducing populations. Eucalyptus trees can be planted to dry up marshy areas. Breeding sites such as wells should be fitted with a handpump or tight cover. A layer of small polystyrene beads or light oil can be added to latrines or septic tanks to form a floating barrier.



Figure 6-4 Residual Spraying

22. Indoor residual spraying involves spraying insecticides onto interior surfaces of dwellings. Sprayed surfaces kill or irritate mosquitoes on contact and should remain active for two to three months. Modern mosquito treatments and chemicals are cheap, effective, and generally safe to humans, animals and the environment, however in some areas, mosquitoes may be resistant. People may object to residual spraying as it tends to leave a visible deposit and they may be reluctant to let strangers into their houses. Spraying programmes require detailed studies, trained professionals, specialized equipment and close consultation with local authorities. Care must be taken when handling insecticides



and spraying personnel must have full protective clothing and a face mask.

23. Insecticide treated mosquito nets kill mosquitoes on contact. The use of impregnated bednets also leads to the reduction of other pests such as bedbugs, lice, ticks and flies. Treated bednets should be retreated at the beginning of each transmission season. Personal mosquito repellants, fumigants (coils) and sprays contain controlled quantities of insecticide and can be very effective yet costly.



Figure 6-5 Insecticide Treated Bed Net

Control of flies in refugee settings

24. Flies are not only a nuisance, but are an important disease vectors for enteric diseases (dysentery, diarrhoea, typhoid and cholera), eye infections (trachoma and epidemic conjunctivitis) and skin infections. The most important fly species include the common housefly *Musca Domestica*, the filth fly *Musca Sorbens* and the blow fly *Chrysomya*. Both *Musca Domestica* and *Musca Sorbens* are 6-7 mm long and greyish in color (*Domestica* has four dark stripes on its back, *Sorbens* has two). *Chrysomya* are 10 mm in length and are shiny blue/green in color. *Chrysomya* have a strong preference for breeding in open latrines, decomposing meat or fish, garbage

and animal excrement. Contrary to popular belief, *Domestica* and *Sorbens* do not lay their eggs in latrines or rotting meat but prefer organic waste including garbage and animal excrement. *Sorbens* are often implicated in transmission of the eye-disease trachoma. Adult flies are mainly active during the day. At night they normally rest, although some flies adapt to artificial light. Fly numbers peak where average temperatures are in the range 20-25 °C. Flies are rarely found where temperatures are below 10 °C or above 45 °C.



Figure 6-6 Flies Feeding

25. Control and prevention strategies generally include:
 - ◆ Educating the refugees on modes of transmission and protection.
 - ◆ Increasing water quantity and soap availability.
 - ◆ Encouraging proper food hygiene practices including storing food and cutlery in closed covered containers.
 - ◆ Preventing open defecation.
 - ◆ Increase the coverage of clean and fly-proof latrines and encourage use.
 - ◆ Controlling fly populations through measures including improved solid waste management, baits, traps,



preventing open defecation, and latrine improvements.

- ◆ Installation of fly meshes, barriers and self-closing doors in shelters.
- ◆ Spraying of exteriors and interiors of doorways and other openings if fly infestation occurs in dwellings.
- ◆ Encourage the population to use insecticide treated bed nets or apply insect repellent to exposed skin for biting flies.

26. Solid waste collection and disposal systems reduce breeding sites especially where collection containers have closed covers. In tropical locations, garbage must be collected at least twice a week. Landfills should be covered with at least 10-20 cm of earth. Latrine use prevents flies encountering pathogens. Efforts should be taken to ensure that any open defecation in particularly children's faeces are safely disposed of. Pit latrines should have a sealed slab with either a water-seal or fly-proof vent and tightly fitting lid.



27. Strategies to reduce the risk of disease transmission from flies not only requires controlling breeding sites but also installing barriers to prevent contaminated flies coming in contact with food or food utensils. Food and utensils should be kept

out of the reach of flies either in a chest or screened box. Screens (typically a mesh <1.5 mm – also used to prevent mosquitoes) and self-closing doors can be used to reduce the number of flies on permanent structures. Aerosol insecticide, traps, sticky tapes, fly swatters, or electrocution devices can be used to kill any flies that make it into a dwelling. Education is important so the refugee populations fully understand the linkages between an insanitary environment, fly breeding, and disease, and they actively participate in fly reduction programmes.

Control of bedbugs in refugee settings

28. Bedbugs, fleas, lice, ticks and mites are parasites that feed on blood and live on the body, and in clothing and bedding. These parasites are responsible for transmitting various human diseases including typhus, relapsing fever, plague and murine typhus, Lyme disease and scrub typhus.



29. Bedbugs have a flat, reddish brown oval-shaped body with no wings and are 4–7mm long. Both male and female bedbugs feed on the blood of sleeping persons at night. The bugs are frequently abundant in bedrooms in warm



climates. Bedbugs are not considered vectors of disease. They are mainly important as a biting nuisance. Control and prevention strategies for bedbugs include:

- ◆ Educating the refugees on modes of transmission and protection.
- ◆ Increasing water quantity and soap availability.
- ◆ Light infestations can be treated by thoroughly cleaning infested articles, pouring boiling water over them and exposing them to sunlight.
- ◆ Mosquito nets impregnated with a long-lasting pyrethroid insecticide are effective in repelling and killing bedbugs.

Control of fleas in refugee settings

30. The most important type of flea in refugee settings is the rat flea *Xenopsylla Cheopis* and the human flea *Pulex Irritans*. Adult fleas are 1–4mm long and have a flat narrow body. They are wingless with well developed legs adapted for jumping. They vary in colour from light to dark brown. The larvae are 4–10mm long and white; they have no legs but are very mobile. The cocoon (pupal stage) is well camouflaged because it is sticky and soon becomes covered with dust, sand and other fine particles.
31. Fleas breed close to the resting and sleeping places of the host, in dust, dirt, rubbish, cracks in floors or walls, carpets, animal burrows and birds' nests. High humidity is required for development. The larvae feed on organic matter such as the faeces of the host, small dead insects and undigested blood expelled by adult fleas. Fleas avoid light and are mostly found among

the hairs or feathers of animals or in beds and in people's clothing. Fleas and their eggs, larvae and cocoons can be effectively removed by keeping shelters well swept and floors washed.

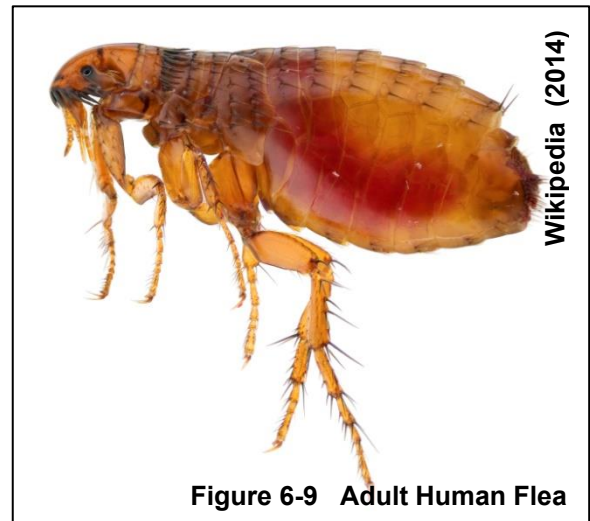


Figure 6-9 Adult Human Flea

32. Flea-borne typhus, also called murine typhus fever, is caused by *Rickettsia typhi* and occurs sporadically in populations of rats and mice. It is transmitted mainly by rat fleas and cat fleas, and humans can become infected as a result of contamination from the dried faeces and crushed bodies of the fleas. The disease occurs worldwide and is found in areas where people and rats live in the same building. Control and prevention strategies for fleas include:
- ◆ Educating the refugees on modes of transmission and protection.
 - ◆ Avoiding flea bites by use of insecticides and repellents.
 - ◆ Reducing rat flea populations through the application of insecticide powders to rat runs, burrows and harbourages.
 - ◆ Controlling rat populations through proper storage and disposal of food and refuse.
 - ◆ Suppressing rat populations by trapping and poisoning. Rat



control should always be preceded by measures to control fleas to avoid the fleas migrating to the human population.

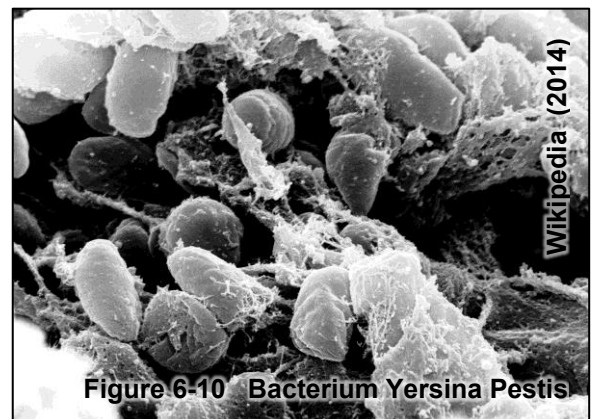
- ◆ Encouraging cleaning and residual spraying of shelters.
- ◆ Encouraging insecticide treated bednet use.

33. The treatment of floors with detergents, insecticides or a solution of naphthalene in benzene can be used in some settings; care should be taken to avoid inhaling benzene fumes. Heavy infestations can be controlled by spraying or dusting insecticides into cracks and crevices, corners of rooms and areas where fleas and their larvae are likely to occur. Insecticides can also be applied to clothing and the fur of animals.

34. Plague is a disease caused by the bacterium *Yersinia pestis*. It occurs primarily in wild animals, such as rats and other rodents. Plague bacteria are transmitted by fleas, and humans may be infected by fleas that have fed on infected animals. Plague is still dangerous because it occurs widely in rodent populations. Rural or sylvatic plague may be contracted in the western USA, South America, Africa, the former USSR, parts of the eastern Mediterranean area, and central and southeast Asia. Human plague frequently occurs in several countries in Africa, Bolivia/north-eastern Brazil, Ecuador, Myanmar, Peru and Viet Nam. Rat fleas (*Xenopsylla* species) that normally feed on rats may occasionally feed on humans and thus spread the disease to them. Control and

prevention strategies for Plague include:

- ◆ Educating the refugees on modes of transmission and protection.
- ◆ Avoiding flea bites by use of insecticides and repellents.
- ◆ Reducing rat flea populations through the application of insecticide powders to rat runs, burrows and harbourages.
- ◆ Controlling rat populations through proper storage and disposal of food, garbage and refuse.
- ◆ Suppressing rat populations by trapping and poisoning. Rat control should always be preceded by measures to control fleas to avoid the fleas migrating to the human population.
- ◆ Encouraging cleaning and residual spraying of shelters.
- ◆ Encouraging insecticide treated bednet use.



Control of lice in refugee settings

35. There are three main species of lice that affect humans. The body louse *Pediculus Humanus*, the head louse *Pediculus Capitis* and the pubic louse *Phthirus Pubis*. Only the body louse is a vector of disease (typhus, relapsing fever and trench fever). The others do not transmit disease but may cause severe



irritation. Lice are spread by close contact between humans. Body lice are found attached to clothing in close contact with the skin. The adult louse is about 3-4 mm long. Control and prevention strategies for lice include:

- ◆ Educating the refugees on modes of transmission and protection.
- ◆ Increasing water quantity and soap availability.
- ◆ Improve living conditions with provisions for adequate bathing and laundering of clothes and bedding.
- ◆ Encouraging cleaning and residual spraying of shelters.
- ◆ Encouraging insecticide treated bednet use.
- ◆ Carrying out delousing campaign using residual insecticide powder applied to clothes and persons.



Control of mites in refugee settings

36. There are over 1,000 species of mites, the most important being biting mites Trombiculid and scabies mites Sarcoptes Scabiei. Mites are very small 0.5 – 2 mm and have eight legs. Biting mites emerge from their eggs and crawl onto vegetation seeking an animal or human host. They feed once and then drop back to the ground where they enter the soil to develop into adults. Almost the entire life of the scabies mite is spent on and in

human skin. Scabies disease results from an allergic reaction to the burrowing mites. Control and prevention strategies for mites include:

- ◆ Educating refugees on modes of transmission and protection.
- ◆ Increase water quantity and soap availability.
- ◆ Encourage personal and domestic hygiene.
- ◆ Providing sufficient quantities of hot water and soap for laundering of underwear, clothing.
- ◆ Washing clothes with cycles of boiling water and drying will kill mites and eggs but may not be needed for most infestations.
- ◆ Encouraging cleaning and residual spraying of shelters.
- ◆ Encouraging insecticide treated bednet use.



Control of rodents in refugee settings

37. Rodents are generally present in most setting where there are humans and there is relatively easy access to food wastes. The risks to human health from rodents include:

- ◆ Rats cause disease through their fleas including murine



typhus and plague (see [section 6.30](#))

- ◆ Rodents can spread diseases such as salmonellosis, leptospirosis, hanta virus and lassa fever through their excreta.
- ◆ Rat bites can transmit pathogens that can cause fever and rabies.

38. Rodents can also cause considerable damage to building structures and food stores by chewing through structural materials. Control and prevention strategies for rodents include:

- ◆ Controlling populations through proper storage and disposal of food, garbage and refuse.
- ◆ Preventing access to dwellings by filling or screening all holes greater than 6mm in diameter.
- ◆ Suppressing populations by trapping and poisoning with rodenticides.

