
Update/Le point

Vector-borne disease problems in rapid urbanization: new approaches to vector control*

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Owing to population growth, poor levels of hygiene, and increasing urban poverty, the urban environment in many developing countries is rapidly deteriorating. Densely packed housing in shanty towns or slums and inadequate drinking-water supplies, garbage collection services, and surface-water drainage systems combine to create favourable habitats for the proliferation of vectors and reservoirs of communicable diseases. As a consequence, vector-borne diseases such as malaria, lymphatic filariasis and dengue are becoming major public health problems associated with rapid urbanization in many tropical countries.

The problems in controlling these diseases and eliminating vectors and pests can be resolved by decision-makers and urban planners by moving away from the concept of "blanket" applications of pesticides towards integrated approaches. Sound environmental management practices and community education and participation form the mainstay of some of the most outstanding successes in this area. On the basis of these examples, it is argued that the municipal authorities need to apply a flexible methodology, which must be based on the possibilities of mobilizing community resources, with minimal reliance on routine pesticidal spraying. In this way, vector control becomes a by-product of human development in the city environment. This is now a true challenge.

Introduction

At the present time, the urban health authorities in many countries are alarmed by the rise in vector-borne diseases, due to increased densities of vectors and other pests which present ever greater burdens on their vector and pest control programmes (1-9). This escalation of disease is closely related to overcrowded urbanization, which is the result of population growth and rural-to-urban migration taking place much faster than ever before since the dawn of man. In many cities, slums and poor neighbourhoods are spreading, where the appalling living and working conditions, lack of safe drinking-water and sanitation, and exposures to emissions from traffic and,

in many places, also from factories are the daily burden of a rapidly growing proportion of city dwellers.

The major urban arthropod vectors are those of dengue, malaria, filariasis, Chagas disease, plague and typhus. In addition, the urban environment favours the breeding of nuisance mosquitos, cockroaches, mice and nuisance bird species, which add to and aggravate the problems.

In 1950, only 29% of the world's population resided in urban areas. Between 1960 and 1980, the urban population in developing countries more than doubled, and is expected to reach 39% of the total population by the year 2000 and 56% by 2025. In developed regions, the proportion of the population living in urban areas was already 72% in 1985, and is projected to reach 74% by the year 2000 and 79% by 2025 (10, 11). With such increases, it is anticipated that pest problems and vector-borne diseases in urban areas will also increase.

Development and health

Forty years ago there were only seven urban centres with populations approaching five million or more;

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in 1970 there were twenty. By the year 2000 it is estimated that there will be 60, all but a quarter of them in the developing countries, with probably 23 mega-cities (i.e., populations exceeding 10 million), 17 of which will be in the developing countries (12). Such growth will not be confined to the capital cities and large metropolitan areas involved, but will impact upon other urban centres as well. Thus, more than half of humanity will live in the sphere of influence of mega-cities. At present, about 46% live in cities of 500 000 or more and 20% in cities of a million or more; about 600 million urban dwellers in the developing countries now live in life- and health-threatening situations with inadequate health care^a and environmental health services.

Accelerated urban population growth results primarily from natural birth rate increases in the resident population, and rural-to-urban migration for whatever reason. It has placed governmental services in both developed and less developed parts of the world in the precarious position of not being able to keep pace with the need for adequate housing and essential services. In most cases, inferior and inadequate housing are becoming part of the daily environment, resulting in increased risks to health due to vector-borne and other communicable diseases, and exposure to pollutants and stress factors. In the developing countries where individual families often construct their own dwelling, great variation exists as to where such structures are sited, how they are built, their size, type of material used, etc., and they are usually made without concern for vector hygiene.

Migrants and refugees tend to settle into new areas, usually at the city boundaries where the drainage is poor, while others look for shelter in the inner city, often in abandoned buildings, low-cost tenements or existing slums. Many urban planners and administrators feel that the provision of amenities for migrants would slow down the process of their settling into existing areas where better facilities are available. Therefore, temporary settlements continue to absorb new residents when the previous occupants increase their means and can pay for better accommodation. Thus, there is little interest to improve these areas of poor sanitation and the disease problems continue.

In many countries where rapid urban growth is taking place without basic amenities, the health services that have to respond to vector and pest control problems find that what is needed mostly surpasses their ability in terms of manpower, expertise, equip-

ment, transportation, and supplies.

The movement of people from agricultural areas to industrial centres cannot be avoided or interrupted. Consequently, we witness the "ruralization" of cities, as people bring their rural practices and traditions to urban areas, such as raising livestock, patterns of water use and storage, etc. Many of these life-styles aggravate and contribute to vector and pest problems.

Even where an adequate health system exists, the health officials often lack pest and vector control expertise. This is a constraint in the monitoring, assessment and management of vector-borne diseases. Managerial or other deficiencies may lead to sudden outbreaks of vector-borne diseases in urban areas, e.g., dengue in the Americas (13-15) and yellow fever in West Africa (16). In reality, the problems associated with rapid urbanization are so multifaceted that they frequently exceed the infrastructural capacity to handle them. It is often assumed that vector and pest control is the sole responsibility of the health department when, in fact, other government departments and agencies share this responsibility for the broad issues of environmental health.

Other factors of grave risk to health include pesticide abuse, where trained and untrained individuals may use pesticides indiscriminately and/or in an unsafe, unsupervised manner, or where empty pesticide containers are utilized for the storage of water or food. Pesticides must always be applied under strict supervision by personnel who have been trained in the necessary precautions. As the problem of insecticide resistance is becoming widespread, careful verification by trained staff is required and, if necessary, the use of an alternative chemical, although this usually increases the costs.

Owing to improved environmental awareness, the public is becoming increasingly critical of the application of pesticides in and around human habitations. Such opposition is not always justified, nor is it related to the real risks of environmental contamination. There is a distinct need for proper guidance and training to ensure that such pesticides are used judiciously and for health education on the appropriate use of such chemicals. Many programmes are using excellent adjuncts in the form of biological control agents. These are environmentally safe and usually equally effective, e.g., mosquito larvicides; in many cases, however, they may require more frequent application.

WHO and other international agencies have for about 15 years been advocating the integration of disease control programmes into a primary health care system. Consequently the single-disease vector control approach is gradually giving way to one

^a *Technical Discussions on Strategies for Health for All in the Face of Rapid Urbanization, Urban Policies and Health Status.* Unpublished WHO document, A44 / Technical Discussions / 3 (1991).

focused on broader issues of environmental health, including the management of vectors and pests. For the most part, this has been implemented only in the more advanced vector and pest control programmes in developed countries, where solid public funding and human resources are capable of dealing with the full scale of issues concerned, ranging from community participation to the management of pesticide resistance and alternative control strategies.

Tropical diseases

Until recent times tropical diseases were basically associated with rural poverty and this remains true. However, the same diseases have also become more closely linked to densely packed urban populations, particularly in the tropics. Table 1 lists eleven diseases which are no longer confined to rural areas but, because of rapid transport and growing tourism, trade and business travel and various forms of migration, have been introduced into the new urban centres of various countries, both developed and developing.

Malaria

For example, malaria today is one of the most widespread and serious tropical diseases. Over 40% of the world population, or more than 2000 million people, are at some risk to this mosquito-borne parasitic disease in 103 countries. In many areas where malaria was previously reduced or eliminated, we now see a significant resurgence. It is estimated that there are 110 million clinical cases each year with around 280 million people carrying the parasite (17). Nearly

200 million people, mainly in tropical Africa, reside in malaria-endemic regions, where few or no anti-malarial control programmes exist.

More than one hundred million clinical cases occur annually in Africa alone, where following prolonged rains in 1990, sizeable epidemics occurred in many highland areas (Botswana, Madagascar, Rwanda, Swaziland and Zambia). The majority of deaths from this disease occur in sub-Saharan Africa where transmission is intense and children are at the highest risk.

Outside the African continent, 95% of the 5.2 million cases reported to WHO in 1989 came from 25 countries, with India accounting for 39%, Brazil 11% and the remaining top six countries (in descending order: Afghanistan, China, Myanmar, Sri Lanka, Thailand and Viet Nam) accounting for another 25%. Malaria is on the increase in all areas where new frontiers for economic development in agriculture and mining have been opened in sylvatic zones and in those areas where war, lawlessness, open conflicts, and refugee migrations are commonplace (17).

There is a global strategy for malaria control, but the need is to have a strong commitment at local, national, international and global level in order to develop and implement locally relevant, integrated programmes for the control of this killer disease.

Dengue and dengue haemorrhagic fever

Dengue is considered to be the single most important arbovirus disease of man. In its more fatal form, known as dengue haemorrhagic fever (DHF), it was previously restricted to south-east Asia and the

Table 1: An overview of some important tropical diseases^a

Disease ^b	Estimated number ^c of infective people	No. of clinical cases/year	Mortality per year	No. of affected countries	No. of people at risk
Malaria	280 million	110 million	1-2 million	103	2100 million
Schistosomiasis	200 million	— ^d	200 000	76	500-600 million
African trypanosomiasis	25 000	—	—	36	50 million
Chagas disease	16-18 million	—	—	Central and South America	90 million
Leishmaniasis	12 million	400 000	—	80	350 million
Filariasis (lymphatic)	90 million	—	—	76	905 million
Onchocerciasis	18 million	—	—	34	90 million
Dengue fever	30-60 million	100 000	—	>75	100s million
Yellow fever	10-25 000	1000s	—	>50	Millions
Plague	Unknown	<1000	100+	24	Millions

Estimated total infections: 600-700 million

^a Based on data from references 31 and 32 and other sources.

^b All have an insect vector with the sole exception of schistosomiasis.

^c Data from *Global estimates for health situation assessment and projections 1990*. Unpublished WHO document, WHO/HST/90.2, 1990.

^d Unknown.

Pacific; since the late 1970s it has become endemic in the Americas and caused serious epidemics, resulting in millions of cases and the loss of thousands of lives (2, 14). The cost of all these epidemics reaches into the millions of dollars annually for control efforts alone, not to mention the burden upon medical services and incalculable losses of vital revenues from decreased workforces and stagnating tourism. Cases of DHF during the period 1956–89, as reported to the World Health Organization, total 2 512 123 with 42 751 deaths (6).

Cause and effect in disease risk

As one reviews the various factors which are linked to the increase in the incidence of tropical diseases in urban areas, there appear to be a number of contributing factors, including high population density, inadequate housing, absence of a safe and reliable water supply, poor or nonexistent sewage and drainage systems, insufficient solid waste management practices, inappropriate human behavioural practices, etc.

It has been calculated that there were 1200 million people at the beginning of this decade who still did not have access to a safe, dependable potable water supply.^b Those without such water are forced to obtain it from a variety of unreliable places resulting in the practice of storing water in the home and frequently providing breeding habitats for vector and pest mosquito species. In addition, people living under such situations are at higher risk for diarrhoeal diseases.

An estimated 1800 million people in the 1990s will lack proper disposal systems for excreta. This not only contaminates drinking-water supplies, but again provides breeding habitats for certain disease vectors and pests. The practice of uncontrolled garbage dumping is an escalating problem in many peri-urban areas which provides food, nesting and breeding sites for rats, mice, and insects of public health importance. Bad drainage of surface water including domestic wastewater often creates pools of contaminated water, unplanned ponds and even small lakes, which results in the breeding of large numbers of vector mosquitos and nuisance insects.

What can be done?

(1) Human behavioural changes

New patterns of human behaviour are required if disease transmission stemming from poor urban

conditions are to be brought under control. Those who are in greatest need are the disadvantaged, the poorest of the poor, who require a maximum of motivation with accompanying resources, and the provision of opportunities in order to improve their own surroundings. There is a distinct need for trained social workers to assist individuals, families and communities as well as primary health care personnel to drop traditional rural concepts which are no longer valid in an urban situation and adopt better standards of environmental hygiene in and around the home.

(2) Health messages

Concise and inspiring health messages are all too often absent from public education or public awareness campaigns. There is a major need for carefully sculptured health education messages to be developed to motivate people in various social settings. There is also a need to promote and establish mechanisms for action between communities, local agencies, countries, and regional authorities in the area of communications and health education. Along with this is a need to develop methods for assessing community responses to health messages and a greater need to know when it is necessary to adjust such messages and, equally important, to have flexible local health policies to accommodate such adjustments.

(3) Sustainable vector-borne disease control

In order to secure the longest-lasting impact in the most sustainable manner, the ideal vector-borne disease control plan is one which is developed in consultation with communities. This rising generation should accept their share of the burden and shoulder at least some responsibility for disease control and environmental management. One logical target group therefore is today's youth, who can become deeply involved in community-based pest and vector source reduction campaigns.

(4) Mobilizing resources

In order to strengthen the capacity of local governments in the campaign against vector-borne tropical diseases, human and financial resources need to be identified and mobilized. Personnel require adequate training and management's capacity must be strengthened to respond to changing vector control needs. Public service departments should recognize that local needs vary among urban centres and within communities, and make adjustments accordingly. Indeed, close contacts must be maintained with communities in order to recognize and respond to their needs.

^b World Health Organization. *Housing and health—An agenda for action, 1987*. Unpublished document prepared in support of the International Year of Shelter for the Homeless.

(5) Community vector control experiences

Vector and pest management programmes around the globe are gradually recognizing the importance of and capitalizing upon the wealth of human resources available in most communities. As community leaders are consulted regarding their needs and priorities and by channelling or harmonizing their perceived needs within broader disease control programmes, it is possible to direct community energy to vector-borne disease control and environmental management activities. Such experiences have been gained in India in the fight against malaria (18) and filariasis (19),^c and in the use of personal protection measures (bednets) and mosquito repellent bars that are applied on the skin in the Western Pacific (20, 21) and African (22) regions and elsewhere (23).

In the West Indies environmental management has been directed at the control of dengue vectors (24).

(6) Vector hygiene as a by-product of urban development

The changes brought about in the urban environment by development do not necessarily have a negative impact on human health all the time. In fact, one could argue that the good housing standards of many new city developments provide for much healthier living conditions for migrants, as has been borne out by many epidemiological studies. Better quality housing, improved water supply and sanitation, and upgraded drainage systems do have an impact on transmission cycles of many communicable diseases, particularly those transmitted by vectors. If these environmental changes are experienced by people alongside job improvements and increased levels of education and awareness, the interactions between human behaviour and the physical/biological environment can raise the level of hygiene, which includes reduced contact with vectors and pests. In peri-urban areas, which are close to agricultural lands, sound cropping practices and efficient use and drainage of irrigation water will contribute to lower vector and pest densities. In this manner, vector-borne disease control can be a side benefit of urban development, even in the absence of specific health sector activities. The urban authorities should be constantly aware of the health implications of municipal planning, not only in preventing and mitigating the bad, but also in looking for ways to take advan-

tage of the good all the time.

It is imperative that vector control leaders exchange their experiences, management ideas and tools, etc. with others. A useful way to do this is through a practical information network which can help inform and convince policy- and decision-makers about ways to integrate vector control methodologies and make partners for health from among sensitized and action-oriented communities.

There are a number of positive examples where integrated vector control is succeeding. For example, in industrial complexes in India, peri-urban area malaria has been brought under control through a combination of bio-environmental control and community involvement which successfully reduced mosquito breeding habitats and the incidence of malaria. Economic benefits resulted from habitat modification and the introduction of aqua-culture farming which helped the villagers through employment and cash-crop spin-offs (25). In southern India, vector control has been found to be more effective, sustainable and environmentally acceptable through community support (26). In Africa, community participation in the Gambia with the use of impregnated mosquito nets marked a reduction in malaria incidence (27, 28). In the Americas, integrated vector control activities with strong community links have been reported and evaluated (24, 29, 30). In each of these studies the role of local belief systems, social settings and cultural understanding, had been taken into account. Success is achieved only when the local communities also help to identify the disease vector problem and are part of the decision-making process on how to deal with it. The above examples show how new strategies for the control of tropical diseases and their vectors in urban and peri-urban areas may be developed.

Conclusions

Health authorities should recognize that in some situations, such as in transitional living areas with no well-defined social infrastructure or where the traditional social structures are being eroded (e.g., in high-rise apartment complexes), community-based cooperation and participation may be very difficult and pose a challenge. However, some definitive steps towards the recognition and utilization of human resources have been taken to move from narrow vector control management strategies to a broader, more decentralized integrated approach. These measures represent a wise and appropriate investment to improve the urban environment on the basis of more successful health development and more sustainable vector control activities.

^c Sharma, V.P. et al., ed. *Community participation for disease vector control*. Proceedings of an ICMR/WHO Workshop, February 1986, New Delhi, India (unpublished).

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