衞生防護中心
Centre for Health Protection

A Three-year Strategic Plan for the Prevention and Control of Dengue Fever in Hong Kong

Report of the Scientific Committee on Vector-borne Diseases

July 2005

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轄下執行疾病預防
及控制的專業架構
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Executive Summary

Dengue fever poses a significant risk to the health of the global community. Population growth, increased urbanization, international travel, and climate changes are some of the factors affecting the emergence and re-emergence of dengue fever in different parts of the world. To tackle the threat brought about by the disease, the Scientific Committee on Vector-borne Diseases has conducted a review and recommended on the following strategies for the prevention and control of dengue fever in Hong Kong for the coming 3 years:

(a) Surveillance for planning and response

(i) Keep clinicians well informed of the surveillance case definitions, public health management, as well as latest dengue epidemiology;
(ii) Maintain a high degree of vigilance for dengue epidemics in nearby countries and provide readily accessible information and health advice to intended travelers;
(iii) Continue vector surveillance and disseminate information in a timely and user-friendly manner to support community efforts in vector control

(b) Disease management

Update and disseminate clinical guidelines for the early diagnosis and management of dengue fever

(c) Emergency preparedness

Review and update emergency response plans, with special emphasis on active case detection and investigation, emergency vector control, and media and risk communication plans

(d) Changing behaviours and building partnerships

(i) Mobilize various sectors of the community in a sustained

programme in dengue fever prevention and control

(ii) Conduct regular surveys to monitor behaviour change and evaluate success of health promotion programmes

(e) Capacity building

(i) Build up surge capacity by providing training on clinical, epidemiological, entomological aspects of dengue fever and its public health management

(ii) Conduct training for medical personnel on diagnosis and management of dengue fever, which may include overseas clinical attachments and exchange programmes

1. Introduction

1.1 Background

Dengue fever (DF) has been recognized as the most important arboviral disease affecting humans in recent decades. Over the past 40 years, major outbreaks of DF have occurred in many Southeast Asian countries, causing significant morbidity and mortality. In Hong Kong, the detection of the first local cases of DF in 2002 has led to heightened vigilance and highlighted the need for strengthening of control measures.

Against this background, the Scientific Committee on Vectorborne Diseases (SCVBD) undertook the task of examining the changing epidemiology of DF in Hong Kong and developed a strategic plan for the prevention and control of the disease for the coming years.

1.2 Purpose of this document

Members of the SCVBD met at several meetings between 30 June 2004 and 22 April 2005 and reviewed the epidemiology of DF in Hong Kong, examined the current public health control measures, considered overseas practices and recommendations, and drew up a plan for its prevention and control for the coming 3 years. Two papers, SCVBD Paper 5/2004 ("Developing a 3 Year Strategic Plan for Prevention and Control of Dengue Fever in Hong Kong") and SCVBD Paper 5/2005 ("Strategic Plan for the Prevention and Control of Dengue Fever in Hong Kong") were discussed and endorsed by Members on 11 August 2004 and 22 April 2005 respectively. This document details the deliberations of the SCVBD and outlines this three-year strategic plan.

2. Dengue and Dengue Haemorrhagic Fever

2.1 Clinical features

Dengue viruses cause two main clinical syndromes: dengue fever (DF) and dengue haemorrhagic fever (DHF). DF is an acute febrile viral disease characterized by fever, headache, myalgia, arthralgia and a maculopapular rash. The pain can be so severe that it is sometimes called "break-bone fever". Most often DF presents as a mild illness and rarely causes death. The initial presentation of DHF is similar to DF. However after 2-7 days of high fever there occurs bleeding and / or circulatory collapse. This is due to a combination of thrombocytopenia (which is usually more severe than in DF), and plasma leakage from 'porous' capillaries leading to effusions such as pleural effusion, ascites or even pericardial effusion. Capillary leak results in haemoconcentration and hypoproteinaemia. The period of shock lasts only 1-2 days in most patients and responds promptly to treatment with fluid replacement and oxygen administration. However, the descent into circulatory failure may be sudden and rapid. In the most severe cases, the patient may go into a critical state of shock – referred to as dengue shock syndrome (DSS). Clinical management of DF involves monitoring of vital signs and laboratory parameters, and supportive therapy including bed rest, fluid replacement and antipyretics (avoiding aspirin and NSAID).

Management of DHF and DSS requires meticulous monitoring of haemodynamic status to detect the earliest evidence of plasma leakage with early and adequate fluid replacement when needed. Blood transfusion may be required in cases that have no clinical improvement in response to intravenous fluid replacement. Case fatality rates of DHF/DSS vary in different countries and can be up to 20%. Expert treatment in a modern ICU reduces the mortality to less than 1%.

2.2 The virus

Dengue viruses are members of the genus *Flavivirus* and family *Flaviviridae*. They are single-stranded RNA virus with an icosahedral nucleocapsid surrounded by an envelope. There are four distinct serotypes:

DEN-1, DEN-2, DEN-3, and DEN-4. Infection by one dengue serotype can give rise to life-long immunity to the serotype but only partial protection to other serotypes. Sequential infection by different serotypes of dengue virus has been generally accepted as the predisposing factor of DHF/DSS. DHF is more likely to occur when dengue virus affects a person with immunity to a heterologous serotype.

2.3 The vector

DF/DHF is mosquito-borne and the primary vector is *Aedes aegypti*. The *Aedes albopictus* more often found in Hong Kong is a less efficient vector. The female *Aedes* mosquitoes acquire the virus while feeding on an infected person. After a period of 8-10 days, the mosquito becomes infective and can transmit the virus to another human through its bites throughout its life. There may be transovarial transmission from the infected female mosquitoes to their offsprings.

2.4 The host

Dengue viruses infect humans and some species of lower primates. Humans are the main amplifying host of the virus. The virus causes disease in humans after an incubation period of 3 to 14 days. Viraemia occurs 1 to 2 days before onset until defervescence. This is the period when the human host can further transmit the virus to *Aedes* mosquitos when the latter feed on the affected individual.

3. Global Situation

3.1 Disease burden

Data on the disease burden related to dengue in the international communities is relatively incomprehensive and delayed despite the effort of the World Health Organisation (WHO) in setting up an electronic DengueNet for surveillance. It is estimated that 50 million dengue infections occur each year with 500,000 DHF and 22,000 deaths mainly among children. Historically, epidemics caused by dengue virus have been reported throughout the 19th and early 20th centuries in the Americas, southern Europe, North Africa, and Asia and Australia. As for DHF, it was first recognized in the Philippines and Thailand in 1953 and 1956 respectively. DHF affects many countries in the WHO Southeast Asian and Western Pacific Regions.

3.2 Epidemiological pattern

WHO has described two characteristic epidemiological patterns regarding the dengue situations in Western Pacific and South-East Asian Regions. In areas where multiple dengue serotypes are endemic, there are more frequent cases of DHF/DSS. Generally there are sporadic cases or small outbreaks in the early phases. The size then gradually increases until an explosive outbreak appears. A pattern of epidemic activity every 2-5 years is then progressively established. In these countries, DHF/DSS is typically found in children with a modal age of 4-6 years. In the other areas where dengue is at low endemicity, multiple dengue serotypes are transmitted at low rates affecting less than 5% of the population each year. Previously uninfected adults and older children are vulnerable.

South American countries have experienced a spread of dengue in the past twenty years and are observed to be following a similar pattern to Southeast Asia. Whilst dengue fever had occurred in the Americas in the 1960s and 1970s, the two major DHF epidemics in the Americas were recorded in Cuba in 1981 and in Venezuela in 1989. In 2001, Brazil reported over 390 000 cases including more than 670 cases of DHF. To date, DHF cases are regularly seen in countries in the South America.

4. Local Situation

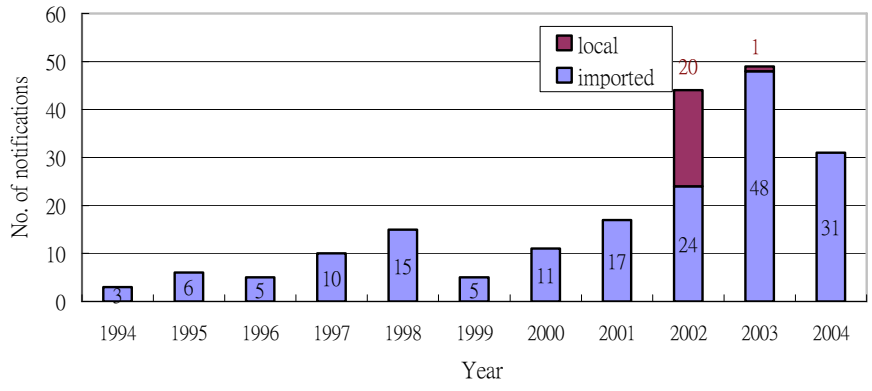
4.1 Overall trend

In Hong Kong, DF has become a statutorily notifiable disease since March 1994. All notified cases were investigated and the source of infection verified. As of the end of December 2004, there were a total of 196 notifications including 6 cases of DHF. The annual number of notifications ranged from 3 to 49 (Figure 1). There were 115 males and 81 females. Only 7 cases aged below 15. There was no fatal case. Among all, 175 were imported cases and 21 were local cases. All of the 72 cases reported before 2002 were imported.

4.2 The first local cases

In 2002, Hong Kong registered the first local cases of dengue fever in September. The subsequent epidemiological investigation revealed an outbreak in a construction site in Ma Wan affecting 16 workers and residents nearby. One of them had further spread to a transfused through blood donation. Subsequent to the 2002 outbreak, DH recorded another 3 local cases in 2002 and one in 2003. As no linkage was identified after thorough epidemiological investigation, these were classified as sporadic cases. For the 21 local cases, one was due to serotype 2 strain whereas six were serotype 1. The serotype 1 strain in the 2003 local case was different from that isolated in 2002.

Figure 1. Dengue Fever Notifications in Hong Kong, 1994-2004



4.3 Imported cases

The source countries and the serotype of the dengue virus among the imported cases were studied. Among the 103 imported cases since 2002, 50 had their dengue serotype available by polymerase chain reaction (PCR). The summary is shown below.

Table 1. Imported dengue fever cases by imported country and serotype (2002 – 2004)

		Den-1	Den-2	Den-3	Den-4	Total
Southeast Asia countries	Indonesia	4	2	1	1	8
	Cambodia	2		1		3
	Mainland	1				1
	Malaysia	1	1	1		3
	Myanmar	1	1			2
	Philippines	3	3	1	4	11
	Singapore		3			3
	Thailand	7	3			10
South Asia countries	India	3	1	2		6
	Sri Lanka		2			2
South Pacific countries	Tahiti	1				1
Total		23	16	6	5	50

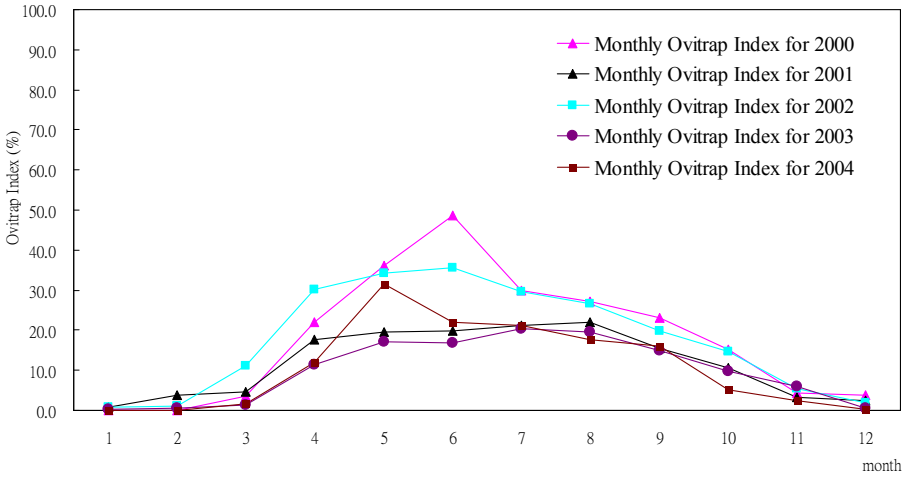
4.4 Ovitrap indices

The Food and Environmental Hygiene Department (FEHD) has been conducting a dengue vector surveillance programme since 2000 using oviposition trap (ovitrap). This programme monitors the adult *Aedes* mosquitoes including *Aedes albopictus*.

Two different indices, namely Area Ovitrap Index (AOI), and Monthly Ovitrap Index (MOI), are enumerated. AOI indicates the extensiveness of the distribution of Aedine mosquitoes in that particular area surveyed while the MOI is the average of all AOIs within the same month, which reflects the territory-wide situation of *Aedes albopictus*.

A higher level of index indicates a more extensive distribution of *Aedes albopictus*. Figure 2 shows the Monthly Ovitrap Indices between 2000 and 2004.

Figure 2. Monthly Average Ovitrap Index (2000-2004)



5. Prevention and Control

Dengue infection is of great public health significance in its potential of causing rapid and extensive epidemics, the resultant stress to healthcare services, and the subsequent disruption to the society.

5.1 Prompt investigation and control

In Hong Kong, all four serotypes have been isolated from imported cases. Mechanisms to detect these cases early and to prevent them from spreading the virus to the local mosquito population are critical. DF is statutorily notifiable and all medical professionals are required to report suspected and confirmed cases to the Department of Health (DH). DH carries out immediate epidemiological investigation on all notified cases and refers the case to FEHD for parallel vector surveys and control. The affected ones are required to be hospitalized in mosquito-proofed facilities during the febrile periods to prevent mosquito bites and further spread to local mosquito populations. The hospital concerned should adopt practical guideline to prevent transmission of the disease. Close observation of the patient is necessary to guard against DHF and DSS. Should a local source be suspected, CHP conducts active case finding through door-to-door interviews of the neighborhood, distribution of pamphlets, and setting up telephone hotlines. Vector control covering the flight range of the *Aedes albopictus* is carried out aggressively.

5.2 Entomological surveillance and vector control

The FEHD is the government department taking the lead in vector surveillance and control. The dengue vector surveillance programme has 38 survey areas covering densely populated areas, schools, major hospitals, and outlying islands such as Cheung Chau, Ma Wan and Lantau. Residents, workplace and areas visited by previously reported local dengue cases are also included. It has been enhanced in 2004 to cover all major port areas including airport, cross boundary sea ports, land ports, cargo working areas and container terminals. Results of these surveys are distributed to partner departments and the public. Specific preventive and control measures will be initiated

according to the level of the Ovitrap Index.

FEHD also carries out regular vector control at hotspots. Source reduction is the fundamental method adopted to eliminate mosquito breeding. For breeding sources that cannot be destroyed immediately, malarial oil, *Bacillus thuringiensis israelensis* (bti) or temephos may be used to disrupt the life cycle of mosquitos. When the Ovitrap Indices are high, more aggressive anti-mosquito actions are undertaken. Fogging may be carried out to suppress the adult mosquito population whenever necessary. Apart from inter-departmental collaboration in response to elevated Ovitrap Indices, the public is also alerted and advised to take corresponding preventive or remedial actions.

5.3 Mobilizing the community

It is crucial to involve the community and private sector to maintain public alertness to the importance of sustained anti-mosquito efforts. The Anti-mosquito Steering Committee (AMSC), which comprises senior officials from a number of policy bureaux and Government departments, was established to oversee strategy and direction setting in mosquito control and to seek to increase the involvement of the community and private sector. The government carries out regular territory-wide anti-mosquito campaigns in collaboration with other government departments. These campaigns aim to heighten the public awareness on potential risk of mosquitoes and dengue fever; encourage community participation and close collaboration between government departments; and intensify elimination of breeding sites for mosquitoes.

On the publicity front, the public are reminded of the necessity for elimination of mosquito breeding places and precautions against mosquito bites both in Hong Kong and while travelling outside Hong Kong through various channels including Announcement of Public Interests (API) in radio and television, health education hotlines, website information, health talks, pamphlets and posters. Health education and advice was given to residents and the general public through press conferences, API in radio and television, health talks, and dissemination of educational materials. In 2003, the

Department of Health conducted a public awareness survey which found satisfactory public awareness on dengue prevention (Annex 1).

5.4 Vaccine development

There is yet no commercially available vaccine for dengue. However, live attenuated vaccines for dengue virus are being actively researched. Because of the apparent relationship between partial immunity and DHF, it is accepted that the vaccine should be able to induce immunity against all four dengue serotypes simultaneously. Four types of chimeric live attenuated vaccines are being developed by introducing genes of dengue viruses encoding premembrane and envelope proteins to an attenuated yellow fever 17D or dengue vaccine in France and United States. Another two vaccines were developed by passaging the four dengue viruses in non-human tissues cultures. One of these developed at the Mahidol University, Bangkok, have been tested in Thailand and the cohorts are followed to determine if vaccination predisposes to severe dengue infection. Recently, some expressed concerns on the possible recombination occurring within and across species of flaviviruses causing changes in virulence.

5.5 Other environmental determinants

The spread of dengue is attributed to expanding geographic distribution of the four dengue viruses and of their mosquito vectors: *Aedes aegypti* and *Aedes albopictus*. Temperature and rainfall can affect dengue transmission. A recent study reported associations observed between the yearly incidence of dengue in Indonesia and French Guiana El Niño years. Urbanization and the public utilities such as household water supply and storage as well as solid waste disposal are important determinants.

6. Strategies for prevention and control

6.1 Global strategies

The WHO Global Strategy for Dengue Fever / Dengue Haemorrhagic Fever Prevention and Control published in 1995 comprised of 5 elements: selective integrated mosquito control with community and inter-sectoral involvement; disease and vector surveillance for monitoring and evaluation; emergency preparedness; capacity building and training; and applied research. Based on this global strategy, regional strategies have been formulated in the Americas, South-East Asia and the Western Pacific during the 1990's. As a review to the global strategy, three fundamental aspects have also been highlighted by WHO in its 1999 informal consultation, these are: surveillance for planning and response; reducing disease burden; and changing behaviours.

6.2 A local three-year strategy

Hong Kong is at risk of dengue outbreaks because of the high volume of international travelers, dense population, availability of *Aedes* mosquitos, and favourable climatic environments. In 2002, a WHO mission report made after the first local outbreak in Hong Kong concurred this view and listed 16 recommendations. These recommendations have been referred to respective governments for follow up (Annex 2).

Further to the review of the situation of dengue fever and the existing prevention and control measures in Hong Kong, and taking reference from the WHO strategy, the SCVBD formulated a strategic plan for Hong Kong consisting of five main elements: surveillance for planning and response, disease management, emergency preparedness, behaviour modification and partnership building, as well as capacity building and training. The following elaborates on the key elements of the strategy.

6.2.1 Surveillance for planning and response

Epidemiological surveillance

Hong Kong had one local dengue outbreak in 2002 and varying numbers of imported cases over the years. Epidemiological surveillance should aim at early detection of dengue fever cases, both local and imported in origin, and initiate prompt control measures. To this end, clinicians should be kept well informed of the case definitions, reporting and referral mechanisms, as well as the incidence of dengue fever in neighboring countries. Clinicians in the private sector should be familiar with the established mechanisms for the referral of specimens for confirmation at the Public Health Laboratory Centre.

From the global perspective, Hong Kong should monitor closely the epidemiology of dengue fever in neighboring endemic countries, and maintain a high degree of vigilance against the spread of the disease initiated by imported cases. Appropriate information and health advice to travelers to these countries should be updated at regular intervals and made readily accessible.

Entomological surveillance

The FEHD monitors the presence of dengue vectors in different districts of Hong Kong using the Ovitrap Index. The results have been widely disseminated to the public as guidance for community actions. It is proposed that FEHD to continue to conduct ovitrap surveys and to regularly review the adequacy of the vector surveillance method.

6.2.2 Disease management

In the absence of specific therapy, management of dengue fever remains symptomatic and supportive. Early recognition and diagnosis together with appropriate management is crucial in reducing morbidity and mortality. This requires well-informed medical professionals and the adoption of clinical management guidelines, including relevant infection control measures to be applied in the hospital ward. Mechanisms for continuous review and updating of these guidelines may be incorporated into the clinical audit framework to enhance the quality of care.

6.2.3 Emergency preparedness

Emergency preparedness and response for dengue fever involves early warning of epidemic transmission and rapid response to contain outbreaks including the instigation of measures to reduce the number of infective mosquitoes over the transmission area. A contingency plan for local dengue fever outbreak is in place which contains essential elements such as protocols for stepped-up surveillance, active case detection and case investigation, emergency vector control, media and risk communication plans, and so on. It is proposed that the contingency plan be periodically reviewed with input from relevant key parties for the optimal response to local outbreaks.

6.2.4 Changing behaviours and building partnerships

A critical variable in prevention and control efforts is human exposure and behaviours contributing to vector control. Source reduction is currently the approach to eliminate mosquito breeding. By removing accumulated waste water on at least a weekly basis, the life cycle of dengue vectors can be interrupted. Measures as such should be institutionalized in environmental management or other community programmes. Health promotion programmes should target at sustainable behavioural changes at the individual, household, and institution levels. It is crucial to involve the community and private sector to maintain public alertness to the importance of sustained anti-mosquito efforts. Currently, the AMSC provides an effective forum for numerous government departments to review, discuss, and advise on the enhancement of anti-mosquito measures. It is proposed that under the guidance of the AMSC, the FEHD continues to take the lead in carrying out regular territory-wide anti-mosquito campaigns in collaboration with the other government departments and the community at large. Special emphasis should be placed on modifying the behaviours in relation to vector control, on top of the conferment of knowledge. Social mobilization and communication strategies may be appropriately incorporated in the design and implementation of behaviour change interventions.

Regular surveys which measure behavioral change can be carried out either independently or to be incorporated into programme evaluation. Possible

behaviours that may be tracked include the use of mosquito repellents and exposure prevention, active steps taken to prevent the accumulation of stagnant water, and general awareness of the disease. The Personal and Environmental Hygiene Survey (Dengue Fever and SARS) commissioned by DH in 2003 identified behaviours for improvement such as "applying mosquito repellent to exposed body parts" and "installing mosquito nets in non-air-conditioned rooms".

6.2.5 Capacity building and training

Surge capacity needs to be enhanced to ensure adequately trained professionals in dealing with emergency situations involving dengue fever. Appropriate training on clinical management, epidemiology, entomological as well as public health aspects for the prevention and control of dengue fever should be provided for clinical, public health, and other related professionals. Such training may involve overseas clinical attachments in countries that have ample experience in dealing with the disease.

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ANNEX 1

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PERSONAL AND ENVIRONMENTAL HYGIENE SURVEY (DENGUE FEVER & SARS)

Executive Summary

Commissioned by

Central Health Education Unit
Department of Health

April 2004

衞生防護中心 Centre for Health Protection

衞生署 Department of Health

Executive Summary

Introduction

The Department of Health (DH) commissioned the Social Sciences Research Centre (SSRC), the University of Hong Kong, to conduct a survey on personal and environmental hygiene. The objectives of this survey are:

a) to examine public awareness of the health campaigns for prevention of dengue fever and SARS;
b) to examine public knowledge of and attitude towards preventive measures for dengue fever and SARS;
c) to monitor public practices of preventive measures for dengue fever and SARS; and
d) to identify factors influencing the adoption of these preventive measures.

Research Methodology

The survey was conducted by telephone interviews. A bilingual questionnaire with 68 coded questions was used to collect the data. Telephone numbers were selected by random sampling using the SSRC's Computer-Aided Telephone Interview (CATI) system. Eligible respondents were individuals aged 12 years or above who had their birthday most recently and were at home at the time of the interview. The fieldwork was carried out from December 1 to December 30, 2003. A total of 3163 successfully completed interviews were conducted and the response rate was 71.2%. Data analyses were performed by using SPSS for Windows version 11.5. Statistical testing was applied to study sub-group differences and factors associated with preventive measures.

Key Findings of the Survey

A slight difference in gender, marital status, education level, and occupation was detected between the sample and the 2001 Population Census data. Over half of the respondents were females (56.3%) and single (50.2%). About three-fifths (63.8%) had education up to secondary school level and one-fifth (23.3%) had tertiary level or above. The working group composed 44.1% of the sample. The largest group of respondents were from the $10,000-$19,999 household income group (29.6%), followed by the $20,000-$29,999 household income group (20.7%).

Section 1 Dengue Fever

Knowledge of dengue fever

Many respondents in this survey had good (31.9%) or fair (59.6%) knowledge

of dengue fever. Nearly all of the respondents (95.8%) correctly identified mosquito bites as the transmission route for dengue fever. Many respondents (85.6%) knew that travelling to tropical and subtropical areas would be most likely to catch dengue fever. Suffering from high fever for 3 to 5 days was recognized by 85.8% of the respondents as a symptom of dengue fever, followed by severe headache (44.2%), pain behind the eyes (24.6%), and skin rash (23.8%).

Many respondents stated that preventing mosquitoes from breeding (84.4%) and preventing mosquito bites (64.0%) are effective preventive measures against dengue fever. Half of the respondents (49.5%) wrongly believed that there is a vaccine for dengue fever. 62.2% of the respondents knew that there would be a fine for allowing mosquitoes or insects to breed in stagnant water.

Attitude towards dengue fever

The majority of respondents (90.2%) did not agree that the consequences of mosquito bites were not serious and preventive measures were not necessary.

Risk perception of dengue fever

Respondents' perceived likelihood of catching dengue fever outside Hong Kong was slightly higher than that in Hong Kong. While 89.8% of the respondents said that they would be likely or very likely to contract dengue fever when travelling aboard, 84.5% said that they would be likely or very likely to catch the disease in Hong Kong. A high proportion of respondents (92.6%) believed that it would be likely or very likely for them to survive the illness if they caught dengue fever.

Practice for dengue fever prevention

Many respondents had carried out dengue fever preventive measures in the past three months. 96.3% of the respondents put refuse that could accumulate stagnant water into a litter bin. 85.4% of the respondents kept all drains free from blockage. 67.0% covered all water containers, water storage tanks or wells properly. 65.6% changed water for flowers or plants at least once a week and 60.7% removed stagnant water under flower or plant containers. Actions frequently taken by respondents to prevent mosquito bites included wearing long-sleeved clothing and trousers (65.5%) and avoiding scrubby areas (59.6%).

Applying mosquito repellent to exposed parts of the body (42.6%) and installing mosquito nets in non-air-conditioned rooms (18.0%) were less commonly practised by the respondents.

The main reason for not taking preventive measures against dengue fever was

that respondents thought that it was not necessary to carry out preventive measures. Other reasons cited by respondents for such hindrance included "no mosquito", "no such habit", and "too busy".

Awareness of dengue fever prevention information

Nearly all of the respondents (97.0%) were aware of dengue fever prevention information in the past three months. Many of them usually obtained such information through television (TV) advertisements/Announcement of Public Interest (63.7%), TV news (54.7%), and newspapers (42.0%). Among the 5.5% of the respondents who obtained dengue fever prevention information through websites, 43.9% visited the website of the Department of Health.

Opinion about Government's efforts in providing dengue fever prevention information

Three-fifths (60.1%) of the respondents were satisfied with the Government's efforts in providing dengue fever prevention information, whilst 6.0% were dissatisfied. The main areas of dissatisfaction cited by respondents were "insufficient advertisements" and "news and information on dengue fever were not well covered or clear".

Section 2 SARS

Knowledge of SARS

The results indicate that respondents' knowledge of SARS was good, with 66.3% of the respondents having good knowledge and 29.5% having fair knowledge. SARS is transmitted by respiratory droplets. Many respondents (72.0%) correctly identified this as the transmission route for SARS. When respondents were asked about the symptoms of SARS, 92.8% of the respondents named fever as a SARS symptom, followed by cough (60.5%), shortness of breath (57.5%), and headache (44.2%).

Respondents stated that a mask should be worn when one is having symptoms of respiratory tract infection (88.1%), visiting the sick in hospitals (83.4%), having had close contact with SARS patients (75.8%), and taking care of patients with respiratory infection symptoms (75.8%). Over three quarters of the respondents knew that the surgical mask and N95 mask are effective in preventing SARS.

Risk perception of SARS

Over half of the respondents (52.8%) perceived that it would be likely or very likely for them to catch SARS. However, most of the respondents (78.7%) were confident that they would survive the illness if they caught SARS.

Practice for SARS prevention

Most of the respondents had carried out preventive measures to prevent SARS in the past three days. Preventive measures frequently taken by the respondents included covering the mouth and nose when coughing and sneezing (94.3%), washing hands after coughing, sneezing, or nose cleaning (89.3%), using liquid soap when washing hands (89.2%), avoiding using public towels (82.8%), and washing hands after touching public objects (70.0%). Other preventive measures often practised at home included keeping toilets clean and working properly (99.1%), maintaining good indoor ventilation (98.0%), making liquid soap always available for washing hands (96.1%), and cleaning home everyday (70.9%).

Using serving utensils when having meals with others (45.9%) and eating with family (20.9%) were less frequently practised by the respondents. Only 9.2% of the respondents reported wearing a mask in the past three days.

The reasons for not taking preventive measures for SARS prevention were that respondents believed that it was unnecessary and too troublesome to do so. Another reason was that they did not have such habit.

Perception of changes in hygiene conditions after the SARS outbreak

Many respondents reported an improvement in their personal hygiene (61.6%), home hygiene (56.8%), and the environmental hygiene of Hong Kong (80.0%) after the SARS outbreak.

Awareness of SARS prevention information

The Government's efforts in disseminating SARS prevention information have been successful. Almost all of the respondents (97.7%) were aware of the information about SARS prevention in the past six months. Respondents usually obtained such information through TV advertisements/Announcement of Public Interest (64.8%), TV news (64.0%), and newspaper (52.7%). Among the 9.9% of the respondents who learned about SARS prevention information through websites, 51.3% visited the website of the Department of Health.

Opinion about Government's efforts in providing SARS prevention information

About two-thirds (64.0%) of the respondents were satisfied with the information provided by the Government on SARS prevention and 7.1% were dissatisfied. The main areas of dissatisfaction cited by respondents were "news and information on SARS were not well covered or clear", "the

Government was not responsive to the issue", and "insufficient advertisement".

Section 3 Environmental Hygiene

Information on environmental hygiene

The majority of respondents (89.9%) knew that the fixed penalty for littering in Hong Kong is $1,500.

More than half of the respondents (51.4%) said that the whole community should be responsible for maintaining a hygienic environment. 43.0% and 19.4% of the respondents said that it was an individual's and the Government's responsibility respectively.

Some important factors identified by respondents about maintaining and improving good hygiene in residential buildings were households' concern (38.4%), good personal hygiene (36.9%) and good building management (36.8%). A quarter (24.6%) of the respondents reported that they had cooperated with their neighbours to improve the hygiene of the public areas near their homes.

Demographic Breakdowns of the Results

The results found that good knowledge of dengue fever and SARS was associated with higher education level and household income. Working individuals, students, and those who were single had better knowledge of dengue fever and SARS. Females' knowledge of SARS was also better than males.

Females were more likely to think that mosquito bites are serious and preventive measures should be taken. More males perceived that they were likely or very likely to survive the illness if they caught dengue fever. More males also perceived that they would be likely or very likely to catch SARS and to survive the illness. Perceived likelihood of catching and surviving these two communicable diseases was associated with education level, occupation, and household income.

Females and married persons took more preventive measures against dengue fever and SARS. The practice of many dengue fever preventive measures was associated with higher education level and household income. But the pattern was different for SARS preventive practices. People who were less educated and who had lower household income generally carry out more precautionary actions to prevent SARS. Working individuals and students were more likely to carry out dengue fever preventive measures, whilst non-working individuals were more likely to carry out SARS preventive measures.

Awareness of dengue fever and SARS prevention information was associated with higher education level and household income. Working individuals' and students' awareness was better than non-working respondents'. Those who were single were more likely to be aware of SARS prevention information.

Age and occupation were associated with respondents' satisfaction level with the Government's efforts in providing dengue fever prevention information, whereas age, gender, marital status, and occupation were associated with respondents' satisfaction level with SARS prevention information.

Factors Influencing the Practice of Preventive Measures

Logistic regression modelling was used to examine the factors of some of the preventive practices of dengue fever and SARS.

Occupation was a significant determinant of the practice of wearing long-sleeved clothing and trousers. Gender, marital status, knowledge and risk perception of dengue fever were significant factors influencing the use of mosquito repellent to exposed parts of the body. Marital status and household income were determinants of installing mosquito nets in non-air-conditioned rooms. Gender, education level, and household income were factors associated with the practice of avoiding scrubby areas.

Gender, education level, and household income were factors influencing the use of serving utensils when having meals with others. Gender, marital status, and household income were significant determinants of the practice of washing hands after touching public objects. Marital status, education level, and occupation were factors in determining the practice of cleaning home everyday.

Conclusion and Recommendations

The Government has been successful in the public health education campaigns as shown by the public's good knowledge, awareness, and practice of preventive measures of dengue fever and SARS. This can be attributed to information and health guidelines on these diseases disseminated to the public. The majority of people are satisfied with the Government's efforts and they realize that maintaining a hygienic environment cannot be achieved without the effort of the whole community.

Comparing the present survey results with the findings of the previous survey on dengue fever conducted in 2002, it shows that there is an improvement in people's awareness, knowledge, attitude, and behaviour in relation to dengue fever prevention.

Dengue fever and SARS are emerging communicable diseases which are

potentially life-threatening. It is important to maintain good personal and environmental hygiene in order to prevent the outbreak of these diseases. With the knowledge of the public's practice of preventive measures and factors influencing their decisions in taking those precautionary actions, the Government will be able to evaluate the effectiveness of its work and to improve its public health education based on the needs of the public. The Government may need to put more emphasis on promoting the less commonly practised dengue fever and SARS preventive measures. Moreover, the Government has to educate working individuals and students about the importance of taking SARS preventive measures because they are less likely to carry out SARS preventive practices. Their good practice is important to prevent the spread of SARS since they are exposed to many people and different environments. Making health information easier to understand and more accessible can help increase the public's knowledge and awareness. Arranging more community cleaning activities in estate can also increase people's awareness that keeping a clean and healthy environment requires cooperation from everyone. This may also help people to turn it into a routine practice. Maintaining a hygienic environment does not depend solely on the Government. Effective disease prevention and control cannot be achieved without the cooperation of the community.

ANNEX 2

WHO's Mission Report on Dengue Situation in Hong Kong

The full report may be downloaded at the following website:
http://www.chp.gov.hk/files/pdf/grp-dfmissionreport-en-2004052100.pdf

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CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The writer conducted a retrospective review of the available reports provided by the Department of Health and by the Food and Environmental Hygiene Department on the dengue fever situation in Hong Kong from September to October 2002. The writer attended several briefings and discussion sessions involving key personnel from both the Department of Health and the Food and Environmental Hygiene Department and field visits were made to areas where local dengue cases had been reported.

The case surveillance and epidemiological investigations done by the Department of Health following reports of the first dengue case at Ma Wan construction site were done well and resulted in the detection of more cases in Ma Wan and subsequently in Kowloon and the other parts of the New Territories. There were two transmission foci involved in the outbreak; the first in Ma Wan and nearby Tsuen Wan in the New Territories and the second in So Uk Estate in Kowloon. The rapid response organized by the Food and Environmental Hygiene Department was effective in preventing the spread of dengue from these two foci even though the vector control staff involved had little prior experience in dealing with dengue outbreaks.

The outbreaks in Ma Wan, Tsuen Wan and the So Uk Estate mark a major change in the pattern of dengue transmission in Hong Kong. Prior to these outbreaks only imported cases had been reported. However, it is likely that a low level of silent transmission had existed for some time but the necessary combination of factors needed for an outbreak had not been present. With Hong Kong's position as a communications hub for Asia, the virus must be

continually carried in by visitors and residents infected overseas. It is likely that weather and other factors had led to a high density of *Aedes albopictus* in the area around the Ma Wan construction site which when combined with the arrival of a worker carrying the virus was enough to result in local transmission. The virus was then carried to the other two receptive areas resulting in secondary outbreaks. It is highly likely that similar outbreaks will continue to take place on a more or less regular basis unless preventive measures are instituted.

The Department of Health and other government departments responsible for the environment should now concentrate on developing a coordinated programme for dengue prevention and control. The focus should be on two aspects: strengthened surveillance leading to the quick detection of dengue cases and vector control. Early recognition and confirmation of probable dengue fever cases will be the key to effective epidemic response and will require a heightened awareness by all medical and health staff. There is no doubt that *Aedes albopictus* is currently the sole vector of dengue in Hong Kong. Experience from Macau in 2001 has shown that this species is capable of causing localized dengue outbreaks when the population density is sufficiently high. Sound environmental management based on a thorough knowledge of key breeding places is required in order to reduce mosquito populations in all private and public areas. To be effective, source reduction must be based on active participation by all sectors of the community including construction companies, property managers, architects, and individual families. It is a complex problem requiring full community participation and it is best that the necessary actions to prevent future outbreaks be put in place now while the memory of the recent outbreaks is still in the minds of the public.

4.2 Recommendations

1) A system for the detection, investigation and rapid response to reported cases of dengue should be developed.

2) Required reporting of all suspected dengue cases must be strictly enforced. This should be based on a clear set of cases definitions.

3) All suspected cases of dengue should be serologically confirmed and all positive cases fully and quickly investigated.

4) Investigations should follow a standard procedure (Annex 3) using a form similar to the one attached as Annex 4.

5) Active case finding should be carried out in the immediate area around all confirmed dengue cases. Recognizing the difficulty of doing such case finding in a high density urban setting such as Hong Kong, at the minimum written notices should be given to all units in the same housing block that urges anyone having fever to seek immediate medical attention.

6) Vector surveys should also be done in the area around confirmed cases to determine the probable vector species and to identify and destroy key breeding sites.

7) The location of all confirmed dengue cases should be plotted on a map and the coordinates entered into a Geographical Information System (GIS) that incorporates routine vector surveillance. That database will facilitate spatial and temporal analyses leading to the identification of possible "hot spots".

8) Current methods for vector control during outbreaks should be re-evaluated, particularly the use of ULV and thermal fogging.

9) A comprehensive larval survey should first be done to identify the key breeding places that should then be the target for ongoing vector control operations.

10) Considering the general lack of useful *Aedes* indices which can be used as predictive indicators, and given the housing structure in Hong Kong, the current use of the ovitrap index as the basis for monitoring Aedes mosquitoes should continue.

11) Localities selected for the ovitrap survey should be further stratified based on epidemiological-ecological characteristics and this should include the housing estates, outreach villages, vacant lands adjacent to the housing area, the public parks, schools and hospitals.

12) The area selected for ovitrap survey should be mapped and location of the ovitraps indicated. Specific targets (ovitrap index) for each area should then be determined to assess the level of control achieved. A stringent target should be

considered in the public housing estate due to its dense population density and greater epidemiological risk for dengue transmission. Any land reserve far from the human habitation should be excluded from the survey. If there is an increase in the readings, control operation should be mounted in the area immediately.

13) Due to the type of housing in Hong Kong and the labour-intensive nature of house-to-house searches for *Aedes* breeding to identify blocks of flats which are likely harbouring *Aedes* mosquitoes, the use of enhanced ovitrap (10% infusion) should be evaluated. The layout of this enhanced ovitrap in the block of building should be carefully evaluated. Strategic location and level in the block of building should be taken into consideration. To lay the trap only on the ground floor of the block would not represent the true condition of *Aedes* breeding in the block of housing. The presence of positive ovitraps would be justified for an indoor inspection on breeding sites. Feedback will then be provided to the inhabitants (or management) to generate their vigilance in source reduction.

14) All ports of entry including seaports, airport and vessels cargo wharfs should be spot-checked and the ovitrap should be used to detect the possibility of importation of *Aedes aegypti* into Hong Kong. Construction sites should be under strict surveillance and enforcement of legislation to ensure mosquito free. Pest control operators should be trained and their quality of work assessed by the Pest Control Advisory Section. All the picnic areas of the country park where people congregate should be ensured *Aedes* free.

15) The Food and Environmental Hygiene Department should take a leading role in the Interdepartment Coordination Committee for dengue prevention and control. Greater support should be provided by the Department of Health to ensure its sustainability. In *Aedes albopictus* control larval source reduction is of paramount importance. Clear technical guidelines on how to eliminate the possible breeding sites in the respective areas of jurisdiction should be provided for each members of the committee and regular training, assessment and meetings should be convened.

16) The current intensive health education programme of dengue prevention should be assessed. In addition to using telephone interviews to assess the level of knowledge, attitude, belief and practice (KABP) on dengue and *Aedes*

mosquito, spot surveys of selected households should be done on the measurement of the behavioural change. Assessment of the effectiveness of the space spraying using enhanced ovitrap should be considered. Since the insecticidal effect of space sprays is immediate and transient, the adult mosquito population must be monitored on a daily basis. The assessment should be over a period of one week in a confined area where migration of the mosquito to the spray area is not possible. This can be done by laying the ovitraps in the centre of the sprayed area with at least 400 meters radius as buffer. The village in Ma Wan should be the priority area to assess.