

Minimizing the Global Threat of Dengue Haemorrhagic Fever: Implications from Taiwan's Surveillance, Epidemiological Findings and Public Health Policies

Chwan-Chuen King^{1*}, Ta-Chien Chan², Day-Yu Chao³, Chuan-Liang Kao⁴, Chia-Chi Ku⁵,
Yun-Cheng Chang⁶, Shu-Fang Chuang⁶, Tiger Zheng-Rong Li⁶, Tsai-Yin Yen⁶, Hui-Ying
Ko⁷, Jui-Hung Kao⁸, Tsung-Hua Tung⁷, Jeff Gwong-Jen Chang⁹, Anmol Chande¹⁰,
Estrella Irlandez Cruz¹¹, Duane J. Gubler¹²

¹. National Taiwan University, College of Public Health, ² Research Center for Humanities & Social Sciences, Academia Sinica, Taiwan, Republic of China (R.O.C.), ³ Graduate Institute of Microbiology and Public Health, National Chung Hsing University, TaiChung, Taiwan, R.O. C., ⁴ Institute of Epidemiology and Preventive Medicine, College of Public Health, National Taiwan University (NTU), Taipei, Taiwan, R.O.C., ⁵ Institute of Immunology, NTU, ⁶ Institute of Epidemiology and Preventive Medicine, College of Public Health, NTU, Taipei, Taiwan, R.O.C., ⁷ Institute of Epidemiology and Preventive Medicine, College of Public Health, NTU, Taipei, Taiwan, R.O.C., ⁸ NTU Department of Medicine, ⁹ Molecular Epidemiology and Immunochemistry Lab., Div. of Vector-Borne Diseases, Centers for Disease Control and Prevention, Fort Collins, Colorado, U. S.A., ¹⁰ International Center for Genetic Engineering and Biotechnology, Aruna Asaf Ali Marg, New Delhi, India, ¹¹ Dept. of Medical Entomology, Research Institute For Tropical Medicine, Filinvest Corporate City, Alabang, Muntinlupa City, The Philippines, ¹² Duke-NUS Graduate Medical School, 8 College Road, Singapore 169857

Background/Objective

The global epidemiology of dengue/dengue hemorrhagic fever (DHF) has shown: (1) a geographical expansion in the spread of dengue viruses (DENVs), (2) an increasing number of severe cases of DHF, (3) a high fatality of pediatric DHF cases in areas where control has failed, and (4) co-circulating multiple serotypes of DENVs in endemic areas. Reversing this epidemiological trend remains a serious target of global health.

Method

Surveillance is the most cost-effective strategy to detect the activities of DENV. Dengue surveillance in Taiwan includes airport fever surveillance, physician-based reporting, entomological survey, virological/serological surveillance, voluntary reporting, semi-active surveillance, and social surveillance

Result

We found that Taiwan's unique semi-active surveillance should be integrated with other surveillance systems at the earliest time period of epidemic season. Serological surveillance is most useful before occurrence of outbreaks. In Taiwan, DENV-1 caused large-scale epidemics whereas DENV-2 and DENV-3 were attributable to most severe epidemics. Since large-scale epidemics of DHF occur less often and DENV has not been endemic in Taiwan, we have the best chance to investigate the important factors contributing to emerging DHF cases. Integrating geographical information system (GIS), epidemiological investigation, viral serotyping/sequence analysis, entomological examination and immunological evaluation, this study found that DHF cases were more likely to occur in areas with elevated density of *Aedes aegypti*, longer duration of epidemic waves, higher proportion of residents susceptible to DENV, as well as areas with greater transmission intensity and lower herd immunity. All of these facilitate viral adaptation to human hosts with increasing replication and immunopathology.

Conclusion

In conclusion, surveillance efforts toward global control of DHF must integrate epidemiological characteristics with virological, entomological and immunological evaluations, through international collaboration.