Public health aspects of volcanic hazards; Evaluation and prevention of excessive morbidity and mortality due to natural disasters

This is a summary of the proceedings of sessions on Volcanic Hazards at the First International Symposium on Public Health in Asia and the Pacific Basin, held 3—11th March 1983, in Honolulu, Hawaii. The Symposium was sponsored by the Association of Schools of Public Health, the U.S. Public Health Service and the Centers for Disease Control (CDC), the World Health Organization (WHO), the South Pacific Commission, and the East—West Center of the University of Hawaii. The full proceedings are being prepared for publication. The Symposium was supported in part by: The Pan American Health Organization and The Amoco Foundation.

INTRODUCTION

Until we develop reliable and precise methods for predicting the location and time of onset; the nature, magnitude, and extent; and the frequency and duration of such natural phenomena as severe weather, earthquakes and volcanic eruptions, *primary* prevention of hazardous exposures may not be technically feasible (Macdonald, 1977; Walker 1982).

When primary prevention is not technically feasible, then public health officials must develop *secondary* preventive measures to recognize, evaluate and prevent excessive morbidity and mortality due to natural disasters such as explosive volcanic eruptions (Baxter *et al.*, 1982; Bernstein *et al.*, 1982, Green *et al.*, 1982; Merchant *et al.*, 1982). The proximity, size and vulnerability (e.g. the predisaster health status, public health resources and prior disaster experience) of populations at risk for natural disasters must be considered in predisaster planning and in response efforts. In addition, the various types of potentially hazardous physical (traumatic), biological (infectious), and chemical (toxic) exposures which may result directly or indirectly from a disaster may require medical surveillance and environmental monitoring of high-risk groups (Bernstein *et al.*, 1982; Buist *et al.*, 1983; Fraunfelder *et al.*, 1983; Olenchock *et al.*, 1983). The biological plausibility and public health importance of both delayed and acute effects should be considered, since more sophisticated methods of recognition, evaluation and secondary prevention may be needed for health effects which may become manifest after a period of prolonged latency (Buist, 1982).

THE HONOLULU SYMPOSIUM

The goals of the Symposium's technical and panel sessions and the subsequent WHO workshop were to: (1) characterize the hazards of explosive volcanic eruptions, including an introduction to the state of the art of monitoring and predicting explosive volcanic activity; (2) discuss the previous multidisciplinary efforts of geologists, social scientists, toxicologists, physicians and public health officials in providing assistance to affected populations; and (3) describe the state of knowledge, the problems, and the research needs in each of these groups regarding the public health aspects of explosive volcanic eruptions.

A major disaster may be quite complex in terms of its potential impact on safety, health, and well-being — the three components of WHO's definition of "health."

The general classes of volcanic hazards and some of the biologically plausible adverse effects on safety, health and well-being within each class are outlined in Table 1. Volcanic hazards may be characterized by their impact on health as *direct or indirect* and by their time of onset as *immediate or delayed.*

The central theme of *secondary* preventive approaches in natural disasters is that, although *primary* prevention of the exposure may not be technically feasible (the source being an unpreventable and relatively unpredictable volcanic eruption), it may be possible to reduce the short- and long-term adverse impact of such a disaster through appropriate multidisciplinary planning and response and relief measures.

In the technical session, **the acute hazard potential** and distribution of active volcanoes in the circum-Pacific region were described. The area includes 238 (87%) of the 275 most active and dangerous volcanoes that have erupted during historic times. Of these 39 (18%) are on the Japanese and Mariana Islands and 37 (17%) are in Indonesia. About 30 to 40 explosive eruptions occur each year around the rim of the Pacific (the "Ring of Fire"). Although most of these are small and occur in uninhabited areas, several each year are large enough to destroy nearby settlements.

In the past 20 years, fatalities and considerable socio-economic disruption have resulted from ten eruptions at nine Indonesian volcanoes. Five of the eruptions were on Java, a crowded island about the size of California but inhabited by 90 million people with high levels of malnutrition and endemic diseases (especially tuberculosis and other respiratory diseases).

In the period 1600—1980, about 160,000 deaths (67% of those for which data exist) have resulted from volcanic eruptions in Indonesia; 32,000 (13%) in the Caribbean Region; 19,000 (8%) in Japan; and only 30,000 (12%) in all other areas of the world. Pyroclastic flows (high speed blasts of hot gases and ash), volcanic mudflows and ashfalls are the most frequent causes of mortality. However, in a few eruptions, enormous numbers of deaths occurred because of starvation and disease or tsunamis. It is of interest to compare the magnitude of fatalities caused by volcanic eruptions with the overall impact of natural disasters: