CHAPTER 11.
COMMUNICATIONS AND TRANSPORT

Effective management of health relief requires access to and control of adequate transport and communication. Because the health sector's resources are usually insufficient to meet those needs, advance planning is particularly important to ensure that other institutions and sectors provide sufficient support in the event of a disaster. As part of pre-disaster planning, the Health Disaster Coordinator should make arrangements with entities such as the ministries of transport, public works, and communications; the armed forces; nongovernmental organizations; private passenger and freight transport companies; private and state telecommunications companies; and ham radio operator clubs.

Responsibility and coordination for emergency government transport and communications should be centralized in a single office of the National Emergency Committee, which can coordinate their use for defined relief needs. The importance of developing a good working relationship with national telecommunications agencies and/or private sector telecommunications service providers cannot be overemphasized.

TELECOMMUNICATION

Adequate emergency communication facilities are essential for maintaining rapid and reliable contact with health facilities and relief personnel in the field, as well as with governmental, nongovernmental, private, and international agencies involved in the relief effort.

In most countries, the government allots specific radio frequencies and equipment to the military, fire and emergency services, police, ham radio operators, the private sector, and others in accordance with standards established by the International Telecommunication Union (ITU), a United Nations agency.

Telecommunication technologies and services have undergone tremendous growth during the past decade. Voice messaging, cellular and satellite telephone, and teleconferencing are among the options offered by an increasing array of service providers. The administration of telecommunications assets and services also has changed. State control has been ceded to private companies in some countries; in other cases, State and private companies cooperate in managing the system.

Reliable, low-cost service is still not available everywhere in the world, however. The increased recognition of how vital communications services are, both nationally and internationally—which has been fueled by new portable satellite services

and the enormous popularity of the Internet—offers the hope of expanded accessibility of telecommunications. Following is a brief overview of available services and their reliability and usefulness to disaster managers.

Radio Communication

Radio systems offer many advantages in disaster situations. However, while operating costs are low, the costs of installing and maintaining an efficient system can be high. In most countries, fire and emergency medical systems, military, police, and related institutions maintain some type of radio link, although each service will tend to operate its system independently of others. The health sector should ensure its connection to the national system or systems, and take advantage of the technical expertise offered by capable personnel. There is a wide range of available technology and possible uses, which are summarized below.

High Frequency (HF) Single Sideband (SSB) Radio

Disaster managers in the field most frequently use HF radio to communicate over long distances. This communication is point-to-point and permits voice and low-speed data communications between and among fixed installations at field headquarters and regional offices. Mobile HF SSB units can be used in a similar manner (although by definition, "mobile" units are considered to be permanent installations in vehicles), as can transportable units, which are integrated communications packages designed to be deployed at single locations upon short notice.

A significant advantage of HF SSB networks is that hardware costs are minimal (US$ 4,000–US$ 5,000 for the basic components of a voice-and-data system), and use is free. A disadvantage is that, because of its wide use, it is difficult to get allocation of the dedicated HF frequencies required to operate the system. HF transmissions are also subject to propagation effects that occur daily and seasonally.

Effective distance of HF voice communications ranges from 2,000–3,000 km to 10,000 km, which is usually sufficient for communications between field operations and national headquarters. The use of advanced technology (e.g., the Pactor Level 2, Clover, and other data modes) along with the use of enhanced modems permit effective data communications worldwide.

Very High Frequency (VHF) Hand-Held Radio Communication

For short distance communication (within cities and within geographic regions of approximately 100 km) use of VHF hand-held radios is ubiquitous among national authorities, United Nations agencies, and NGOs for communication among staff. As are HF radios used for longer distance, VHF radios are relatively inexpensive to purchase and free to operate. However, the use of VHF equipment is subject to the delivery of a license with a limited number of assigned frequencies, a process requiring a significant amount of negotiation with local telecommunications authorities. In the absence of regular telephone communication, VHF radios provide a basic and vital administrative function. Another important function is security, as it is possible to maintain contact with staff traveling from one part of a city to another.

Amateur Radio Operators

Amateur, or "ham" radio operators have historically been the first to establish and operate communications networks locally for governmental and emergency officials during and immediately following a disaster. Amateur radio facilities can generally be characterized as having a high survival capability. Although amateur radio operators are most likely to be active after disasters that cause power outages and destruction of telephone lines, they frequently support the delivery and relay of pre-disaster and warning information. Amateur radio operators are generally well-motivated, willing, and prepared to work under extreme conditions encountered during acute emergencies, where both solid technical knowledge and the ability to improvise are required. Although most operators belong to organized groups and show a great sense of discipline and responsibility, the accuracy of their reports may vary widely. Direct, close coordination of these groups by emergency telecommunications managers is critical to avoid the danger of transmitting inaccurate, unconfirmed, or unreliable information.

Governments license amateur radio operators in most countries. Some governments severely restrict the use of amateur radio operators. The International Amateur Radio Union (IARU) coordinates the activities of amateur services and actively supports their introduction in those countries where their value has not yet been fully recognized.

Radio Paging Service

Radio paging is increasingly common in most countries. Its coverage can range from local to international and it is of unquestionable value to disaster managers. Access to and reliability of these systems during disasters depends on a variety of factors ranging from the availability of telephone, cellular, and/or satellite lines to interconnect and operate the system, and the availability of independent sources of electrical power, to the quality of the actual paging transmitter.

While the majority of paging systems are one-way and do not guarantee delivery to the recipient, 1½-way (message receipt acknowledgment) and two-way systems are emerging, often with electronic mail links.

In countries where there is sizable GSM (mobile telephone) penetration, traditional paging systems have been supplanted by the SMS (short message service) which is built into GSM protocols.

Although limited resources may not make it possible to routinely use pagers, if paging service is available, it may be advisable to lease the service for essential personnel in disaster situations. It must be kept in mind that most radio paging services rely on terrestrial infrastructure which is vulnerable during disasters. This is the case to a lesser extent with satellite-based paging systems.

Terrestrial Telecommunications

Traditional terrestrial telecommunications services, the most characteristic of which is telephone service provided via telephone wires, have been costly to install, difficult to repair, and vulnerable to disasters, particularly in remote areas of developing countries. If even one telephone pole is incapacitated in a terrestrial

network, all communications past that point are affected until that pole and its connection to the system can be repaired. Thus, although they may play a role in disaster planning and early phases of warning, terrestrial communications cannot be relied on for continuous use during the disaster onset and in the acute phase of disaster response.

Even if the telephone system is not damaged by the disaster event, it is likely to be made unreliable or unusable because of heavy demand by the affected population. Outages due to overloaded circuits can last anywhere from several hours to several weeks. Dial tones, too, can be affected by power outages and overloads and can be a further obstacle to disaster management.

Health sector disaster managers should develop and maintain good relationships with local and national telecommunication service providers and work with them to develop disaster services and emergency protocols based on the infrastructure at hand.[1] National governments should be encouraged to strengthen their terrestrial telecommunications infrastructure and to make it resistant to the type of hazards present in their countries.

Satellite Communications

Fixed Satellite Service

Early satellite communications service and infrastructure were developed first within large urban areas. Then, through rapid advancements in space technology, population centers were connected. Early communication satellites developed in response to the demand for their services.

The phenomenon of television resulted in increased requirements for greater satellite capacity which was, again, dedicated largely to population centers. Because the technology of these early fixed satellite services did not provide for powerful transmitters, large, complex, and expensive earth stations had to be used to receive and send signals from and to the satellites. They were used as regional or national gateways for major telecommunications trunking services and for television distribution. They are still, for the most part, limited to communications within and between capital cites and large urban areas.

Space segment providers and satellite designers soon recognized the need to reduce the size and expense of the ground hardware and launched a new generation of services that relied on more versatile and powerful satellites. Because these new satellites transmitted more powerful signals, the new ground hardware size and power requirements were significantly reduced.

The capital cost for hardware and the recurrent cost of satellite time were also reduced. In practical terms, this meant a move from stationary earth stations to transportable (*not* portable) systems. These changes in service made possible the advent of very small aperture terminals, or VSATs. The applicability of VSAT services could include linking, in a permanent or semi-permanent network, national health sector disaster managers. This is still costly and it must be remembered that, as with terrestrial telecommunications links, fixed satellite service infrastructure is

[1]See Mark Wood, *Disaster Communications Manual*, available in print from The Disaster Relief Communications Foundation or on the Web at http://www.reliefweb.int/library/dc1/dcc1.html.

susceptible to damage or destruction at the onset of the disaster. Unlike its terrestrial counterparts, however, if one link goes down, all others are not affected.

Global Mobile Personal Communications by Satellite (GMPCS)

In the near future there will likely be dozens of low earth orbit (LEO) satellite systems covering the entire world in addition to the existing geosynchronous satellite networks. They will consist of from 1 to as many as 325 satellites per system and will be a part of a new category of service, GMPCS. These systems offer disaster managers the promise of easy-to-use, reliable, and affordable communications, regardless of the nature of a disaster, its location, or the terrain of the affected area.

These systems will have a wide range of capabilities ranging from narrow band (data only) to broad band (allowing video, voice, and data) communications. GMPCS technologies will likely be of such low cost as to be affordable to all sectors and, thus, should be of great interest to health sector managers.

Despite their promise, in the near-term disaster managers should be cautious when deciding what new and emerging technologies to use and invest in. It is advisable to explore a mix of technologies, including, but not limited to, new GMPCS services until such time as their strengths and weaknesses have been proven.

Mobile Satellite Service

Mobile satellite services were first developed for maritime applications and now are broadly used for aeronautical and land-based purposes. Mobile satellite services are less expensive than traditional fixed satellite services. They are easily transportable and are not dependent on the terrestrial telecommunications infrastructure. They are far less vulnerable to natural disasters and, because they can be used reliably to send data or call anywhere in the world, their use in the field has grown rapidly.

Although lower in cost, they are not inexpensive, and are still used almost exclusively by United Nations agencies and larger NGOs. Although some national/domestic systems are available, the most widely used is that developed by INMARSAT, an international consortium. Costs range from US$ 4,000–US$ 35,000 for hardware and US$ 1–US$ 13 per minute for use.

Additional systems at either end of the technology and cost spectrum are rapidly becoming available. These range from Iridium, featuring hand-held telephones that allow for voice calling from anywhere in the world, to Orbcomm, which offers worldwide low data messaging and data collection from fixed sites or hand-held units.

Electronic Mail Services

Communication by electronic mail has undergone explosive growth. Initially, it was possible to communicate within closed networks, but with the opening of the Internet to the civilian world, millions of individuals and institutions can exchange information from almost any point on the planet. Electronic mail requires a computer with a modem, access to telephone or other telecommunications service, an Internet account, and some training.

The Internet is very useful not only in the immediate post-disaster phase, but also in prevention, preparedness, and mitigation aspects of disaster management.

It is inexpensive to use compared to traditional communication systems. The service makes it possible to contribute to and use information on Web sites about disasters; form and participate in discussion groups and "virtual" conferences among institutions worldwide; and send documents and graphics. It allows free exchange of information among interested parties, with a minimum of bureaucratic restrictions.[2]

It should be understood, however, that most Internet Service Providers rely on terrestrial telecommunications infrastructure, making Internet service vulnerable during disasters. This is an issue not only in terms of the Internet's reliability as a communications tool, but also because Internet users have become accustomed to "storing" valuable data on the servers of their Internet Service Providers and the safety of this data may be in jeopardy during disasters.

Teletype

Teletype is a well-known system, but it has been largely superseded by other systems in emergency communications because of high cost and slow transmission speed. It is still used in certain areas, such as in banking, since it offers security in certain types of data transmission. Availability and access are limited, and its use in emergency situations should not be considered.

Donated Radio Communication Equipment

After a major disaster, there may be an outpouring of offers of donations from countries, organizations, and businesses. Supplemental radio equipment is sometimes included in these offers, but often the radio units are delivered well after they are needed. To make sure that the equipment is of use in the disaster, the donor should be informed of certain technical characteristics, such as: transmitting and receiving frequencies; output requirements (wattage); the country's voltage and amperage; number and type of units needed (hand-held, mobile, base stations); type and quantity of antennas; necessary material for installation (coaxial cable, tools); and the need for specialized personnel.

It is important to keep in mind that radio communications are affected by many factors, and therefore are never completely reliable. Geographical features, atmospheric conditions, urban density, electromagnetic radiation from power transmitters, condition and quality of antennas and transmission cables, quality and capacity of equipment, as well as sunspots and solar eruptions, can all have a negative effect on communication quality. All communication systems are dependent at some stage on radio: telephones have microwave links between central exchanges, and links with satellite; the Internet depends on links between satellites and earth stations; radio pagers depend on radio signals between the central exchange and the beeper. Disaster managers need to be aware of potential failures in these systems at the disaster planning stage. They must also have an inventory of equipment available.

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[2]Recommendations made at the Meeting on Health Crises and the Internet, held in Bogotá, Colombia, November 1997, can be viewed on the Internet (http://www.paho.org/english/ped/ped-internet.htm).

Effective communication after disaster does not depend only on the nature and quantity of equipment available. The willingness of authorities to exchange and communicate specific and detailed information to the public, other governmental agencies, and the international community is of primary importance.

TRANSPORTATION

As in the area of communications, the health sector should coordinate with national institutions for logistic support in transportation. It is crucial to identify the entity responsible for coordinating transport in emergency situations. Arrangements should be made during the disaster planning phase with the following: ministry of public works or transport, the armed forces, the police, public and private passenger and freight transport companies, shipping companies, airlines, and NGOs involved in disaster relief.

Frequently, these institutions or agencies provide vehicles in case of disaster, and the requesting institution covers the cost of fuel and the salary of operators. Airlines generally transport humanitarian relief supplies at a reduced cost. As part of disaster planning, the health sector should establish relations with selected entities, and identify necessary financial resources for operations.

Inventory of Resources

As part of pre-disaster planning, an inventory should be made of vehicles in the country or province that can be commandeered for relief purposes, and the institution providing them (e.g., ministry of health, social security, municipal health service, NGO, etc.). The inventory should specify the type of vehicles (with emphasis on collective transport, four-wheel-drive cars or trucks, and refrigerated vehicles); their maintenance and fuel requirements; their ability to transport personnel or cargo; location; and the names and contact numbers of persons responsible for authorizing use. The same inventory should include agreements made with public and private transport companies during the disaster planning phases, and names of contact persons. It is important to note that contracting vehicles locally must be done immediately in the event of a disaster, as competition among agencies for vehicles in good condition will be intense.

Transport Equipment Needs

Initial requirements for transportation usually focus on life-saving operations; transporting essential staff, equipment, and patients; conveying specialized personnel to assess and evaluate health status in the affected zones; delivery of necessary health supplies to treatment centers; removal of bodies and animal carcasses; clearing access routes to hospitals and health centers; and transporting international donor representatives and media personnel to and from the affected area.

The need for ambulances is often exaggerated. In the early life-saving phase, demand is very high and almost any vehicle is used. Multi-purpose vehicles where stretchers can be fitted are now routinely used by many organizations. The trans-

port of potable water and fuel are areas of special importance to continued humanitarian health operations.

Equipment Sources

Figure 11.1 shows possible uses and sources of vehicles and logistical support equipment that may be available for use in the period immediately after a disaster. The uses suggested depend on the actual situation (as with the use of boats in a flood), and potential sources will vary from country to country. It is often more realistic to rely on national and local sources rather than on international sources.

The Health Disaster Coordinator should give forethought to the logistical support required to carry out a relief operation. This includes fuels and lubricants, road-clearing and cargo-handling equipment, trained drivers, and vehicle mechanics. Mechanics are needed to ensure that the vehicles in emergency reserve are kept in operating condition.

FIGURE 11.1. Possible uses and sources of transport equipment available during immediate post-disaster period.

	USES													SOURCES					
Vehicle type	Survey of disaster	Transport health personnel	Evacuation	Supplies to staging areas	Supplies to/ within affected area	Removal bodies	Removal/burial animal carcasses	Transport media personnel	Road clearing	Water supplies	Fuel supplies	Supply handling	Epidemiological surveillance	Functional ministries	Military	Local commercial dealers	Private/ commercial ownership	Foreign agencies/ governments	Red Cross other NGOs
Ambulance																			
Utility 4-wheel drive																			
Pickup truck																			
Van/station wagon																			
Motorcycles																			
Medium/heavy trucks																			
Bicycles																			
Water tankers																			
Boats (river)																			
Barges (+ tugs)																			
Amphibious vehicles																			
Helicopter																			
STOL aircraft																			
Cargo aircraft																			
Amphibious aircraft																			
Fuel tankers																			
Bulldozers																			
Auto cranes																			
Animal transport																			