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Global public health and the information superhighway

Tomorrow, the world

New technology can vastly improve the accumulation and dissemination of information on public health.[1] Vice President Al Gore has written that the United States's current national information policy "resembles the worst aspects of our old agricultural policy, which left grain rotting in thousands of storage files while people were starving. We have warehouses of unused information 'rotting' while critical questions are left unanswered and critical problems are left unsolved."[2] This also reflects the status of global public health: we have vast repositories of "warehoused" information on health, nutrition, the environment, demography, and society. Telecommunication systems will give us access to this. Moreover, much of public health and prevention depends on the transfer of information, which telecommunication systems provide very cost effectively.

From Bitnet to Internet

Discussions about the applications of networking to health care have typically focused on the potential of networking to transmit data (in particular, images) and to reduce the cost of health care. But the vast potential of telecommunications to prevent disease has gone undiscussed.

Telecommunication networks began with electronic computer-to-computer correspondence among scientists.[3] In the early 1980s networks began forming among academic institutions; one of the first was a system called Bitnet (Because It's Time Network).[4] Although it linked institutions that granted degrees, Bitnet was handicapped because government agencies and industry were not represented. During the 1980s Internet evolved.[5] Internet represents a "meta-network"—a network of networks. It provided a way of joining many diverse networks, including those of governments and very recently industry.

The number of its users is growing by 12% a month: 10 million people in 91 countries now have access to the system. Internet was initially used for electronic mail and allows "bulk" mailings, with over 2500 electronic newsletters and 4000 discussion groups. Bulletin boards supply information of public interest, details of relevant meetings, and the like.[6]

In addition to these, Internet supports three tools to help find and retrieve files[5]: the gopher, the wide area information server, and the worldwide web. The gopher (from "go for") allows you to tunnel through "gopher space" to identify various databases. It provides a means to move through various layers of databases. With the gopher you can browse the card catalogue of the Vatican library, gain access to data on global weather, examine labour statistics, obtain publications from the United States government, and review pictures from art galleries.

While the gopher finds information by going through a series of menus, the wide area information server (WAIS) searches the full text of stored articles for keywords provided by the investigator. The third information server is the worldwide web (WWW), which is a hypertext information retrieval system. Hypertext joins documents through a preselected group of words and thus permits rapid linking of ideas.

In Krol's example[5] you could identify the specific title of a book (for example, J Last, *Public Health and Preventive Medicine*; subject: public health, preventive medicine). Hypertext would then allow you to obtain Dr Last's curriculum vitae (if this was available), his picture, and articles that he had published (through Medline). You could expand on the subject of public health, obtain the definition from a dictionary, identify papers on the topic, and enter databases on the subject in the public domain. Thus you "jump" from topic to topic on the basis of interest and need. All these systems and more can now be accessed using systems such as Mosaic, which allows access to picture, video, and sound.

Lessons from elsewhere

This is today; what of tomorrow? Given the technology that is already available, we could inaugurate a global health information infrastructure to improve health worldwide. Clearly, we cannot achieve this vision overnight; we need to progress systematically, collaborating with governments, learning from existing models, and selectively deploying technologies appropriate to host cultures and existing practices. As far as possible we must draw on lessons learnt from other wide area information systems, such as the National Aeronautics and Space Association Science Internet (NSI), which links the association's scientists worldwide with most of the world's networks. Perhaps a partnership with organisations such as this one, along with the strong support of national and international health organisations, can bring

standardisation, new perspectives and resources to a set of urgent global health problems.

The first step is to connect everyone in public health: without this a telecommunication system for global public health will fail. Public health organisations such as ministries of health, the World Health Organisation, the Pan-American Health Organisation, the United Nations, and public health and medical societies should encourage members to be reachable electronically.

Once local and global public health centres have been connected, how can these links be used? Obviously, computer based telecommunication will vastly improve communication owing to effective transmission of information. There are, however, several further possibilities for its use in public health.

Using links

Public health networking—Networking public health workers, including those in local health departments, academia, governments, industry, and private agencies, will bring great benefits. Information regarding what works (and what doesn't) can be transmitted almost instantaneously. Here is how the public health web might work in the case of an outbreak of cholera in Peru. News of such an outbreak could be almost instantaneously transmitted to Peru's minister of health, the Pan-American Health Organisation in Washington, the World Health Organisation in Geneva, leading experts in cholera working outside Peru, and people experienced in dealing with cholera outbreaks in Pakistan and Thailand. Information on improving water quality would be identified by use of the gopher. Technical reports concerning the control of cholera could be sent immediately to Peru. Linkage to medical libraries could provide immediate access to relevant information.

Global disease telemonitoring—With new epidemiological techniques such as capture-recapture and a telecommunications backbone, accurate estimates of incidences of important communicable and non-communicable diseases can now be obtained.[7 8] Data on registered cases can be sent nightly from the disease reporting centres to national centres. Rates adjusted for missing cases by using capture-recapture can be reported to international centres by Internet, with accurate information concerning the patterns of disease available almost daily. Issues such as confidentiality need to be worked out, but extraordinary potential exists for very accurate disease monitoring and forecasting in much the same manner as we monitor and forecast the weather.[9] Currently all countries in the Americas except Haiti are connected through Internet. Connections to Africa are rapidly being established, with integrated systems of telecommunication being developed in, for example, Zambia and Mozambique. No systematic integration of telecommunication and public health systems across countries has occurred.

On line vital statistics—All vital statistics (but especially births and deaths) could be entered electronically and be usable almost instantaneously. This would facilitate monitoring and forecasting of population growth and the health needs of mothers and children.

Environmental monitoring—Data systems for environmental monitoring have not been organised with user friendly databases that integrate environmental information with morbidity data as morbidity data for non-communicable diseases are poor.[7 -9] Linking global disease telemonitoring with environmental data would considerably improve our understanding of the environmental determinants of disease.

E-mail searches—Internet is already linked to the National Library of Medicine through Bitnis. Should someone in Bolivia be interested in having the library search for references on a particular topic the request and the results can be transmitted through Internet.

Public health gopher—We are establishing a public health gopher, which will allow people to roam through the existing sources of data relevant to public health. Gophers can also be developed for national data with a common set of querying commands to find data, reports, or other materials.

Distance education—Computer based distance education is rapidly improving. For example, networking of injury epidemiologists would allow electronic courses on injury prevention to be provided across the world. Reading materials, video, pictures, and sound could be transmitted across huge distances for low costs, and interaction would be possible. Students from several countries could work together to establish research programmes in public health. Health education might be targeted at those most in need—for example, maternal and child health programmes could send targeted messages to mothers and have mothers ask questions through media such as television. The links are being established between cable television and telecommunication systems. Hundreds of schools are already networked together.

On line journals—Much has been written concerning electronic journals and books and their potential for improving the dissemination of information. Manuals of operation and protocols for studies and public health actions could be made available for free and almost instantaneously through gopher servers.

Global public health needs to begin to plan for a public health communication system that can reach all the public health workers in the world. The first step is to network public health workers. It is time for public health to enter the electronic information superhighway.

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