# SECTOR COMPETITIVENESS FRAMEWORKS

# TELEHEALTH INDUSTRY

## PART 1 – OVERVIEW AND PROSPECTS

Industry Sector
Health Industries

Secteur de l'industrie
Industries de la santé

Canada

# TELEHEALTH INDUSTRY

## PART 1 – OVERVIEW AND PROSPECTS



PREPARED BY:
HEALTH INDUSTRIES BRANCH

This *Overview and Prospects* is the first of two companion documents on the Canadian telehealth industry in the **Sector Competitiveness Frameworks** series, which is being produced by Industry Canada in collaboration with Canada's key stakeholders in the industry. *Part 2 — Framework for Action* will be prepared in coming months, based on discussions with major industry stakeholders, following study and review of the *Overview and Prospects*.

The **Sector Competitiveness Frameworks** series focusses on opportunities, both domestic and international, as well as on challenges facing each sector. The objective is to seek ways in which government and private industry together can strengthen Canada's competitiveness and, in doing so, generate jobs and growth.

*Part 1 — Overview and Prospects* is being made available for distribution in printed as well as electronic forms. In all, some 30 industrial sectors are being analyzed.

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# FOREWORD

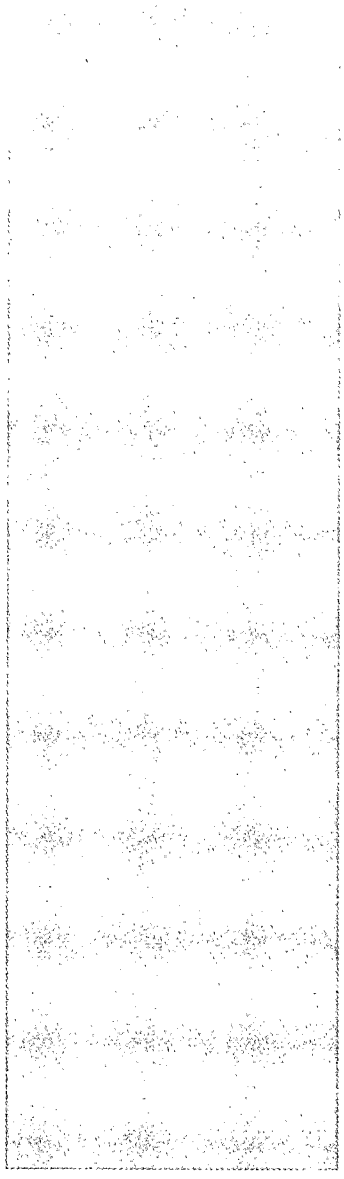
The new Canadian marketplace is expanding from national to global horizons and its economic base is shifting increasingly from resources to knowledge. These trends are causing Canadian industries to readjust their business approaches, and government must respond with new tools to help them adapt and innovate. Industry Canada is moving forward with strategic information products and services in support of this industry reorientation. The goal is to aid the private sector in what it is best qualified to do — create jobs and growth.

Sector Competitiveness Frameworks are a series of studies published by Industry Canada to provide more focussed, timely and relevant expertise about businesses and industries. They identify sectors or subsectors having potential for increased exports and other opportunities leading to jobs and growth. They cover 30 of Canada's key manufacturing and service sectors.

While they deal with "nuts and bolts" issues affecting individual sectors, the Sector Competitiveness Frameworks also provide comprehensive analyses of policy issues cutting across all sectors. These issues include investment and financing, trade and export strategies, technological innovation and adaption, human resources, the environment and sustainable development. A thorough understanding of how to capitalize on these issues is essential for a dynamic, job-creating economy.

Both government and the private sector must develop and perfect the ability to address competitive challenges and respond to opportunities. The Sector Competitiveness Frameworks illustrate how government and industry can commit to mutually beneficial goals and actions.

The Sector Competitiveness Frameworks are being published sequentially in two parts. An initial *Overview and Prospects* document profiles each sector in turn, examining trends and prospects. The follow-up *Framework for Action* draws upon consultations and input arising from industry–government collaboration, and identifies immediate to medium-term steps that both can take to improve sectoral competitiveness.



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**Note:** An extensive body of literature has been used to prepare this report on telehealth. The bibliography is contained in the electronic version of this report, which is available on Industry Canada's *Strategis* web site: **http://strategis.ic.gc.ca**

# 1 HIGHLIGHTS

Telehealth is the use of communications and information technology to deliver health and health care services and information over large and small distances. At a time when health industries and service providers are generally increasing their use of computers and telecommunications, there has emerged a new and rapidly evolving high technology market segment that is Canada's telehealth industry.

In June 1997, more than 300 Canadian companies were active in the telehealth business, of which 121 have registered themselves in Industry Canada's Canadian Company Capabilities database. These Canadian telehealth companies are either very large, such as computer manufacturers and telecommunications carriers, or small, such as software developers, consultants, or R&D or service providers. Many businesses are new: 20 percent of the companies were created in 1997. Employment in the telehealth private sector companies is estimated at around 1 700 people, mainly highly skilled professionals and technicians. The combined estimated annual revenue of these 121 companies is $330 million. The industry is growing quickly: the projected sales potential is $1 billion a year by 2000, with employment at 5 000 people.

Much of the basis for recent growth and prospects of the telehealth industry lies in the fact that telehealth is one avenue for maintaining quality health care in an environment where budgets are constrained/declining. Canada spent an estimated $75.2 billion on health in 1996, or $2 511 per person, representing 9.5 percent of the gross domestic product. A decrease of 0.6 percent was recorded in 1996, which is the fourth consecutive year of decline in spending (disregarding inflation).

Canada's health care expenditures do not include special budgets for telehealth. However, a brief overview of telehealth systems available on the market today indicates there are many telehealth applications that can — and increasingly are — facilitating or substituting for conventional health care procedures. Current Canadian telehealth projects are valued at an estimated $500 million. Provincial and federal governments will spend another $500–750 million on telehealth sites and projects over the next three to five years.

A good deal of the goods and services contained in the budgets for these projects is supplied by imports, either purchases from abroad or products distributed through Canadian subsidiaries. At the same time, Canada's emerging telehealth industry has reached annual sales levels of at least $330 million, made up of revenues from projects and programs in Canada plus substantial export activity.

## 1.1 Major Trends

Telehealth is an industry born of the confluence of information technology and telecommunications (IT&T), health care and medical technology. Each of these three sectors are currently undergoing transformations, although in quite different directions. IT&T is enjoying an accelerated period of growth, with rapid technological and regulatory changes combining with high employment and increased market opportunities. Health care and medical technology, on the other hand, have lately been subject to downsizing, not only in Canada, but also in most of the developed world.

Canada's early telehealth projects were driven by the need to deliver advice, diagnoses, consultations or education in the context of traditional medicine and education, linking tertiary care institutions in more populated centres with first-line health care providers in remote and isolated communities.

While these activities remain prominent, one of the most important trends in the telehealth industry today is that of integration of the various applications over one network, or in a series of interconnecting networks, as in regional or community health information networks (CHINs). Today, telehealth systems can be employed in many different settings by different users — researchers, specialists, nurses, home care workers, pharmacists, general practitioners and patients — and can be designed to span a range of health care applications to meet different needs using a variety of technological combinations.

Today, telehealth faces two major trends: increasing demand and technological advance.

### Increasing Demand

Depending on the type of application, several market drivers are influencing the industry:

- *An aging population:* The needs of aging health care consumers have initiated efforts to develop and adopt better telehealth systems outside institutional walls where they would be better geared for the home telecare industry.
- *Cost containment:* Telehealth systems are facilitating redistribution of health care services, cutting down on duplication, potentially helping to reduce the number of drug interactions and inappropriate prescriptions, reducing patient and professional travel and generally contributing to better productivity and reduced unit cost.
- *Access:* There is increasing demand for equitable access to health care services for inhabitants of isolated geographic areas (for example, in sparsely populated areas of Canada's North and in many parts of Latin America, China and Africa).
- *Demand:* The increasing consumer demand for wellness and health information of all kinds has fuelled increased access to the Internet and the World Wide Web.
- *Increasing sources of information:* The exponential increase in medical and health information has led to demands for better medical information management systems, faster and more efficient electronic access and better online research networks.

### Technological Advance

The following technological features distinguish modern telehealth activities from earlier developments:

- *Technology and its economic significance:* Computer hardware, other more powerful technologies and communications bandwidth are becoming available at decreasing costs.
- *Improved high-capacity IT&T technologies:* These include networks and high-speed interoperating technologies, and permit the integration of different applications within one network, as well as integration of telehealth projects within the context of the total health care system.
- *Private sector involvement:* In Canada, this now is more prominent than in past telehealth projects, facilitating technology transfer and commercialization.

Telehealth projects five to ten years ago were mainly driven by remote consultation needs (telemedicine) or distance health and continuing medical education (CME). But only 30 percent of today's Canadian telehealth projects are based on telemedicine. The largest number of start-up projects are concentrated on integrated health networks, one component of which may be telemedicine.

These evolutions have resulted in important changes for communities. Hospitals are being fused, downsized, shut down and modified to handle ambulatory care clients. The current era is also characterized by the linking of new technologies, by the provision of technologically mediated services directly to consumers, and by the gradual decrease in the role of the hospital as the central authority in health care in favour of electronically linking all services and participants in a community's health care system.

For the health care professionals, the central focus of this new era is the penetration of the electronic health record and the electronic or computerized patient record, of faster access to information even before it is published, and of more versatile desktop multimedia tools. New technology produces unmet educational and training needs at the same time as it offers more efficient means to keep up-to-date on developments in health. Health professionals at all levels need to keep pace with a growing number of new discoveries, developments, techniques and practices. CME provided by traditional means will never meet that demand. Telehealth networks facilitate distance education and tele-learning.

The world market for telehealth systems and services is expected to grow dramatically over the next decade. In the developed world, the most important growth area is expected to be in the home care market, where a range of devices and technologies can be substituted for services traditionally delivered in hospital settings, or by visiting home care workers. In the United States alone, more than US$26 billion was spent on home care in 1994. Canadian provincial government budgets for home care alone amounted to close to $1.5 billion in 1995–96. The U.S. National Association for Home Care projects a 13-percent annual growth in home care to 2005. In Canada, home health care has expanded by more than 15 percent annually over the past five years. With

closures of hospital beds and reduced in-patient stays for operative procedures, there is every reason to expect that Canada's future growth rate for home care will be at least as rapid as that in the U.S.

Profiles of telehealth companies in Industry Canada's database show that 30 percent depend chiefly on telehealth business. For companies whose primary sales activity is reported to be telehealth products and services, their annual sales per company are in the $1–5 million range, and they are most often staffed by 20 to 25 people. For this group, their combined sales are at least $130 million. Taking into account the telehealth sales of other companies whose primary business is in other fields, the Canadian telehealth industry amounts to a minimum of $330 million annual revenues. While many Canadian companies are too small or too inexperienced to bid successfully on larger projects in Canada, it is expected that some recent Canadian public initiatives will help stimulate the industry and improve technological capacity of Canadian companies.

## 1.2 Challenges, Issues and Barriers

By almost any measure, the telehealth industry in both Canada and the United States, even in its oldest and best-known form — remote telemedicine — has remained until recently a health services subsector with a small devoted set of pioneers, researchers and practitioners operating in an environment dependent on government subsidies and research and development (R&D) grants. As late as January 1996, the field was still very small and had not grown much since its origins some 30 or 40 years ago.

Despite proliferation of new applications, the size of Canada's telehealth industry is relatively small and undeveloped. This state of affairs may be attributed to a range of barriers and major issues confronting the private and public telehealth industry.

### Business Challenges

The industry is fragmented. Market distribution channels are absent and every firm entering this field does so at more than normal risk since there are few published market studies. It therefore remains difficult to make a business case for the adoption of telehealth systems.

Though a majority of the Canadian telehealth companies claim to be exporters, few are exporting telehealth products and services. In part, this reflects underdeveloped marketing capacity, including lack of familiarity with overseas markets and with foreign distributors for telehealth products. In addition, the shortness of the track record of many Canadian companies means a lack of knowledge abroad of much of Canada's telehealth capability.

While there is a demonstrated need for turnkey, trouble-free telehealth systems, there are very few companies capable of providing such services.

Stable financing is difficult to find for both the private and public industries.

Several smaller companies have either sold controlling interest or have struck viable partnerships with U.S.-based and overseas companies. Though this has advantages, it does mean fewer made-in-Canada technologies and products.

The federal government in its February 1997 Budget announced the creation of a health transition fund, which the provincial governments may use to help launch pilot projects including better approaches to home care. Fewer than 10 percent of Canadian telehealth companies are offering products and services in home telecare.

The evolution of telehealth-related technologies is so rapid that even small, young companies must invest with caution in any given product or system.

### Care Provider and Patient Challenges

The industry is in its infancy, and many potential users have little knowledge or experience in the field.

Some 30 percent of Canada's telehealth projects involve medicine-at-a-distance, but physicians might not be licensed nor remunerated for their telemedicine work.

Telephone triage systems allow nurse-practitioners to provide health care advice over the telephone. However, potential liability issues exist.

With ambulatory care on the rise, home care telehealth technologies could be adopted on a wider scale but few technologies are available in Canada, and few professionals are aware of the range of the technologies available.

Confidentiality, privacy and security on the health networks are still causing concern among patients and providers alike.

Over 80 percent of telehealth industry participants interviewed for this *Overview and Prospects* report stated that lack of common standards hampers the development of telehealth networks in Canada.

Good partnership models are needed to help private and public sector partners work together toward the implementation of successful telehealth systems.

## 1.3 The Bottom Line

Telehealth development is closely linked to the development and penetration of information and telecommunications infrastructures. Many challenges, however, have to be resolved in Canada and in many parts of the world before the telehealth industry can experience significant growth. There is a clear role for the public sector and private industry to play in addressing these issues and challenges by working together.

Growth of this industry depends on a number of factors. Close partnerships are required between the customer/purchaser/user and system or service providers, and between content and technological system. In many countries like Canada, these entities are located in separate public and private domains, but good working examples exist where the best of both sectors partner successfully. The best telehealth projects and sites combine expertise of health users together with the best suppliers of technological innovations.

The prospects for Canada's telehealth industry are positive, since there is excellent potential in this growth sector. Many new Canadian telehealth companies are being created and more are identifying telehealth as one of their activities, but too few of these enterprises are known to potential purchasers and too little is known about Canadian telehealth capabilities in general. Familiarity of foreign markets with Canada's competence needs to be strengthened if Canadian suppliers are to participate fully in this growing global market. Public sector institutions and resources assisting in export market development will need to be brought to bear even more in the future to assist Canada's telehealth industry to capitalize on market opportunities.

# 2 KEY POINTS ABOUT THIS INDUSTRY

There are many definitions of *telemedicine*. The one used in the guideline for companies registering in this field in Industry Canada's Canadian Company Capabilities (CCC) database is: "all forms of remote medicine: teleconsultations, telepathology, teleradiology, telepsychiatry, teledermatology, telecardiology and so on."

However, there are few definitions to aptly define *telehealth*, an integrating and more holistic term encompassing all of the telematics applications in health and health care. In Europe, the field is referred to as *health care telematics*. The definition of *telehealth* as "the use of communications and information technology to deliver health and health care services and information over large and small distances" reflects the changing nature of the twin fields of health and medical information on the one hand, and telemedicine on the other hand. Historically, these two fields operated separately but now are merging, not only because the technology is making it possible but also because current applications are making it necessary.

The telehealth industry encompasses practices, products and services bringing medical care and health information to remote locations. It extends the arm of the health care system for people at home and provides health services direct to consumers. It offers continuing medical and health education, and assists consumers in obtaining emergency assistance wherever they may be. Moreover, it incorporates health informatics and telematic applications, using communications technologies in association with monitoring and medical devices, emergency systems, health, medical and computer systems to transform and transfer medical and health content and deliver health care services, education and assistance at a distance. As defined, it embraces a wide range of traditional telemedicine practices with newer activities and applications combining medical and health informatics with telematics systems and applications.

## 2.1 One Definition, Many Applications

Increased use of telecommunications technology in health reflects a trend occurring in virtually every industry. Therefore, the telehealth industry shares characteristics with other sectors of Canada's growing knowledge-based economy. The principal asset of knowledge-based industries is, as would be expected, knowledge — both as input and output — which comes to be seen as a key source of innovation, technological development, long-term growth and job creation. Telehealth systems exchange or distribute content based on the pharmaceutical, medical, educational, health and social service industries. These industries have all been classified as knowledge-intensive in comparison with many other mature or traditional manufacturing and

**The effective uptake of telehealth has solid foundations in the convergence of the two driving forces necessary for successful implementation of these programmes. These are the advances in the technology facilitating telemedicine capability and the increasing demand for universal access to high-quality medical care irrespective of location.**

**— S. F. S. Coles, "Telemedicine: The Rise of Digital Healthcare," Financial Times Management Report, London, 1996.**

service industries. Telehealth is also technology-intensive, another characteristic of knowledge-based industries, as it involves computers and information technology, networks, multimedia, and (in more experimental applications) artificial intelligence, robotics and virtual reality.

For this Overview, telehealth applications are grouped into five categories, each with its own set of users, from health care professionals and administrators to patients and consumers (Table 1).

**Table 1. Telehealth Categories and Users**

| Category | Users |
|---|---|
| All forms of medicine-at-a-distance: teleconsultations, telepathology, teleradiology, telepsychiatry, teledermatology, telecardiology, etc. | Physicians<br>Health care professionals<br>Health care institutions |
| Interinstitutional, patient and clinical records and information systems, electronic health and clinical records and databases accessible by network | Health care institutions<br>Health care professionals<br>Health care workers<br>Physician's offices<br>Researchers |
| Public Health and Community Health Information Networks (CHINs) and multiple-use health information networks | Government (including policy makers)<br>Epidemiologists<br>Public health professionals<br>Physician's offices<br>Pharmacies<br>Clinics and CHINs |
| Tele-education and multimedia applications for health professionals and patients, and networked research databases; Internet services | Universities and colleges<br>Associations<br>Researchers<br>Physicians<br>Health care professionals<br>Patients |
| Telemonitoring, telecare networks, telephone triage, remote home care, and emergency networks | Consumers<br>Elderly<br>Chronically ill<br>Disaster victims<br>Accident victims<br>Telenurses<br>Call centre users or operators |

Telehealth permits the transfer of different kinds of health data and information related to:

- provision or confirmation of a diagnosis
- surveillance and epidemiology
- health care management
- clinical practices
- research

- literature search and retrieval
- health and wellness
- health and medical educational content.

The technologies and systems used for telehealth vary greatly from one application to another, but each application — even the simplest — contains at least three components:

- a device or a means to capture, process and store content (input), whether sound only, electronic or digital images, tracings, alpha-numeric data or a combination
- content and a means to transfer or exchange the content (throughput), including communications, telecommunications or network technologies of all kinds and their associated software
- a means for receiving, storing and displaying the content (output), including a video monitor, a computer file server or a recorder of some kind.

Current telehealth practices across the board are notable for their adoption among a variety of organizations from both the public and the private sector. Participation may be direct, indirect or financial. Organizational stakeholders include government; private sector; universities, colleges and research institutions; hospitals; institutes and associations; foreign organizations; other health care facilities; and patients and consumers.

**Telehealth use penetrates many sectors**

## 2.2 Global Context

Rapidly rising costs of health care and how to control them have become the most important health policy issue in developed countries in the past two decades (Table 2).

**Table 2. Health Expenditures of the G-7 Countries**

| Year | U.S. | Canada | France | Germany | Italy | Japan | U.K. |
|---|---|---|---|---|---|---|---|
| | | | (Percentage of gross domestic product) | | | | |
| 1975 | 8.4 | 7.2 | 7.0 | 8.1 | 6.1 | 5.6 | 5.5 |
| 1980 | 9.3 | 7.3 | 7.6 | 8.4 | 6.9 | 6.6 | 5.6 |
| 1985 | 10.8 | 8.4 | 8.5 | 8.7 | 7.0 | 6.6 | 5.9 |
| 1990 | 12.7 | 9.1 | 8.9 | 8.3 | 8.1 | 6.8 | 6.0 |
| 1994 | 14.3 | 9.7 | — | — | — | — | — |

Source: Organisation for Economic Co-operation and Development Health Data (**http://www.oecd.org**).

Many factors contribute to overuse of health care system

Population aging with its associated rates of chronic disease and disabling conditions are contributing factors to the rise in health care costs, though not the only ones. Other factors affecting the way in which the health care system is used or overused include physician supply, new approaches to medical care, user expectations, superspecialization, culture, employment, education and environmental factors. Moreover, particularly in the developed world, advances in medical technologies and pharmaceutical products are making possible a wider range of diagnostic, therapeutic and surgical procedures and services. New technologies, their diffusion and frequency of use have contributed a great deal to the rising costs of health care, especially in the United States. Regardless of the root cause, rising costs of health care are now threatening prospects for higher-quality services to broader population groups.

There exists an ongoing movement in the developing world to provide better access to health care and to increase the quality of health. Meanwhile, however, there are pressures in the developed world to reduce public funding for health care.

New ways are sought to reduce health care costs

Reductions in traditional health care delivery costs are forcing payers and administrators to seek new and different ways to provide adequate levels of services at lower costs. Studies have shown situations where telehealth technologies can realize savings while at the same time broaden the health care system's reach. Broader research is going on in this field.

Interesting innovations are arising out of the new necessity to cut costs, permitting shorter hospital stays through assisted home care and enabling the integration of community resources through networking and facility sharing. On the other hand, the financial outlay required to establish the necessary infrastructures for integrated telehealth systems are high. In this context, a major contribution can be played by telehealth, defined as the use of communications and information technology to deliver health and health care services and information over large and small distances (Table 3). Telehealth systems and services provide cost-effective links to all elements of the health care system.

## Table 3. Telehealth Applications that Can Facilitate Health Care Procedures

| Health care procedure, process | Possible telehealth application |
|---|---|
| Telephone-based or face-to-face consultation between specialists and general practitioners | Videoconferencing, IATV, computer-based e-mail |
| Physical transfer of medical images for specialist opinion on radiographs, ultrasound, computed tomography scans, pathology slides | Electronic transfer of images to specialists via any number of networks; comparison of images against banks of stored electronic slides and images for comparison |
| Hand-written, paper-based patient files and charts | Palm-top pen-based computer tablets, desktop workstations, computerized patient records |
| Hand-written, paper-based prescriptions | Electronic ordering of the prescription using a CHIN, HIN or pharmanet |
| Consulting Compendium of Pharmaceuticals and Specialties, 32nd ed. (Ottawa: Canadian Pharmaceutical Association, 1977) for information regarding drug being prescribed | Drug interaction software, drug information database online |
| Home visits unassisted by technology | Laptop or portable computer with modem to communicate with physician or health care institution |
| Home care, elder care | Telemonitoring from the home, assisted devices and technologies |
| Visits to the emergency room of the local hospital | Telecare, tele-assisted triage, 1-900 telephone calls to obtain assistance, video visits |
| Referrals from general practitioner | Appointments by e-mail, by electronic scheduling from general practitioner's office |
| Patient travelling from remote location if requiring specialized counselling, diagnosis or treatment | Video-consultation with specialist from afar |
| Literature search in medical library for current literature on new procedures, clinical trials, etc. | Electronic search from home or office using Medline or other medical information management and database retrieval service |
| Travel to another location for grand rounds, CME, conferences, meetings, seminars | Attendance from home or office via audio-, video- or computer conferencing, or IATV |
| Clinical trials | Clinical trial management systems, expert advice online |

### *Case Study: Telemedicine in Northern Norway*

The major referral centre in northern Norway, the University Hospital of Tromsø (UHT), has been involved in a variety of telemedicine activities since the late 1980s. Many of the departments in the hospital regularly use videoconferencing to conduct remote medical consultations and for education and meetings. From June 1995 to June 1996, some 334 videoconferencing sessions were conducted at UHT, with 2 715 participants. Thirty-nine of these sessions were for telemedicine clinics, during which 478 patients were seen. In 1995, UHT also received 6 917 teleradiology studies from a remote site. In northern Norway in that year (June 1995 to June 1996), 772 videoconferencing sessions were conducted with 5 978 participants (including the numbers from UHT). In the region, over 85 percent of the general practitioners use an electronic patient medical record system and most receive their patients' laboratory results electronically.

Nationally, the Norwegian Ministry of Health and Social Affairs has acknowledged telemedicine as a legitimate way of delivering health services and has supported its development both politically and financially. On August 1, 1996, Norway became the first country to implement an official telemedicine fee schedule, making all telemedicine services reimbursable by the national health insurer. The government is also in the process of formulating a comprehensive four-year plan that will direct the implementation of a wide range of telecommunications and information technology in the health care sector.

— D. R. Elford, "Telemedicine in Northern Norway," *Journal of Telemedicine and Telecare* (March 25, 1997).

**Telehealth is top priority**

Telehealth was a top priority in the European Commission's 1994 *White Paper on Growth, Competitiveness and Employment.* This report identified 10 key areas for development of a European information society, including the creation of direct communication health care networks. Because the health sector is the largest public employer of the European Commission (EC), telehealth development has been of considerable interest. A significant number of health care telematics projects are part of the EC's research and technological development (RTD) programs.

**Disproportionate number of deaths are due to lack of health care**

Many developing countries have inadequate health care and medical services. Of 51 million people who died in 1993 worldwide, 39 million deaths took place in the developing world and 12 million in the developed world. According to *World Health Report 1997* (**http://www.who.ch/whr/1997/exsum97e.htm#The_state_of_world_health**), of over 52 million deaths worldwide in 1996, more than 15 million were ascribable to circulatory disease. Prompt medical attention and health promotion measures could have avoided many of these deaths, although at present about 1 billion people worldwide do not have regular access to local health services. The Pan-American Health Organization (PAHO) estimates that one third

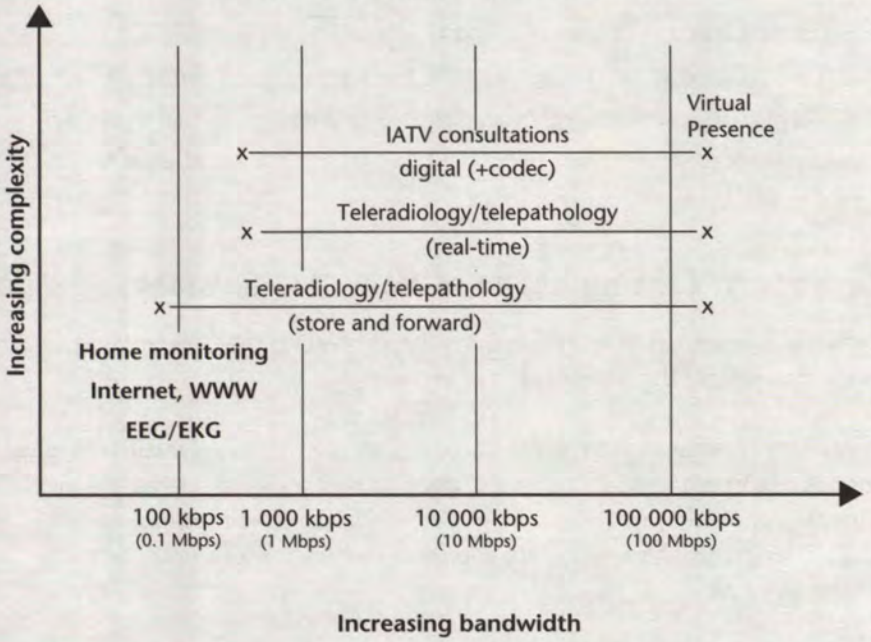
of the people of the region represented by their organization have no access to health care. Most others have limited access. The greatest need is to link resources through effective communications to rural communities and medical centres, but the "last mile" of connectivity linking patients to resources is still missing in most countries.

## Technology

**Variety of bandwidths transmit signals in many applications**

A broad range of communications technologies are used for telehealth. For networks, cost and quality generally increase with increasing bandwidth. Figure 1 illustrates the type of signals that can be transferred at different bandwidths. In both the U.S. and Canada, videoconferencing is the medium of choice for teleconsultations. High-quality, full-motion, full-colour video without image compression requires the largest bandwidth, whereas electronic data for electrocardiogram monitors and Internet communications may be carried at very low speed and bandwidth, using plain telephone lines. High bandwidth is more costly than the plain ordinary telephone system (POTS), but increasingly available in the developed world, via fibre optic networks. For very large distances, large bandwidth requires satellite communications, but satellites may also be used for lower bandwidth and expensive telehealth applications. Health care providers in remote hospitals can receive information by radio/telephone communications on the ground.

**Figure 1. Network Bandwidth and Complexity, with Health Application Examples**




Source: Telemedicine Today, 1996 Buyer's Guide and Directory.

## Remote Care and Telemedicine

Definitions vary with applications

The definitions for telemedicine are as varied as its potential and actual applications. It is an emerging field of health care and has the capacity to deliver health care across the geographic separation between the two or more parties involved in the health care process. The total worldwide telemedicine, telepathology, teleradiology, telecommunications and videoconferencing market is projected to generate revenues of more than US$1.1 billion by 2000 (Table 4).

**Table 4. Total Worldwide Telemedicine Telepathology/Teleradiology, Telecommunications and Videoconferencing Market**

| Year | Estimated annual revenues | Estimated annual growth rate of revenues |
|---|---|---|
| | (US$ Millions) | (Percent) |
| 1995 | 352.224 | — |
| 1996 | 411.664 | 13.8 |
| 1997 | 503.024 | 18.6 |
| 1998 | 635.544 | 23.2 |
| 1999 | 839.144 | 30.5 |
| 2000 | 1 131.664 | 32.4 |

Source: Feedback Research Services, January 1996, p. 100.

Telemedicine use grows rapidly

The International Telecommunications Union (ITU) undertook a survey in August 1995 and found telemedicine activities in 29 countries. The Telemedicine Information Exchange Database (**http://tie.telemed.org**), when searched in October 1996, had short descriptions of 168 telemedicine projects in 35 countries. By May 1997, the number of projects had grown to 183.

### *Case Study: Looking Ahead to Now: Teleradiology*

Canadian companies of late have been demonstrating that teleradiology is more than simply the transmission of images.

In April 1997, Imaging Dynamics Corp. of Calgary **(http://www.imagingdy.com/index.html)** announced that it would create a digital teleradiology network connecting communities in the Northwest Territories, northern Saskatchewan and Alberta to radiologists at the Telehealth Centre of the University of Alberta.

At the other end of the country, Sterling Diagnostic Imaging Inc., Canadian head office in Mississauga **(http://www.sterlingdi.com)**, as part of a seven-

year deal worth $10 million, will supply the Atlantic Health Sciences Corp. of New Brunswick with a digital, diagnostic imaging system that includes the company's leading-edge technology for routine X-rays. The digital radiography technology uses a self-scanning digital array to convert X-ray photons to electronic signals. Once captured electronically, diagnostic images can be manipulated on screen.

— Jerry Zeidenberg, "Giant telehealth system will serve Canada's remote regions"; and Andrew Van Velzen, "New Brunswick hospitals to acquire system for digital X-rays from Sterling Diagnostic," *Canadian Healthcare Technology* 2 (4, July 1997): 1, 4.

### Interinstitutional Networks and Community Health Information Networks

The telehealth industry covers the use of networks to link care providers and their institutions. Regional health networks and CHINs often include pharmanets, networks which link clinics and/or physicians' offices to pharmacies for the transmission of information regarding prescriptions. The heart of the CHIN is the electronic medical record (EMR) or computerized patient record.

**Use of CHINs is relatively recent**

Originally, computers entered the health care market through the door of administrative applications. In the past decade, clinical applications have been more widely available. The idea of linking computer networks for the exchange of health and medical information outside hospital walls is relatively recent. Computers are widely deployed now but still are not widely connected.

### Population Health Networks

Population health networks are networks that permit epidemiologists, health policy makers and governments, as well as public health officials to exchange information regarding the health status of entire populations. The World Health Organization (WHO) makes increasing use of the Internet to disseminate health information widely.

**Networks monitor diseases and their spread**

Disease surveillance networks are designed to identify epidemics and emerging diseases. According to the WHO, 29 new diseases have emerged in the past 20 years. In Canada, a Public Intelligence Network has been developed to monitor, prevent and control risks to health, involving the collection and analysis of appropriate data and information dissemination. The Internet is the communications medium.

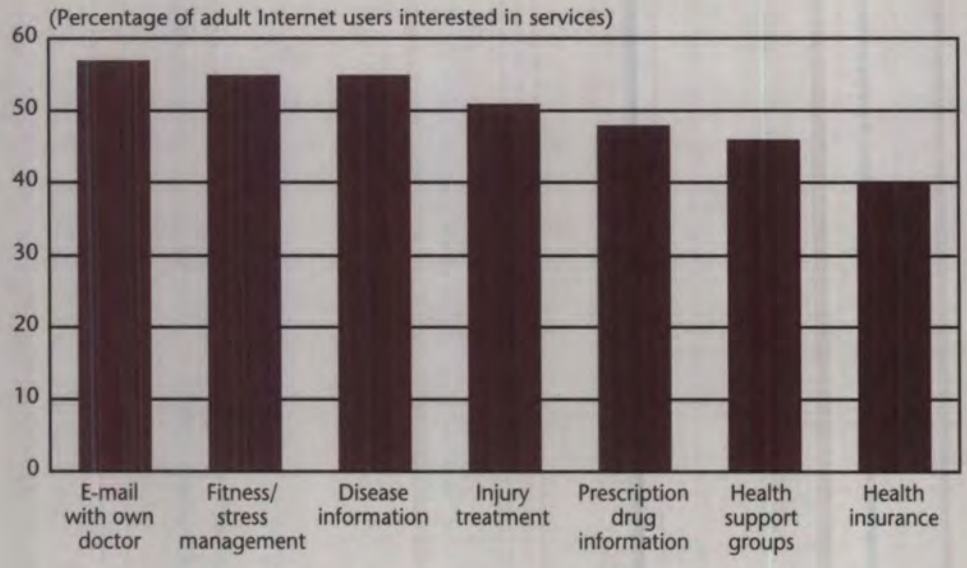
It is a recognized fact that the health sector is lagging behind in the adoption of telecommunications-based services compared with other segments of society.
— Rodrigues et al., *Telecommunications in Health and Health Care for Latin America and the Caribbean*, Pan American Health Organization, 1996.

### Tele-education for Health Professionals and Patients

Telehealth networks are extensively used for health and medical teletraining and education. The TELMED study, involving 29 European projects out of 277 health care telematics projects, found that the teletraining and education market, while immature, is highly service-oriented, with growth potential through integration with other applications such as telediagnosis.

Patients and consumers are using the Internet to obtain health and medical education. An international Internet association for medicine has been formed, the Society for the Internet in Medicine (**http://www.mednet.org.uk/mednet/**). Membership is increasing steadily. Figure 2 illustrates the type of health and medical information obtained by consumers from the Internet. A popular source of information and medium of communication, the Internet offers new business opportunities. However, while the health care market is benefiting from this, it lags behind other industries in leveraging the power of Internet-derived technologies. Factors such as privacy, liability and compensation undoubtedly contribute to this time lag.

**Figure 2. Internet Consumer Interest in Interactive Health Services**




Source: American Internet User Survey, 1996 (**http://etrg.findsvp.com/internet/top.html**); American Interactive Health Care Professionals Survey (**http://etrg.findsvp.com/health/prsp-aihps.html**).

## 2.3 North American Context

The giant U.S. health care market is the largest in the world. Indeed, in 1992, it accounted for roughly 42 percent (US$817.3 billion) of world health care costs, which have gone from about 5 percent of the gross domestic product (GDP) in 1960 to 15 percent currently, with costs rising

at an annual rate of 11 percent over the past few years. Activity in the U.S. clearly dominates the North American context.

**Cost reduction gives impetus to managed care and telemedicine**

Managed care organizations came into being in the U.S. in the 1980s to try to meet the demand for lower health care costs, especially for hospital and physician services. Managed care is a system of management and financing health care delivery that ensures services are provided to plan members and are appropriately priced. Over half of all employees covered by employer group health insurance in the U.S. are enrolled in managed care plans. Managed care, together with the deregulated U.S. telecommunications industry, are both major contributors to the development of IT&T and telemedicine in U.S. health care today.

Moreover, U.S. research and industrial strength is in all categories of telehealth applications. There are several academic and industrial associations (e.g. the American Telemedicine Association and the American Telemedicine Service Providers Association), with well-established publications including peer-review journals, and a large number of web sites and Internet services have been generated. Annual conferences and symposia take place in many states and cities. U.S. firms are active on the international scene as well; several have created partnerships with Canadian firms and have a significant Canadian market.

### Remote Care and Telemedicine in the U.S.

**Hospital use of telemedicine grows rapidly in U.S., lags in Canada**

Some 40 U.S. states have ongoing telemedicine projects, many of which are developing state-wide telecommunications networks to link hospitals with rural areas. In October 1996, the U.S.-based Telemedicine Information Exchange (**http://www.tie.telemed.org**) web site listed some 142 U.S. telemedicine projects and only six Canadian projects. A survey of 2 472 rural hospitals in the U.S. showed that 17.55 percent (416 hospitals) already have telemedicine programs, and 303 hospitals reported plans to start telemedicine programs. The most active and best-known telemedicine projects in the U.S. are located in Georgia, Kansas, Texas, Alaska, Oregon and the Mayo Clinic in Boston, Massachusetts. Some 300 companies sell telemedicine products and services in the U.S. health care market. Fewer than 3 percent are Canadian.

Teleradiology represents the most mature and best-known telemedicine application. According to the U.S. Council on Competitiveness, there are 7 000 film digitizer units in use. In Florida, a corporation with 23 000 employees contracts out radiology requirements to providers who have a teleradiology link with the University of California at Los Angeles for consultations. Filmless (digital) medical imaging represents an important breakthrough in teleradiology in terms of lowering the costs and improving the quality and cost of transmission of radiological images. Medical imaging, including ultrasound, computerized tomography (CT), nuclear magnetic resonance imaging (MRI) and nuclear medicine scans have become extremely valuable

diagnostic tools in recent medical practice. Efforts are under way to create better and less expensive ways to both capture and transfer these images. Since 1994, WorldCare™ (**http://www.worldcare.org**) has successfully demonstrated the quality of international high-resolution teleradiology transmission capabilities from Saudi Arabia to the U.S. using compressed, digitized data from CT, MRI and radiological images.

U.S. military pioneers telemedicine applications

The U.S. military operates one of the largest telemedicine organizations in the U.S., and is especially active in researching new applications and technologies. It recently established the Department of Defense Telemedicine Test Bed (TTB) for the purpose of using information technology in re-engineering of medical practices in peacetime and wartime, and is close to achieving medical interoperability in the worldwide delivery of health care. With military personnel located in 70 geographical locations worldwide, TTB provides medical personnel in the field with 24-hour tertiary care capability. The U.S. Veterans' Administration is using teleradiology to improve primary care access for patients located in remote regions. In some states, particularly Texas and Georgia, telemedicine has been adopted for treatment of prison inmates to cut down on transportation costs and risks.

Statistics describing the size of the telemedicine market vary conspicuously from one source to another. One source speculates that the U.S. telemedicine market will grow from US$20 billion in 1995 to US$100 billon by the year 2000; a report from the U.S. General Accounting Office (**http://www.telemedtoday.com**) found that in 1994–96, US$646 million was deployed in this field. In parts of the U.S., steps are being taken to solve the problem of reimbursement for physicians undertaking telemedicine, an inhibiting factor for telehealth. Sixteen states have adopted or are considering legislation for reimbursement.

U.S. FDA reviews safety and effectiveness

The U.S. Food and Drug Administration operates a Center for Devices and Radiological Health, which ensures the safety and effectiveness of telemedicine systems. Canadian companies wishing to market systems in the U.S. must be aware of these regulations. The centre offers premarket review of telemedicine devices, postmarket surveillance, quality systems, participation in standards development activities and research related to telemedicine.

### Interinstitutional Networks and CHINs in the U.S.

In 1995, the U.S. Office of Technology Assessment (OTA) issued a comprehensive report titled *Bringing Healthcare Online: The Role of Information Technologies*. It presents a thorough overview of the actual and potential uses of IT&T in the U.S. health care system and discusses

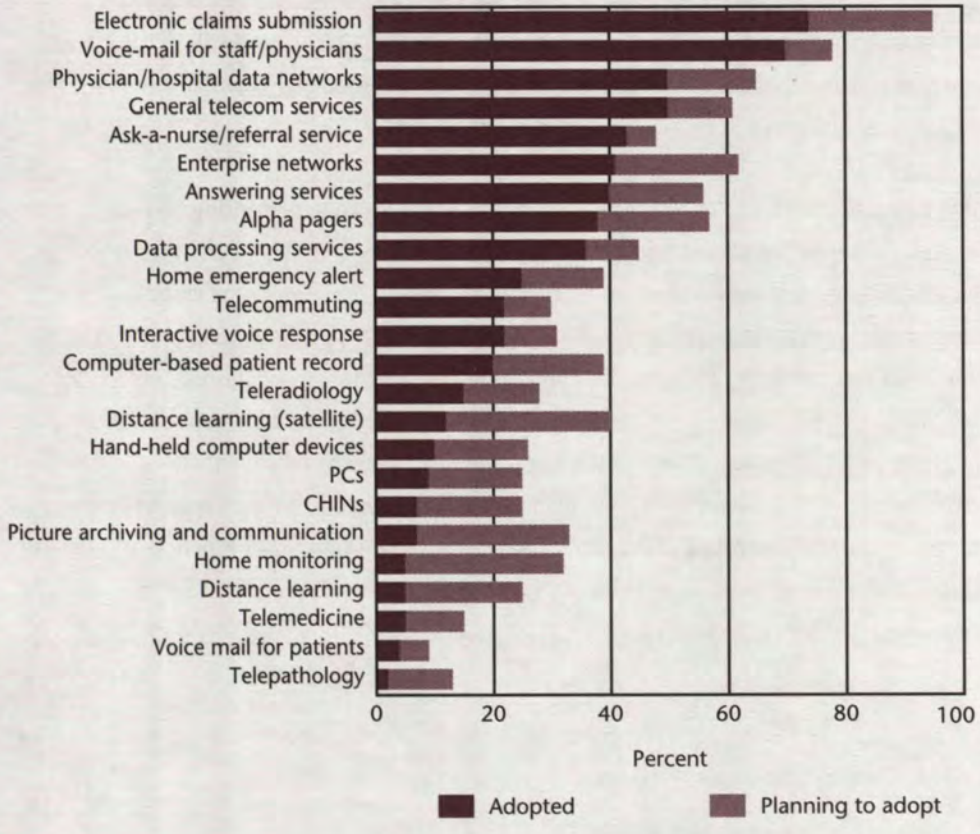
cost-savings, potential efficiencies and other benefits to be gained if the health care system incorporates more widely appropriate IT&T systems and applications.

U.S. companies have long dominated the development and marketing of EMR software in North America. This predominance has begun to cross the border as some American companies have struck partnerships with Canadian firms developing and marketing complementary telehealth products in order to better position themselves to penetrate the Canadian market.

**U.S. predominance starts to penetrate into Canada**

Figure 3 shows applications being adopted in the U.S. In 1995, ComNet (Community Medicine Network Society) published a Market Directory listing demographic, operational, organizational and management backgrounds of 515 of the most advanced CHINs and health information "networks in progress" in the U.S. At the heart of the CHIN is the electronic patient, medical or health record (EMR).

**Figure 3. Information Technology Applications Currently Being Adopted in Health Care**




Source: Center for Health Care Management Information, Ann Arbor, Michigan, 1994.

Electronic house calls represent a move back to a health care system that is more home-centred rather than hospital-centred. Using a variety of technologies — including telephone, computers, monitoring devices and interactive video — telemedicine could reduce or eliminate patient travel, resulting in lower costs for the patient and perhaps making a hospital or clinic visit unnecessary. — *Bringing Health Care Online*, U.S. Congress, Office of Technology Assessment, 1995.

### Health and Medical Distance Education and Patient Tele-education in the U.S.

According to a report from Feedback Research Services, tele-education and administration, not telemedicine, constitute the principal content of most telehealth networks in the U.S. As early as 1991, voluntary health agencies in the U.S. (such as the Cancer Society) reported spending over US$623 million on health education and information. Most health and medical professional associations have home pages and actively offer products and services on the World Wide Web.

### Telemonitoring, Telecare Network and Remote Home Care in the U.S.

The home care market in the U.S. has grown very rapidly in the past decade. In 1987, US$4 billion was spent on home care in the U.S.; by 1994 the figure was US$26 billion and by the year 2000, it was expected to grow to US$70 billion. In 1995, alone there were about 500 million home health care visits, at a cost of US$90 a visit.

Over 130 million home visits could employ telemedicine by 2001, representing 20 percent of home care visits, according to a recent Insight Research Corp. report. The U.S. Health Care Financing Administration (HCFA) is currently mandated to research the cost and value of providing care via telemedicine and has been commissioned to issue a report within three years. There is evidence that care at home represents important cost savings, serves a patient educational function and provides a greater feeling of well-being.

Home care services that can be tele-assisted, partly replacing and augmenting home care visits, include the following: wound management; cardiac monitoring and rehabilitation; oncology patient management via home infusion; electronic and tele-house calls and video visits for the chronically ill and elderly; home care telemonitoring for vital signs including blood pressure and heart conditions; remote-controlled programmable infusion; blood glucose meters with telecommunication capabilities; telemonitoring of hemadialysis; use of laptop computers by home care workers to note and check medication and progress on patient charts and to electronically communicate with home care teams; and emergency or alert systems linking homes to clinics or hospitals. These applications all involve a significant expertise and service component.

## 2.4 Canadian Industry Snapshot

Canada's telehealth industry is still too immature for firm statistics to be available on its size or performance; the information presented here is therefore illustrative only. Information about Canadian telehealth projects in the private and public sectors in Canada has been gathered from a number of sources, including interviews with project directors. A database has been developed displaying these projects by site, technology, purpose and application. Though not a comprehensive portrait of telehealth activity in Canada, the list of projects demonstrates that telehealth activity in Canada consists of a small but broad spectrum of applications. Most project descriptions can be found on Industry Canada's web site (**http://strategis.ic.gc.ca/cinch**).

**2 500 companies have $3B in annual sales**

The Canadian telehealth industry belongs in part to the health care services industry, which consists of approximately 2 500 companies, mostly small and medium-sized. (The count of telehealth companies arises from company registrations in Industry Canada's Canadian Company Capabilities (CCC) database, whereas Statistics Canada is the data source for the broader health care services industry.) The health care services industry provides services relating to the design, establishment, operation, maintenance and improvement of health care systems and institutions on a fee-per-service basis, totalling $3 billion in annual sales.

**Telehealth data are scarce**

Overall, however, there is a dearth of standard information on the size of Canada's dynamic, knowledge-based telehealth industry, which is still in its early stages of development. While it is generally agreed that the sector has a promising future, economic measurements on the industry — sales, trade, employment, contribution to gross domestic product, etc. — have not been compiled, as the statistical system has yet to catch up to the day-to-day evolution of the industry. Major companies, in telecommunications for example, play an important role in telehealth delivery, but these revenues make up only a small percentage of their total sales.

## *Canadian Success Stories*

Canada's telehealth industry enjoys a high profile internationally. Max House, for example, founder of the telemedicine program at Memorial University of Newfoundland, established a telemedicine link to Africa and the Caribbean by using the then newly established Satellites in Health and Rural Education (SHARE) project as early as 1985.

There are a number of Canadian private and public organizations participating in the projects funded by the European Union's Framework programs. Canada is present as well in all nine of the G-7 Global Healthcare Applications Projects (GHAP), leading in two of these: the Global Telemedicine Network, and Evidence and Effectiveness.

Moreover, a number of telehealth small and medium-sized enterprises (SMEs) in Canada have achieved significant export success. Winnipeg's InfoTech Inc. specializes in the development of consumer-oriented software on health-related topics for the corporate, health care and health promotion markets. The company boasts that its first product, the Wellness Checkpoint is "the world's leading wellness program," being used not only in Canada, but also in the United States, Mexico, Belgium, France, Netherlands, Luxembourg, Germany, Spain, Britain, Italy, Hong Kong, Singapore and other countries in Asia Pacific (**http://www.infotech-wellness.com/wellness.html**). In Montreal, Theratechnologies Inc. in conjunction with the Société générale de financement du Québec has formed Andromed, a medical instrument and device company. Andromed's flagship product is Stethos, a fully electronic stethoscope now available in Canada, Japan, France, the Benelux countries, Britain and Ireland. Over the next 12 months, the product is expected to generate $2 million in exports (**http://www.theratech.com**). Dartmouth's Digital Image FX Inc. signed a technology transfer agreement with the U.S. National Aeronautics and Space Agency (NASA) in 1996, which will seriously boost the company's credibility in terms of technology research. With the help of NASA, Digital Image FX hopes to realize its objective of becoming the first in the world with medical training software incorporating virtual reality technology (**http://www.digital-fx.ca**).

Interviews conducted with industry and government officials in March 1997 reveal that:

- current projects are valued at approximately $500 million
- provincial and federal governments anticipate spending another $500–700 million over the next three to five years for all categories of telehealth applications.

While the telehealth industry in Canada is still new, it can capitalize on acknowledged strengths in associated sectors:

- telecommunications products and services
- world-class software industry
- an excellent publicly administered health care system
- a solid history of developing innovative distance education solutions
- a respected expertise in consulting and other business services
- recent advances in the knowledge-based industries.

In recent years, many of these stakeholders have come together to design and carry out telehealth projects intended to advance and apply technologies on site in various regions of Canada, particularly remote areas.

### Private and Public Organizations Involved

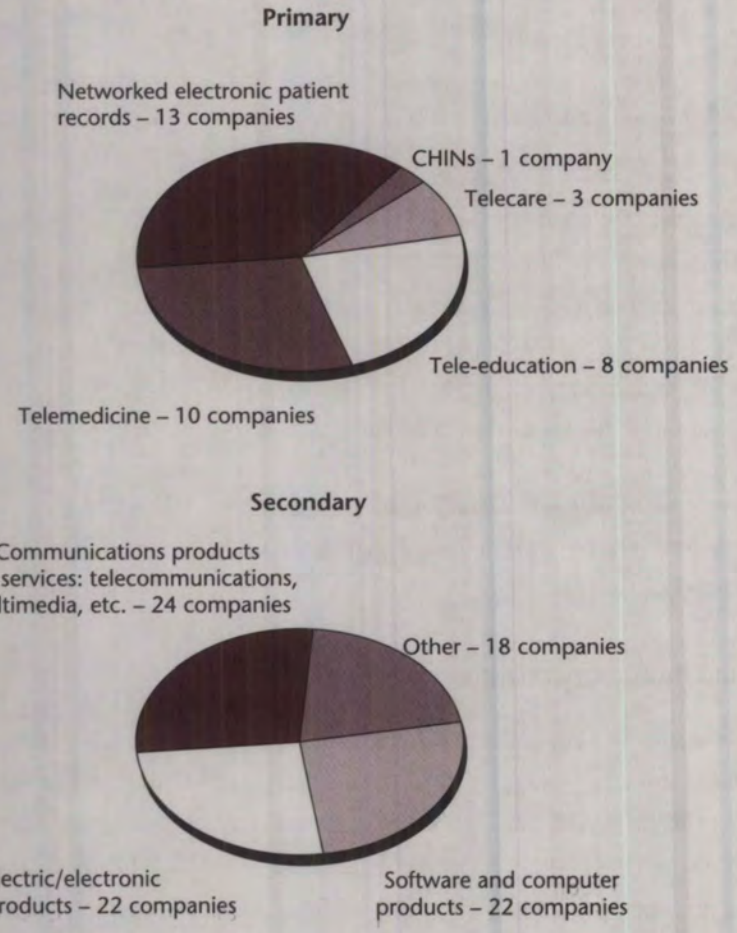
Canadian telehealth projects are operated within the provincial and federal public sectors. In Canada, some provincial projects for telehealth systems are expected to produce significant cost savings. Participants include university faculties of medicine, provincial governments, research centres and a selection of private companies ranging from very large (computer manufacturers and telecommunications carriers) to very small (service and turnkey companies, consultants, software developers and R&D or service providers). Some 36 private companies are involved in a selection of 65 telehealth projects reviewed for this Overview, the majority being telecommunications companies.

Over 300 Canadian companies are active in the telehealth business, of which 121 have registered themselves in Industry Canada's Canadian Company Capabilities (CCC) database. Figure 4 shows the proportion of the companies whose primary activity is telehealth as well as those who claim telehealth as a secondary activity.

**Public–private participation reduces costs**

**Figure 4. Telehealth Companies in Canada, by Activity**

(N = 121 *Strategis* registrants)

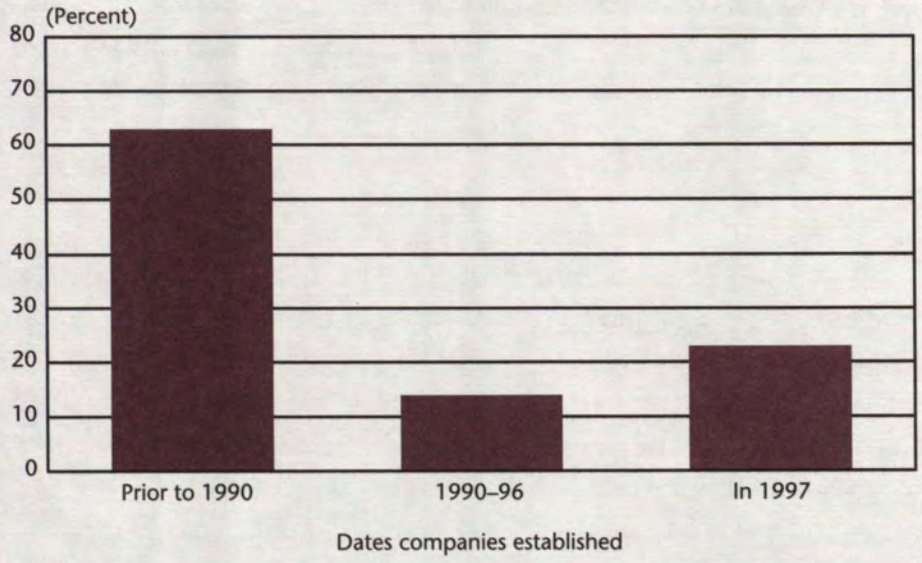



Source: Industry Canada Canadian Telehealth Company database, April 1997.

**Strategic alliances allow providers to bid on larger projects**

Over 85 percent claim they are already exporting, though what is exported may not be telehealth products and services. Many of the small companies are forming strategic alliances to strengthen their capacity to bid on large projects. Their product offerings include: diagnostic software, encryption, imaging, mobile stations, networking and video products (the largest number are in this category), patient and clinical records, peripherals, publications and databases, and telecare products. Employment in the telehealth private sector companies is estimated at around 1 700 people, and the combined annual revenue of these firms is estimated at about $330 million. The industry itself is young: 20 percent of the companies were created in 1997 (Figure 5).

**Figure 5. Age of Canadian Telehealth Companies, as of April 1997**




Source: Industry Canada estimates based on data from CCC database registrants.

A detailed analysis of these 121 company profiles shows that 30 percent report their primary sales activity to be dependent upon telehealth. Their estimated sales are in the $1–5 million range, yielding a combined total of upward of $130 million. These companies are most often staffed by 20 to 25 people.

**Sectors integrate to provide community health services**

Reflecting a trend toward integration of health care networks, the newest projects are those that can be labelled as regional or community health information networks or CHINs. Telehealth in Canada has long been the domain of research, consisting of pilot projects and experiments that were run from universities and research centres.

Public initiatives boost firms' capacity

One feature of the current telehealth scene in Canada is the growing involvement of private companies. While many of Canada's telehealth companies are too small or to inexperienced to bid successfully on larger projects in Canada, recently announced Canadian public initiatives are expected to help stimulate the industry and improve firms' technological capacity. Several recent initiatives attempt to bring together private companies and researchers involved in telehealth:

- Early in 1995, the Canadian government created the Information Highway Advisory Council (IHAC), which consulted stakeholders from all walks of life across the land and produced a report containing some 300 recommendations, some of which deal with telehealth. In May 1996, the Minister of Industry tabled an action plan to deal with recommendations of the report.
- In September 1996, the Canadian Network for the Advancement of Research, Industry and Education (CANARIE) (**http://canarie.ca**) released a document outlining a vision for the development of a Canadian health information network of networks that would span the country from coast to coast and provide a coordinated, secure and integrated set of network-based applications and services.
- The CANARIE Technology Applications Development (TAD) program has targeted health and telehealth technology development, and 13 projects were approved for funding in the latest round of call for proposals, as opposed to only four in the first round in 1995. Through the TAD program, innovative Canadian-based telehealth applications are being developed.
- The federal government-funded Networks of Centres of Excellence (NCE) program cultivates strategic partnerships between universities and the private sector for technology transfer and capacity-building of scientific knowledge and technology of Canadian companies. The Health Evidence Application and Linkage Network (HEALNet), created in 1995, has been funded to a level of $8.6 million over a period of four years. HEALNet (**http://hiru.mcmaster.ca/nce/default.htm**) is a health research program dedicated to the development of evidence-based decision-making tools for health care and links researchers from 16 Canadian universities. The project supports R&D innovation, commercialization and marketing of research applications, and involves 22 companies.
- A new Canadian telehealth association is in the process of being formed, bringing together representatives from the private and public sectors to address issues relevant to telehealth in Canada.

### Telemedicine and Teleconsultation in Canada

Isolation and shortage of health care workers working in northern nursing stations in tiny communities far from urban centres, as well as the hardship of travel for people living in areas accessible only by air over long periods in the spring or by ferries, have been cited as principal

motivation for the development of remote telemedicine systems in Canada. Costs of travel for medical purposes are high. Health Canada estimates that travel costs associated with health care for First Nations people in remote communities amounts to $200 million per year, including health staff.

While Canada's early telemedicine projects were designed to deliver advice, diagnoses or education to first-line health care providers in remote and isolated communities, today's telemedicine systems serve health professionals and patients in many different settings. They can be designed to span a wide range of health care delivery needs using a variety of technological solutions.

Medical and health disciplines that use telemedicine networks include pediatricians, radiologists, nurses in remote nursing stations, general practitioners in rural medicine and psychiatrists. All of the telehealth networks based on remote telemedicine applications involve telecommunications companies, using networks that range in speed and capacity from asynchronous transfer mode (ATM) to integrated services digital networks (ISDN). The Telus Corporation, for example, is directly involved in several Alberta-based telehealth projects. With the exception of telepsychiatry, where ordinary interactive television (IATV) is used, all use some form of specialized or adapted multi-purpose workstations. There is at least one telemedicine project or service in nine of Canada's provinces and territories.

### Interinstitutional and Clinical Record Networks in Canada

Hospitals are downsizing or closing in Canada's cities as they redistribute or re-engineer their services and/or combine their facilities and administrations. Electronic linkages for rapid exchange of information between the institutions therefore become necessary. Interinstitutional health networks are a more recent application of telehealth networks in Canada, being but one feature of health care reform efforts across the country. More than 10 percent of Canadian telehealth companies claim that their principal activity is in this category.

### CHINs and Multiple-use Health Information Networks in Canada

A trend in telehealth applications in Canada and elsewhere is the integration of health networks. Designing health networks for multiple applications brings together health care professionals and facilities to serve all the patients' health care needs in a given community setting. The main benefit consists of avoiding duplication, drug interaction, unnecessary multiple diagnostic procedures and optimizing resources. Of a selection of 65 Canadian telehealth projects, only six claim to be CHINs, but eight more telehealth projects count public health and

**Canada was one of the first countries to demonstrate telemedicine technology. Unlike many other countries whose early projects were unsustainable after government funding ended, Canada did have a few successful transfers of the technology. Currently, a number of sites around the country are demonstrating or evaluating telemedicine systems and a few are providing ongoing services. Overall, the future of telemedicine in Canada looks promising.**
**— D. R. Elford and A. M. House, *"Telemedicine Experience in Canada, 1958–1996,"* Montreal, June 1996.**

community health networks as part of their activities. A combination of dedicated computer networks are most often the basis for CHINs. Very few of the Canadian telehealth companies claim that their principal activity is in this category.

The *Health Care Computing and Communications Canada 1997 Resource Guide* lists 23 firms who are application software vendors in the community health market.

Federal Budget injects $50M for CHIS

About $3.2 million has been invested by Canada's provincial governments, building upon and strengthening national surveillance and disease control and prevention networks and programs. The purpose is to provide early detection of emerging diseases and epidemics, and to support disease prevention efforts. The federal Budget of February 1997 injected a further $50 million to build a Canadian Health Information System (CHIS) in Canada.

### Health and Medical Tele-education and Patient Education in Canada

Today most of Canada's universities and colleges offer credit and/or non-credit courses by distance, using all forms of mediated conferencing. Credit and non-credit continuing medical education (CME) and continuing nursing education (CNE) courses are being offered via tele-education by 13 post-secondary institutions. Often the same telehealth networks used for telemedicine are being employed for continuing education purposes.

Distance education is used to train health workers

Canadian companies and several public organizations are involved in designing and providing distance education courses in health and health care around the world. A Montreal-based company, GlobalMedic, has developed a software system that delivers health education and management programs for health care providers and organizations.

Over 10 percent of the Canadian telehealth projects identified for this Overview are based on tele-learning or distance education; 15 percent more include education as one of their activities. Almost 10 percent of the Canadian telehealth companies claim "tele-education and multimedia applications for health professionals and patients, networked research databases and Internet services" as their principal activity.

Electronic health education is available in many formats

Patient education is a growing field. Universities are developing multimedia health and medical curricula accessible electronically, on the Internet or in multimedia format on CD-ROM. As well, patient education materials are being developed and distributed by a small number of Canadian firms.

Internet links homes to wellness information

Also playing a significant role in the dissemination of health information to the Canadian populace is the Internet. The number of Canadian households with access to the Internet has grown from 7 percent to 13 percent in 1997, and numerous health groups, professional associations and most governments now have their own web sites. Health Canada's site (**http://www.hc-sc.gc.ca/**) is one of the most popular of its kind in Canada. Bell Canada's *HealthyWay* (**http://healthyway.sympatico.ca**) boasts access to over 8 000 health and wellness sites. It has reported a steady increase in the number of subscribers since its launch date in 1996, and now records 20 percent increases every month in the number of users accessing the site. Several small Canadian companies offer health and medical information, as well as services on the Internet. Many Canadian consumers are interested in wellness information. In March 1997, the Canadian Wellness Network Internet service was established, jointly funded by Industry Canada and the Nova Scotia Economic Renewal Agency.

### *Case Study: A Canadian Accomplishment*

The HealthyWay Web site has won the International Digital Media Awards' 1997 People's Choice Award for the Best World Wide Web site. The HealthyWay site, a leading resource for health and medical information on the Internet, was created by MediaLinx Interactive of Montreal.

Launched in April 1996, the HealthyWay site offers an abundance of medical and health information, including more than 4 000 site reviews. There are more than 8 000 links to Internet health sites.

— "HealthyWay Wins Site Award,"
*Canadian Healthcare Technology* 2 (4, July 1997): 21.

### *Corporate Profile: GlobalMedic*

The mission of GlobalMedic of Montreal is to become North America's leading provider of online health information management systems designed for corporations and consumers.

The company develops and markets interactive and intelligent software programs. GlobalMedic Self Care Solutions for the health care user provide personal health information delivered on-line via Internet/Intranet or hybrid CD-ROM. GlobalMedic's Health Manager is a leading-edge health information management system designed for employers, health care providers and organizations as well as third-party payers involved in this sector, such as insurance companies and pharmacy benefit management groups. This product delivers health education and management programs for members while providing outcome analysis and reporting for management purposes.

GlobalMedic's expert system technology is key to its offerings. This expert system is capable of dynamic reasoning and its cognitive models are based on years of R&D necessary to transcribe doctors' and specialists' knowledge into medical consultation modules. By means of a Health File completed by each member, the expert system integrates the user's medical profile and provides personalized answers. The result is health information specific to the needs of each individual user.

Founded in 1995, GlobalMedic (**www.globalmedic.com**) is based in Montreal. The company is run by the president and CEO Fernand J. Taras and a very competent team of 18 employees. On the financial side, GlobalMedic's shareholders include Bombardier and de Havilland pension funds, Desjardins and the National Bank. The company is also proud of its investments in research and development totalling more than $5 million.

As any other company, GlobalMedic has different partners. This enables it to stay competitive in its two main branches: Internet and health, two areas in constant evolution. With regard to the former, it works with companies like Vidéotron, Sympatico Bell, AOL Canada, Microsoft and Quebec Tel. Its list of partners in the health sector includes Sainte-Justine Hospital, Hôtel-Dieu de Montréal (Research Centre), University of Toronto, Emery Hospital (Atlanta, Georgia), McGill University and Université de Montréal.

## Telemonitoring, Home Telecare and Teletriage in Canada

**Telemonitoring has slow start but bright future**

In Canada, this category of telehealth activity is still in its infant stage, since most of its projects or services have been created within the past two years. Some projects in the Industry Canada database indicate their principal activity as falling into this area, though others count it as one activity among related others. Rising use of ambulatory care, shorter hospital stays and greater numbers of elderly and chronically ill being cared for in the home have all generated home care needs that can be effectively met, in part, through video-visits or telemonitoring devices. It is anticipated that technologies, services and training will be increasingly needed for both patients and home care workers. Only 7 percent of the Canadian telehealth companies claim to be offering such services and products, but it is likely that this category of need over the short to medium term will quickly mature, growing dramatically and substantially out of sheer necessity. One such Canadian company, TeleMedisys, is offering a wide range of tele-monitoring services using portable devices to transmit signals to a centre staffed by experienced nurses trained in intensive care.

## *Corporate Profile: TeleMedisys*

TeleMedisys of Montreal provides global telemedicine and telehealth services and makes it possible to diagnose a patient's vital functions remotely regardless of location. Utilizing state-of-the-art technology, TeleMedisys's medical call centre provides immediate analysis and intervention services.

The company's primary objective is to provide the general public with a means of participating in their own care management by linking patients to their primary and/or specialty physician at all times, while simultaneously reducing unnecessary usage of — and by extension costs to — the health care system.

TeleMedisys currently provides portable monitoring products and health services in cardiology (arrhythmia, ischmia and pacemakers), respirology (asthma and chronic obstructive pulmonary diseases), nursing assistance and video technology. The company is also in the process of installing fetal monitoring technology. A new development is medical and tele-assistance for corporate executives, business persons and expatriates. TeleMedisys has also developed a new and innovative service for patient medical histories and information management.

As an illustration of how the cardiac monitoring system works, consider the example of a client experiencing cardiac discomfort who calls the TeleMedisys medical call centre and speaks immediately to an experienced nurse trained in intensive care. As soon as the call arrives at TeleMedisys's medical centre, it automatically triggers the pop-up onto the computer screen of the patient's personal medical file and history. The nurse would lead the patient through an EKG transmission via an ordinary phone line. The whole process takes less than two minutes, upon which the nurse is able to take appropriate action. This service is available 24 hours a day, seven days a week and now has over 50 000 patients worldwide.

Established in 1995 after two years of market research, TeleMedisys (**www.telemedisys.com**) is a joint venture of three companies: Bell Canada (telecommunications and information technology), Imasco (one of Canada's biggest corporations, which includes Shoppers Drug Mart/Pharmaprix), and the Medisys Health Group (Canada's largest corporate health care service provider). With its 27 employees consisting of nurses and specialists under the constant supervision of senior medical professionals, the company has created an open architecture environment that utilizes most advanced transtelephonic technology devices available on the market today.

In the field of health care projects, TeleMedisys has been selected as both the hardware and service provider for the Canadian Trials of Atrial Fibrillation study, to take place over the course of two and a half years. The purpose of the study is to evaluate the best treatment for atrial fibrillation. The $1.2-million initiative involves 400 patients in 38 cardiology centres across Canada who will submit their heartbeat recording by phone to TeleMedisys's medical monitoring centre for evaluation whenever they sense an abnormality.

# 3 CHANGING CONDITIONS AND INDUSTRY RESPONSE

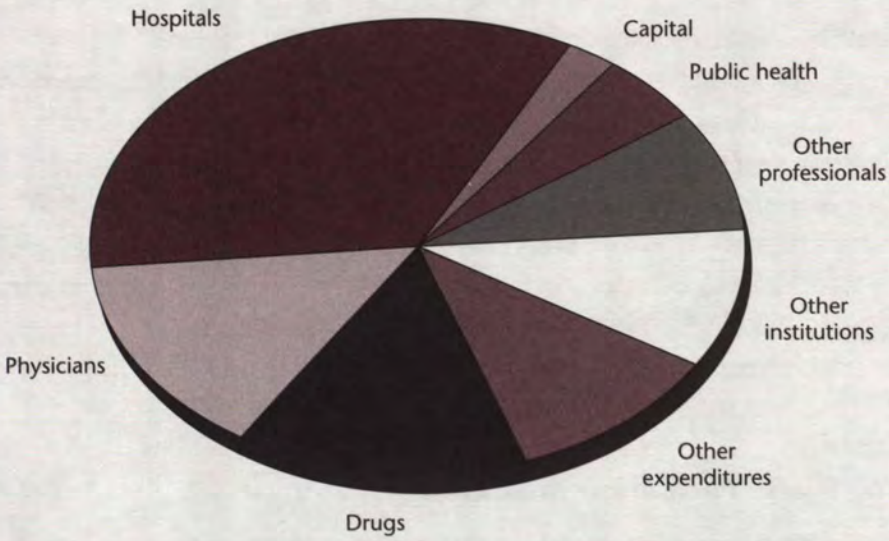
Several factors are currently helping propel this industry forward in Canada and make more widely available appropriate, desirable and affordable products and services. These innovations have the capacity to provide good returns in an increasingly competitive environment while still helping to maintain the high quality of health care enjoyed by Canadians today. Despite the potential, barriers remain as powerful deterrents to development and implementation. Even as some major issues are being addressed, the need remains for an effective development of good models for collaboration, partnership, design, implementation, cost-effectiveness, evaluation and technological transfer of telehealth systems.

## 3.1 Investment and Financing

In 1996, health care costs in Canada totalled $75.2 billion, or 9.5 percent of the GDP. From this amount, public sector health expenditures represented 69.9 percent of the nation's total, with the private sector accounting for the remaining 30.1 percent of expenditures. Figure 6 shows how those funds were applied.

**Health care costs $75.2B, or 9.5% of GDP**

**Figure 6. Health Care Expenditures in Canada, by Category**




Source: Policy and Consultation Branch, Health Canada, June 1997.

**Telehealth investment begins to draw on private investment**

Prior to the 1990s, most telehealth activity was funded exclusively from the public purse. While current telehealth projects are still primarily financed publicly, there is now growing involvement, participation and investment from the private sector.

Canadian telehealth companies can be large, publicly owned companies; for example, information technology and telecommunications (IT&T) companies. Investment in IT&T has increased dramatically in most industrialized economies over the past two decades. In Canada, the share of total investment for IT&T was 8 percent in 1990, up from 4 percent in 1971. The IT&T investment share in service industries — including communication, social and personal services — increased by 4.6 percent in 1971 to 18.1 percent in 1990.

**Small size limits access to capital**

There are also many small to very small companies privately held by a small group of founders or owners. Being part of the knowledge-based economy, small telehealth companies have few tangible assets, and they experience difficulty in obtaining long-term capital from traditional sources, despite their being highly innovative and often having strong market R&D potential. The nature of telehealth systems requires suppliers to work with a number of companies in order to offer the necessary complement of technological tools and services making up a complete telehealth system. As government and institutional purchasers of telehealth systems require guarantees, they more often place their faith and money in traditional, large, well-established and well-known companies rather than in small, albeit innovative, newcomers.

**Large, foreign MNEs partner with small Canadian firms to extend reach of both**

Increasingly, small companies wishing to remain competitive are creating partnerships or strategic alliances with large, foreign multinational enterprises (MNEs) to benefit from their technological expertise, international contacts, track records, markets and distribution channels. This trend has contributed to a growing number of acquisitions — most often by foreign interests — of small Canadian telehealth companies with promising markets and products. Most often, the parent company is able to find easy entry into the Canadian market through contacts established by the Canadian counterpart. Such mergers are by no means exclusive to the telehealth industry. In the first half of 1997, the combined value of all mergers and acquisitions amounted to $45.5 billion, up from $35 billion in 1995. The value of transactions involving a foreign buyer of a Canadian operation increased to $11.5 billion in the first half of 1997, up from $6.3 billion in the same period in 1996.

### *Case Study: Partnering in Winnipeg*

In June 1997, Electronic Data Systems Corporation (EDS), a worldwide company with Canadian headquarters in Toronto (www.eds.ca), purchased 51 percent of SmartHealth of Winnipeg, a subsidiary of the Royal Bank of Canada. In doing so, the company strengthened its capability to build a $100-million computer network to track patients through Manitoba's health care system, and link every doctor, clinic, hospital, pharmacy and diagnostic laboratory in the province of Manitoba over the next 10 years.

Canada's venture capital industry is showing increased interest in investments in medical and health-related companies. Amounts of capital placed in this sector by members of the Association of Venture Capital Companies grew from $71 million in 1995 to $111 million in 1996, and further growth is evident in 1997 for smaller enterprises in health. However, small Canadian telehealth companies do not appear to be greatly benefiting from the increased flow of venture capital into Canada's medical and health-related sector, and instead are often selling controlling interest to foreign companies that are major players in telehealth. By selling major interest to this type of firm, they gain the expertise to tackle larger projects and commercialize products coming out of the development stage. This does come at a cost, of course, in terms of the number of independent Canadian companies in telehealth.

**Venture capital shows interest in telehealth**

A recent major study undertaken by a committee formed of over 30 decision makers and specialists from the Montreal region health care sector (*Projet de rapport du comité santé*, August 1997) makes a number of proposals in the area of telehealth. The main recommendations are that small companies in this sector form strategic alliances to facilitate access to large international markets for their new, innovative products, and that financial institutions and governments provide capital funding for post-start-up firms involved in health innovations.

**Strategic alliances increase access to markets, attract more funding**

## 3.2 Trade

### Telehealth Products and Services

With telehealth markets straddling both private and public sectors and with no well-known principal marketing, distribution and financing mechanism for their products and services, telehealth companies are facing some significant challenges.

The major players in product and software development in the global telehealth sector are in the U.S. and Europe. As a result, Canada's telehealth market is substantially supplied by imports. In fact, U.S. exporters have won major contracts to develop telehealth systems for some Canadian provinces.

**Challenges from imports daunt domestic suppliers**

Despite considerable evidence of activity both on the import and export fronts, trade balance statistics for telehealth are not yet available.

The Canadian telehealth industry draws significantly for its activities from a combination of the IT&T industry as well as the medical devices sector.

### Information Technology and Telecommunications

In addition to more established companies entering the field of IT&T, over the past two years, brand-new companies have been formed offering products and services specific to this sector. In 1994, IT&T in Canada had total revenues of $54.6 billion. The telecommunications equipment domestic market alone is valued at $6.2 billion, representing 3 percent of the world market. It is undeniable that international trade for Canadian telehealth products and services have been significantly enhanced by Canada's international reputation in quality health care and its well-respected expertise in the IT&T (particularly the telecommunications) sector. Over one quarter of IT&T revenues were derived from exports in 1994. Canadian exports are expected to grow in the Asia Pacific region, Latin America, eastern Europe and Africa.

### Medical Devices

Medical devices are health care products other than drugs or medicine used for diagnostic or therapeutic purposes. The driving force behind the Canadian industry is the integration of several core technologies necessary for the development and manufacture of sophisticated medical devices including biomaterials, microelectronics, biotechnology, nuclear energy and telecommunications. Ninety percent of these firms are Canadian owned. An estimated 1 500 categories of medical devices are currently being manufactured, and several categories are being retrofitted for telemedicine purposes, particularly those involving medical imaging.

**Trade in medical devices soars rapidly**

Medical devices production has grown steadily over the past 15 years. The dollar value of production has nearly tripled since 1978 to reach about $650–700 million in 1990. In 1993, production equalled $1.8 billion and consumption was worth $3.3 billion. Imports and exports totalled $1.7 billion and $538 million, respectively, in 1993. This represents a 21-percent surge in exports since 1990. Hard data on the telehealth portion of this broader sector of activity are not yet available, but indications are clear that the amount of international trade is extensive.

### International Project Financing

**IFIs support Canadian telehealth projects in Third World**

Funding for trade projects in health care services and IT&T can be obtained from international financial institutions (IFIs), the World Bank Group (**http://www.worldbank.org**), regional development banks and the International Federation of Health Funds. The World Bank has given priority to information and communications technologies through such programs as Info-Dev. Several IFIs, such as the Inter-American Development Bank (IADB), have given priority to projects in health and science and technology (**http://www.iadb.org**). They provide significant export opportunities for Canadian telehealth companies. Canadian organizations have also been supportive. The Canadian International Development Agency (CIDA) and the

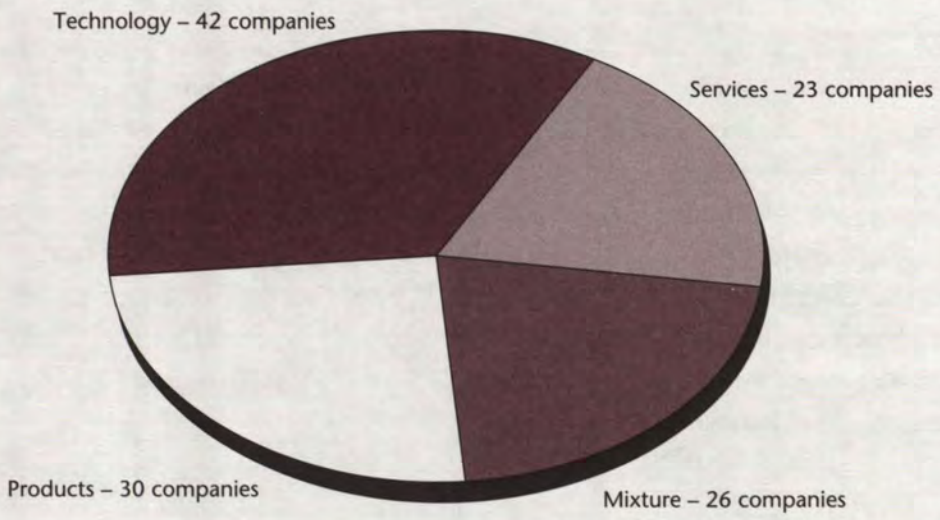
International Development Research Centre (IDRC) have had a long tradition in supporting health and telehealth-related activities in developing countries. IDRC supported Canada's participation in the SatelLife project, for example, and continues to use information technology to link health educators and researchers around the world.

## 3.3 Technology

Though a wide variety of telehealth technologies are used to meet different needs in disparate locations, telehealth has its origins in three basic technologies: telecommunications and networks including electronic data interchange (EDI), information technology and medical technology. The combination of these opens the door to an assortment of technologies for capturing, processing, storing and receiving information, ranging from POTS, to sophisticated medical imaging devices used for medical ultrasound examinations, to a host of different platforms and software to capture clinical records or create multimedia databases.

Figure 7 displays the proportion of Canadian telehealth companies producing technologies, services and other products, based on a composite of 121 companies registered in the Industry Canada Canadian Telehealth Company database.

**Figure 7. Canadian Telehealth Companies Offering Products, Technologies or Services**




Source: Industry Canada Canadian Telehealth Company database, April 1997.

**There is still no system that comprehensively facilitates the flow of all types of health information and symmetrically addresses the needs of clinicians, administrators, policy makers, patients and consumers.**

**—*Bringing Health Care Online,* U.S. Congress, Office of Technology Assessment, 1995.**

This project also may be the first time groups of hospitals in Canada, and possibly in North America, have used a totally paperless system for purchasing all goods and paying all vendors.
— Jennifer Mahoney and Robert Fletcher, EDI Forum 9 (1), 1996.

## Technological and Application Changes

Telehealth is a technology-intensive industry whose recent evolution rests on spectacular advances in telecommunications and information technology, particularly in the past two or three years. Reductions in size and costs, coupled with increases in capacity and speed, are the main results of these changes. For example, in teleradiology, a chest X-ray image when compressed to 35 percent will require 48 minutes to be transferred over a telephone line using a 28-kilobits-per-second modem. The same image is transmitted in 7.49 seconds on an ISDN line and in less than a second on an ATM network.

Change also manifests itself in a number of other ways.

*Old technologies used in new ways:* POTS are being used for help lines, toll-free telenursing, telecare, telecounselling and triage (e.g. Info-santé in Quebec and Telecare in New Brunswick). Cable TV and video are being revamped to meet market demand for such applications as telepsychiatry and tele-learning, and the use of interactive television (IATV) for telemedicine.

*Integration:* Early telehealth applications tended to transmit one type of information (e.g. X-rays) originating from one source, but current technological advances permit the capture, storage and transmission of multimedia information from many sources simultaneously and securely on high-capacity networks. This permits more holistic approaches to counselling, prevention, treatment, research and even health promotion and teaching.

*EDI:* The U.S. health care industry, early adopters of EDI systems for electronic claims processing, has more recently turned to EDI for use in CHINs. In Canada, provincial governments are employing EDI in association with third-party providers such as Livingston Healthcare Services Inc. of Oakville (**http://www.livgroup.com/html/livingston_healthcare_canada.html**), to offer just-in-time inventory replenishment services using radio-frequency transmissions from health care institutions to host computers. With such technology, orders may be processed immediately and then shipped and received within 12 hours. The main incentive for adopting EDI, however, has been cost reduction. In Ontario, 15 hospitals participated in a pilot project that realized combined savings between $1.45 million and $2.98 million on a total annual supply budget of $60 million.

*Image processing:* The past 10 years have seen massive improvements in information systems' capacities to process images. This rapid technological development has permitted many processing and storage-intensive types of telehealth applications to become a reality.

*Standards:* Given telehealth's rapid technological changes, most technical standards and practice guidelines are in early developmental stages or are non-existent. The lack of standards has serious implications; for example, systems made by different manufacturers are unable to communicate with one another. Several groups are in the process of generating both equipment standards and clinical guidelines. Some Canadian companies have appropriated the DICOM (Digital Imaging and Communications in Medicine) standard developed and adopted by the American College of Radiology for teleradiology in order to be able to export to the U.S. In Europe, there are National Standardization Bodies in each country; also, a technical board of the European Standardization Committee (CEN/BT) in 1990 established a committee for medical informatics (TC 251). The Canadian Institute for Health Information (CHI) (**http://www.cihi.ca**) has established a Health Informatics/ Telematics Partnership initiative, which invites industry partners to work together to identify, adopt and/or develop national health information standards.

*Encryption:* Health information needs to be confidential, private and secure. Canadian companies have discovered a new market in developing encryption software and security systems. Sixteen Canadian telehealth companies offer products in this category.

*Convergence:* The convergence of computer, telecommunications and media sector technologies is expected to speed up the development of telehealth significantly, especially for home care and tele-learning.

*Multimedia:* Medical knowledge and the means to distribute it are growing at an increasingly rapid pace. Multimedia applications on-line use CD-ROMs and other means to organize and store data, and allow professionals to have at their fingertips vast amounts of medical information.

*Expert systems and smart cards:* Innovative products are being developed for the telehealth industry by small and successful Canadian companies such as Digital FX, which is developing virtual reality products. Though not yet in wide use in the health care system, smart cards are featured in a number of Canadian projects, and four provinces are considering their more widespread adoption.

*Wireless:* Industry observers hold great hope that wireless technologies will permit telehealth systems to be adopted more widely in areas where traditional telecommunications infrastructures have never been developed. A form of wireless communication has been used at the bedside and even in very remote locations in the North where UVHF radio has been used for telecommunications in health care (at the edge of satellite footprints).

A recent study on telehealth conducted for Industry Canada by Innovitech Inc. found that by combining the expertise of a number of private companies offering wireless products and telehealth services, a viable telecardiology service could be marketed in a number of countries.

*Health information infrastructures:* Until recently, the term "infrastructure" referred to the fixed installations and facilities necessary to support and supply a country's operations. Lately, however, the term has been expanded to describe networks as well as information content, including computer systems, software, information services and databases, and even trained people who can build, maintain and operate these systems (infostructures). The creation of a health information infrastructure requires the integration of existing and new architectures, application systems and services. Core elements of this infrastructure include patient-centred care facilitated by computer-based patient record systems (electronic patient records or electronic health records). Continuity of care is enabled by the sharing of patient information across information networks.

*The Internet and the World Wide Web:* The advent of the Internet and the World Wide Web have had a substantial impact on the telehealth industry in general. Consumers now have access to information about health and medicine previously unavailable, even in public libraries. They also have access to user and support groups for practically every disease or medical condition known to modern medicine. Physicians and health professionals have found in the Internet an effective way to communicate with each other and with their patients, as well as to exchange research information. Governments use the Internet as a medium for exchange of population health information and disease surveillance. Private companies have turned to Intranets to help employees stay well and fit by making available information about healthy lifestyles. There are even documented reports of the Internet used to convey emergency treatment information to medical personnel in foreign lands. Indeed, most health and medical associations and many institutions including hospitals, colleges and universities have web pages. There are virtual hospitals, diagnostic services, treatment advice, chat rooms and support groups available on the World Wide Web.

**Health a major subject of interest on Internet**

Growth in net users interested in health-related material is equally impressive. The 1997 American Internet User Survey conducted by The Emerging Technologies Research Group (**http://etrg.findsvp.com/internet/top.html**) found that health/medicine rates sixth in the top 10 Internet user's content preferences; 50 percent of female users were reported to access these sites compared with 43 percent of male users (see Figure 2 above on types of information retrieved).

## 3.4 Human Resources

**Personnel shortages impact telehealth**

For many professional positions in the information technology sector, demand for personnel exceeds supply. Telehealth companies in particular may encounter a shortage of project managers, systems specialists and network architects.

Directly employing about half a million Canadians, the health care sector is one of the nation's largest employers. Some of the human resources realities and developments in health care have a major impact on the market for telehealth.

**Telehealth bridges access to health specialists in remote areas**

The geographic distribution of health care professionals poses an administrative problem for various jurisdictions, and their attempts at solutions have met with resistance, including major court cases. This situation does have some positive implications for the demand for telehealth services. There are nearly 10 times the number of physicians working in urban areas relative to those working in rural areas in Canada, and there are more than 30 times more urban specialists than rural ones. Specialist physicians practice in over 50 medical and surgical specialties and, in less populous areas of the country, the shortage of some of their essential specialties is particularly pronounced. According to figures obtained for 1994, there are no dermatologists, rehabilitation specialists, anesthesiologists, pathologists, urologists, or cardiovascular and thoracic specialists in either the Yukon or the Northwest Territories. Three provinces have no emergency physicians, and two have no public health physicians.

For those specialities where videoconferencing and imaging can be most useful — dermatology, psychiatric counselling, diagnostic radiology, and physical medicine and rehabilitation — telehealth systems can bridge the gap produced by understaffing in several provinces. One area at the forefront of these developments is pediatric ultrasonography, which increasingly has been the object of remote teleconsultations in four provinces.

**Former public health care workers find opportunities in telehealth**

Cutbacks in 1996 led to elimination of 33 000 public sector jobs, with many positions having been trimmed from the health care sector. These health care workers could find future employment in the new telehealth industry, be it in telenursing, telecounselling, home telecare or services associated with informatics and telematics. In the U.S., physicians' assistants and telenurses are among the new occupations that have been created to meet new demands, and the need for their special skills is being increasingly recognized.

Most, if not all, health care personnel will be affected one way or another by the advent and increased use of telematics in health care, yet most health care workers have had no training or education to prepare them for the already-arrived information age. Physicians need to

acquire keyboard skills. Video-counselling, telenursing and telephone triage all create new and expanded roles for nurses, who may be employed by telecare agencies to provide emergency or first-level information and advice over the telephone. In Quebec, for example, InfoSanté, a service of the Centre local de service communautaire (CLSC), has been providing such services for quite some time. With a number of hospitals closing down, the number of calls to these centres has increased dramatically: nurses took 440 000 calls in 1996, up from 300 000 in 1995, and in 1997 are expecting to handle 660 000.

Home care workers visiting patients using monitoring devices are required to learn and teach the use of these new tools. At present, only one formal training program, at the University of Victoria in British Columbia, has been identified to prepare health care workers for the knowledge and information industries. A recent market study of new media learning materials has predicted that employment in the home care industry will show the greatest level of growth of any other occupation in the next few years. Accordingly, it has also been designated as the occupation most likely to require of its employees the most significant increases in training and retraining as new telehealth technologies are introduced.

## 3.5 Other Changing Conditions

### Institutional Change

From 1986–87 to 1993–94, there was a 42-percent increase in outpatient treatment in acute care public general hospitals. The total number of hospital beds was reduced by 16 percent, the average hospital stay was one day shorter in 1993–94 than it was in 1988–89, and the number of inpatient days dropped by 18 percent over this period.

Telehealth fills gaps left by cutbacks in patient services

Changes in the ratio of inpatient to outpatient care coincide with current downsizing initiatives in which hospitals are merging and community resources are being integrated to eliminate duplication, lower administrative costs and offer a more cohesive system of services to their clients. Information networks and telehealth technologies are facilitating these amalgamations, whether through interhospital electronic links or through CHINs. Such mergers are taking place in at least five major Canadian cities.

More home telemedicine services are needed to address hospital downsizing

Home care is seen as an attractive option to hospitalized care, which can cost $800–1 000 a day or more. According to the Canadian Home Care Association, the total home care budget for the country in 1995–96 was at least $1.5 billion. A wide range of products and services has been developed to meet the home telemedicine, telemonitoring and telecare needs of patients and consumers receiving care at home, but only a few Canadian companies are actually offering products and services to this market. One such company is Althin Biopharm Inc., a Montreal

area-based firm developing dialysis systems for use in the home. More such innovations are needed in Canada. Recent hospital downsizing and the subsequent increase in ambulatory care could end up forcing more elderly, convalescent or chronically ill Canadians to import technologies developed elsewhere.

### *Corporate Profile: Althin Biopharm Inc.*

Althin Biopharm Inc. is a subsidiary of Althin Medical, Inc., whose international head office is in Miami Lakes, Florida (**http://althin.com/worldwide.html**). Besides manufacturing electrolyte solutions for hemodialysis, Althin Biopharm distributes hemodialysis equipment and dialysers manufactured by Althin Medical U.S.A. Inc., as well as ancillary products related to hemodialysis. Althin Biopharm is the only supplier offering a complete line of products for hemodialysis treatments, including concentrated solutions.

Althin Biopharm has two manufacturing plants: one located in Calgary, Alberta, and the other in Laval, Quebec. The company has 32 employees. Of these, four sales representatives, including the national manager, have been assigned territories as follows: western Canada, Ontario, and Quebec and the Atlantic provinces. Their national sales manager travels throughout the Canadian territory.

In early February 1997, Althin Biopharm put together a software development project to allow for remote monitoring of any patient from anywhere via the Internet. As a result, more patients will be treated at home, secure in the knowledge that they are being carefully monitored.

The nephrologist will have access to any of his/her patient's files at any time. This new software will help in providing better care to the patients and increasing life expectancy.

## Consumer Demand

One of the most important changes in the health care sector relates to consumer demand and patient needs. A growing interest in health promotion, disease prevention and wellness has given rise to more and more related Internet sites and applications. Moreover, shorter hospital stays have given rise to a greater reliance on telephone triage and counselling, which in turn has increased pressures to create more telecare, triage and call centres.

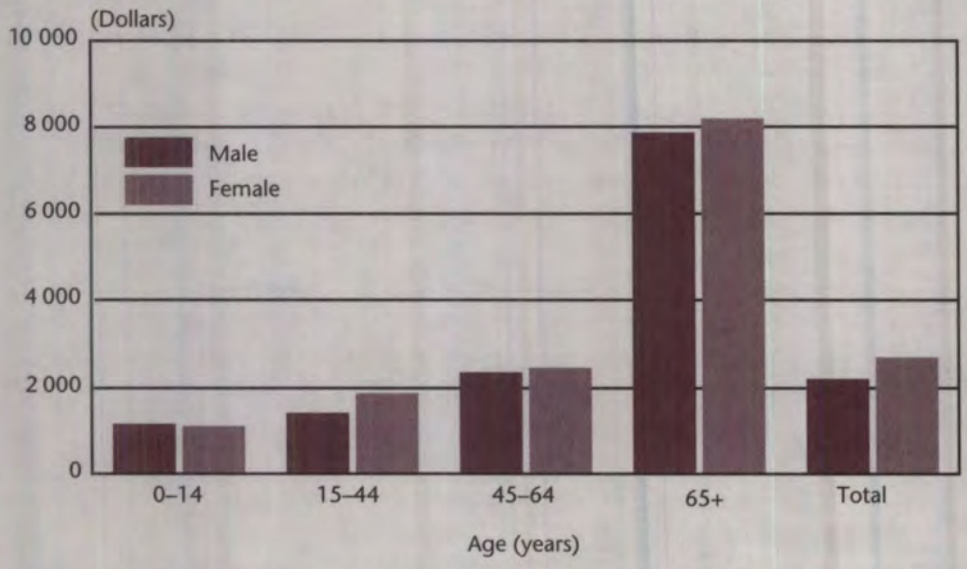
**Internet, telephone triage replace reliance on institutions**

## Aging Population

Population aging increases demand for home care telehealth devices

The average age of the population is rising. Since the elderly require more health care, greater stress will continue to be placed on the health care system (Figure 8). It is projected that in less than 10 years Canada will witness an increase of over 715 000 people over the age of 70. Even if there is some slowing of the rate of growth of this age group, by 2016 those aged 70+ will have grown to over 3.9 million, compared with fewer than 2.5 million in 1995. More of the elderly will need to be cared for at home and, as a result, telehealth devices currently on the market or in development will be in high demand by these clients as much as by the chronically ill. Even the older retired and fit consumer will need different types of devices and services, not only currently available equipment such as heart monitors, but also other, more sophisticated personal monitoring and treatment devices.

**Figure 8. Per Capita Total Health Expenditures, by Age and Sex**




Source: Health Canada, National Health Expenditures in Canada 1975–94.

## Globalization

Networks extend expertise in raising quality of life

International collaboration for diagnosis, case management and research is being facilitated by groupware, e-mail and easy access to health and medical research information and databanks. Cost-cutting in the health care sector has encouraged publicly funded institutions to increase their revenues from international projects and markets — initiatives that may be facilitated through the use of networks. In some developing countries, rising quality of life is not being matched by higher levels of health care services; expertise can and is being provided using global telecommunications and satellite networks.

### Privacy, Security and Confidentiality

Telehealth drives need for IT&T improvement in other areas

The increased use of IT&T in health care has put a spotlight on the importance of security and protection of privacy. For telehealth industry players, this issue presents both an opportunity and a threat: while the fear exists that telehealth networks may erode and endanger security, confidentiality and privacy protection, the potentially lucrative development and marketing of safeguards to ensure privacy protection — such as encryption and all forms of privacy enhancing technologies — have also been recognized.

In summary, many of these changes are being driven by health care reform. A summary of such changes is presented in Annex B, highlighting both the telehealth applications being developed or affected and the state of the art in Canada for each of them.

## 3.6 Telehealth and Sustainable Development

Electronic technologies reduce need for potentially harmful materials

Since telehealth uses environmentally friendly, non-invasive technologies and since networks have and continue to be used to promote health and disease prevention, telehealth practices and applications may be seen as contributing to sustainable development. Telehealth applications actually maintain environmentally friendly industries by reducing investment in raw materials to build structures while increasing investments in knowledge work. Teleradiology, for example, is partly responsible for the introduction of film-less radiology, which reduces the need for raw silver and other materials used to make X-ray film. Interinstitutional networking and CHINs dramatically reduce the need for paper-based records by substituting them for electronic records and data warehousing; such eliminations of film and paper greatly reduce the need for storage structures. Remote telemedicine also reduces travel, which saves on fuel. One Canadian company that has pioneered the development and implementation of diagnostic tele-imaging products is Cifra Médical Inc., which has experienced substantial growth in a relatively short period of time.

### *Corporate Profile: Cifra Médical Inc.*

Since its founding in 1995, Cifra Médical Inc. has become a very important Canadian company in staff training and in the marketing of new products designed for the global remote medicine market. The company, located in Sainte-Foy, Quebec, develops applications adapted to specializations as varied as cardiology, radiology and obstetrics, with the aim of meeting the needs and expectations of health professionals.

The Cifra mobile examining station can set up a most efficient communications and diagnostic bridge. Just a bit larger than an average computer, the mobile station can capture images from medical equipment and process and transmit

the images, thus permitting subsequent consultations. This allows a health specialist to assist another physician in a place kilometres away, at any time, enabling them to perform competent and rapid diagnoses.

At the head of the company is its founder and CEO, Jean-François Meunier. With its 23 other employees, Cifra Médical is making its presence felt across Canada. Cifra Médical's technologies mainly affect hospitals in two important fields of remote health services: remote diagnosis via transmission of digital imaging, and digital and computerized capturing of X-rays. It also makes itself felt through its annual sales of $1–5 million.

Besides these products, Cifra Médical has established a partnership with other organizations such as Siemens, QuébecTel, Bell Canada and Telesat Canada. More specifically, in 1996, they linked up with three partners and 16 hospitals, most of them in eastern Quebec, on a remote diagnosis clinical pilot project. This project will create North America's largest network of remote diagnosis, using digital imaging in pediatric cardiology and in radiology. Cifra Médical is responsible for coordinating the project and has set up 21 remote diagnosis stations.

Cifra Médical's products and innovations help ensure that remote health services will occupy a significant position in the field of medicine. Because of them, there have been reduced delays in obtaining a diagnosis, reduced transportation costs for patients, shorter care cycles and greater availability of specialized expertise in remote areas.

**Devices monitor, control illnesses**

Telehealth networks also facilitate health prevention and promotion, public health, education and human resources management. WHO has shown through a number of projects that telehealth can contribute to sustainable development. For example, the onchocerciasis (river blindness) control program in west Africa studied ways to cure the illness caused by larvae. Detectors were installed along the Volta River to measure hydraulic variables, and data coming from satellite radio frequency was collected in the main station. After 14 years, the lands were recontrolled, and their fertility levels rehabilitated.

# 4 GROWTH PROSPECTS

## 4.1 Telehealth in Industrialized Countries

The Council on Competitiveness in the United States notes competing pressures defining the predicament facing the health care system today:

- increasing need to control costs
- rising demand for health care services.

To these could be added a third and fourth pressure:

- increasing expectations by consumers of health care services, fuelled by the widespread availability of information on health and medical matters
- deepening penetration of IT&T impacting on health care systems and their institutions, which inevitably brings about anticipated and unanticipated changes including organizational impacts.

Some observers predict that the health information infrastructure market is likely to grow to above US$100 billion within a decade, up from US$20 billion in 1995. Excluding revenues from equipment and software, telemedicine and health information networks could generate telecommunications-carrier revenues of about US$2 billion by 2001. The videoconferencing market alone is expected to reach the US$5 billion market by the end of the decade.

**Infrastructure must be expanded quickly to keep up with demand: US$100B by 2005**

It is important to note that for the five groupings of telehealth applications constituting part of the industry's definition, there are different stakeholders and markets for each.

- Home telecare devices and technologies have the potential to position the patient or consumer as the buyer (though often through prescription followed by third-party reimbursement).
- By accessing physicians' offices, research and drug databases, the Internet or other networks, the health care provider (physician, pharmacist or group of pharmacists, in the case of pharmanets) is the purchaser, except when such networks have a wider institutional, provincial or national basis.
- For all other applications, public health networks, disease prevention networks and interinstitutional networks, government in one form or another will be the purchaser.

## National and Global Health Networks

It is no longer desirable to mount isolated networks for isolated activities, sole specialties or individual institutional research and pilot projects. Rather, such networks now are being viewed as components of a whole spectrum of services centred on the patient and the professionals offering health care services.

Some governments are unconvinced that telehealth networks will reduce costs overall

In 1995, the G-7 Ministers of Industry and Telecommunications met to discuss the development of a global telecommunications network and agreed on the possible establishment of pilot projects in 11 theme areas. Theme 8 concerns global health care applications, with a subproject based on a world telemedicine network. At an international telemedicine meeting held in May 1997 in Kobe, Japan, Dr. André Lacroix, the Canadian representative and project leader, launched this project by stating, "the most industrialized nations bear the responsibility to develop and test new technologies, which have a potential to improve the quality of life in less industrialized countries." Opportunities exist, therefore, for participating countries currently at a reasonably advanced stage in health infrastructure development to develop:

- tools and techniques to demonstrate and evaluate the feasibility, value and cost effectiveness of health and telehealth networks
- products and services to contribute to the interoperability of global, national and local telehealth and health networks

Challenge for participants is to prove effectiveness in key areas

At least four requirements are needed to convince governments of the usefulness and value of such networks:

- Telehealth and health networks within participating countries must be viable and operational, and not just demonstrations of technical feasibility. Documented experience is a core value in this regard.
- Products and services must be developed to conform to minimal standards, allowing them to interact and operate smoothly and efficiently at least within in-country networks. Flexibility is therefore essential.
- Along with standards, products and services assuring cost-effective transport of information while safeguarding integrity are essential. Wherever these products are being developed, they must be brought to the attention of developers of national and global health networks. Encryption, digitization and compression products thus retain a high value.
- Users and developers of health networks must themselves be sharers of information in terms of what works and what does not. Telehealth networks in this sense serve two functions: first, to demonstrate their usability for tele-learning; second, to demystify the processes and technologies and thus provide information to health professionals and potential and actual users. Appropriate content and learning tools are therefore as valuable as the technological tools themselves.

## Telemedicine, Remote Care and Teleconsultations

*Teleconsultation and distance medicine:* Some countries, including Canada, are providing incentives to physicians to move to rural regions. The recent passing of legislation (in California) permitting reimbursement for telemedicine services has stimulated a number of developments. Nineteen projects involving rural, intercity and suburban areas totalling US$42 million have been announced, along with a three-year medicare project involving five different telemedicine centres to pay for services at 57 certified sites. Such regulatory changes are expected in other parts of the U.S. and are likely to stimulate the establishment of a number of new telemedicine applications and sites. Estimates of the size of the U.S. market grew from a low of US$77 million in 1995, mostly for teleradiology and videoconferencing, to a projected US$283 million by the year 2000. When military and other peripheral expenditures are included, the estimate comes closer to US$750 million.

**Reimbursement for service use remains unclear in many regions**

In Canada, the issue of physician reimbursement for telemedicine services has yet to be resolved for all but a few types of consultations. Stentor Alliance companies therefore foresee only modest revenues at around $150 million for telemedicine over the next five to seven years.

Small communities require better tools to access the Information Highway. Industry Canada's Community Access Program (CAP) recently funded over 400 projects to link more than 700 small communities to the Information Highway. Health care professionals and workers and their patients could be some of the first to benefit from these initiatives.

*Aboriginal care:* In some previous telemedicine projects, Aboriginal peoples in isolated northern communities were linked to the south for health care services via telemedicine networks. Health Canada is currently transferring all of its medical service responsibilities directly to the Aboriginal people. The timing seems ripe for the deployment of better systems and technologies that will ease the transfer of services and facilitate dissemination of information between northern communities, and permit Aboriginal peoples to collect and exchange health information among their own communities. The 1997 federal government Budget announced that, in partnership with First Nations, a Health Information System would be created, consisting of 13 integrated subsystems to track information and support case management, and facilitate health program delivery, management, planning and evaluation in over 500 First Nations communities.

**Better networks allow direct responsibility for telehealth services**

*Psychiatric counselling:* Telecounselling experiences using videoconferencing have been reported recently in Canada, Australia and Norway. These applications are expected to become more common in the near future, since specialists (psychiatrists especially) may not be able to relocate to rural areas because low numbers of patients there make such a move economically unfeasible. The videoconferencing market is expected to reach US$5 billion by the year 2000.

### Interinstitutional Networks

Global rules are required

*Information infrastructure-related technologies:* According to the Organisation for Economic Co-operation and Development (OECD), governments now are coming together to draft a set of common rules for the construction of a global information society. Underlying this effort is the need to develop and diffuse broadband communication technologies allowing for rapid transmission of large quantities of information and the integration of data, video, text and voice traffic at low costs. The health care sector is frequently mentioned in infrastructure programs, particularly for its ability to use national information infrastructures (NII) in the reduction of costs while increasing quality and access to services. By using EDI to manage information flows and by adopting personal health information systems, dramatic cost reductions are foreseen.

It has also been reported that the U.S. health information infrastructure is likely to grow to well above a US$100 billion market sector within a decade, up from US$20 billion today.

Most physicians remain to be linked electronically

*Automating the physician's office:* The single largest medical informatics initiative over the next decade will be focussed on automating the physician's office. In the U.S., this market is expected to reach US$1 billion by 1999, and will be captured by 10 to 20 large vendors with scalable systems. But in Canada, using Quebec as an example, among 243 health sector establishments, only 23.7 percent are equipped to communicate electronically with the outside world. Only 16.2 percent of these use laptop computers and therefore would be poorly equipped for telehealth applications of even the most basic kind.

*Encryption:* The telehealth market has raised concerns among consumers regarding privacy and security of data. Public key technologies with digital signatures and encryption technologies could offer solutions. The potential market for cryptographic products is forecast to increase tenfold from $571 million in 1995 to $5.2 billion at the turn of the century, with health care systems being big users.

*Professional uses of the Internet:* The phenomenal rise of Internet access to health and health care information and services could hardly have been foreseen even a few years ago. But perhaps the Internet's greatest contribution to telehealth is that it provides a relatively high bandpass digital channel at a very low, fixed cost. Newer protocols to meet the demands of real-time, high-quality image transfer, real-time protocol (RTP) and real-time streaming protocol (RTSP) promise to make video, voice and data communications over the Internet as commonplace as a simple telephone call, at dramatically reduced costs.

**Drop in costs of advancements speeds spread**

*Consumer needs:* Though the market seems saturated with products such as do-it-yourself html coding, web paging and so on, there has been a resurgence of needs for products in the wake of technologies such as those permitting users to receive Internet information on home TV sets. Web sites offering medical advice are very popular, as are newsgroups, electronic medical forums, virtual hospitals and disease control networks.

A growing challenge in public institutions is the rate of change introduced by the Internet. Some contend that public institutions simply cannot keep up with the private sector in electronic networking and communication. A revolution in learning and access to research may turn the private sector into society's chief educator, though reliability/accuracy of information/training needs to be maintained. Seeking to help professionals manage the increasing volume of information growing out of health care reform and evidence-based medicine, Synapse Publishing Inc. of Edmonton, an Alberta-based company, provides easy-to-use systems for informed and efficient clinical decision making.

**Pace of change threatens to exceed public sector capabilities**

### *Corporate Profile: Synapse Publishing Inc.*

Synapse Publishing Inc. of Edmonton was the first organization to bring together the power of Internet-based publishing, the demands of health care reform and the science of evidence-based medicine. Its focus is to increase health care efficiency and quality while decreasing overall costs by providing up-to-date, pertinent information to decision makers at the bedside and the boardroom.

The main networking tool provided by Synapse is the Disease Guiding System® (DGS). This system enables the physician to: record critical patient information, provide input for diagnosis, generate corresponding patient care orders, retrieve literature for viewing through "hot links," print patient summaries and education materials, and conduct and record outcome assessments. The DGS also provides links to supporting evidence within the Synapse Library (accessed through the DGS), which is maintained by international academic faculties of opinion leaders, and to other external publications.

Formed in 1993, through start-up capital provided by CANARIE Inc., Synapse Publishing Inc. (**www.medlib.com**) originated as a project within the Neurology Division at the University of Alberta. Located in Edmonton, Synapse Publishing Inc. now employs 10 full-time professionals from a variety of fields, with Andrew Penn as its president.

With new research coming to light every day, there is now an overwhelming volume of medical literature of which clinicians are expected to keep abreast. With the added pressure of health care reform, it is clear that efficient access to information has never been more valuable or important than it is today. For these reasons, Synapse provides comprehensive, easy-to-use systems for managing medical information in the most efficient manner.

Synapse's product encompasses almost all of the health industry, taking account of who and what will benefit most from the DGS. They include patients, health care professionals, academic researchers, medical associations, regional health and health ministries. Being an online library means that the DGS can be implemented around the globe by using a variety of networking options, including the Intranet or the Internet. In the end, being better informed and more efficient means higher-quality health care for everyone, which is the mission of Synapse Publishing Inc.

### Tele-learning, Multimedia, Research Databases

Distance learning reduces training times

*Videoconferencing and multimedia:* Though health care has long been considered a low-volume user of videoconferencing, the sector has been embracing this technology more readily of late as equipment and telecommunications costs decrease and as videoconferencing units improve and become less cumbersome. As the preferred tool of continuing medical education (CME) distance educators, videoconferencing is being adopted more widely by Canadian universities. At the same time, however, multimedia content is actually overtaking tele- and videoconferencing in popularity as more and more CD-ROMs with health and medical content become available. Though multimedia start-up costs may be high, their use has greatly reduced the time spent on training, in some cases by as much as 30 percent. TANDBERG Inc. of Norway has recently acquired Canvas Visual Corporation, of Saint-Laurent, Quebec, a well-known Canadian videoconferencing company, and has implemented a number of such systems in telehealth in Canada.

### *Corporate Profile: TANDBERG Inc.*

TANDBERG Inc. of Norway, a company that produces the world's top-selling videoconferencing unit and commands more than 40 percent of the market share in its category, in 1997 acquired Canvas Visual Corporation (**http://www.canvasvisual.com/frame.html**) (formerly known as CBCI Telecom Inc. in Canada and BT Visual Images in the United States). The latter manufactures, markets and services a comprehensive portfolio of general purpose and application-specific visual communications systems for business to business, institutional and vertical markets including health care and education. Canvas Visual, with 147 employees and US$31 million in sales, is the fastest-growing visual communications provider in North America.

Having maintained its name under TANDBERG, Canvas Healthcare Systems® (HCS) and services have already begun to cut costs and increase the quality of care in health care facilities. Now, family doctors in remote regions can engage in interactive sessions with specialists in major cities. Experts in urban centres can offer top-notch consulting via videoconferencing without having to incur the costs associated with transporting the patient. With the transference of live video, voice and data from operating rooms, local general surgeons are able to perform lifesaving operations with the assistance of specialists.

The Canvas HCS accepts a number of medical inputs and offers a large number of options in order to custom-tailor the system for any medical application, from pediatric settings to general practice offices in remote areas. The entire system is integrated into a lockable, portable cabinet narrower than a trauma bed and is able to blend into any medical setting.

The system has been specifically designed to offer maximum flexibility for ease of use in telemedicine applications including remote diagnostics, remote consultations and assisted surgery. In addition, it can be used for CME, videoconferencing and training applications.

*Content development:* In remote care and telecare as well as in teleconsultation and telemedicine, content development is unnecessary, as the specialist and the general practitioner's particular expertise provide the content. However, for health and medical tele-learning, for both CME and patient education, much needs to be done to develop, adapt, maintain and, in some cases, translate this information into formats — such as multimedia — respecting good tele-learning design and sound pedagogical principles. To meet these demands, a number of public and private Canadian organizations are developing content suitable to this market. Implementation therefore is not simply a matter of adding on a new technology; change and learning are part of the process.

**New learning is needed to help practitioners keep pace with change**

## Telemonitoring, Telephone Triage, Home Care and Emergency Networks

Telephones replace institutional response to health care queries

*Call centres:* The past few years have seen a phenomenal rise, in North America generally and in Canada specifically, of the use of call centre technology. This increase is in response to a widening market for reservations, telepurchasing, information access and responses to telephone-based inquiries. Several provinces, notably Quebec (Info-Santé) and New Brunswick (Telecare) have implemented 1-800 numbers and call centres to handle health care queries and problems. Foundation Health Systems International (**http://www.hsintl.com**), a large, managed health care organization, recently announced the launch of comprehensive call centre services serving approximately 25 000 members in nine U.S. states. Telephone-based counselling has grown very substantially, and is expected to grow even more as patients are encouraged to seek lower-cost services, obtain health information and undertake self-care.

Telephone access reduces need for face-to-face consultations with specialists

*Home telecare technology:* Expenditures in home care are increasing in both the U.S. and Canada. This sector requires very different user-friendly and robust systems that can ideally be plugged into a plain telephone network. The industry may be divided into several types: the in-home patient care product market, where the customer buys the product needed from a retailer; an institutional market, where a patient receives a service on an outpatient basis; and the replacement of face-to-face visits with telemedicine technologies and monitoring devices linked by telephone. The last of these represents an important growing market for the telehealth industry, with the health care sector seeking to replace institutional care with home visitations by qualified nurses. In fact, at a recent meeting of the National Association of Home Care, it was predicted that by the year 2000, more than 80 percent of patients in the U.S. will visit nurses only.

The home care of the future will often occur through referrals, with more than 70 percent being made over the Internet, thereby lending credence to the assessment that the industry is racing toward high-tech, automated technologies. The telehealth industry is changing, as most others have done earlier, in response to falling costs and improved capacity of communications and computers.

Budget sets $150M federal incentive for home delivery innovation

In Canada, the National Forum on Health recommends that home care be treated as part of an integrated system of health care delivery and that information be systematically gathered for evaluation of these services. The Canadian federal Budget of February 1997 responded favourably to this recommendation by establishing a $150-million transition fund that, in part, can be used to encourage innovation in this area.

*Virtual reality and advanced imaging:* Virtual reality is being used as a teaching tool to simulate surfaces and contours in the absence of the real thing for medical students being trained to examine patients and detect such conditions as tumors. The technology is also being used to simulate environments for phobic patients to be counselled or treated in real time as they encounter their feared experiences. Three-dimensional imaging and surgical navigation systems are being employed on an experimental basis to image tumors and organs of the body in order to guide surgery. Both these applications can be used in a networked environment to train medical students and other health professionals.

**3-D imaging aids learning, reassures patients**

*Data warehousing:* Data warehousing will prove increasingly essential in the development of large data banks for research information, comparative literature databases, clinical trials, clinical guidelines and the safe storage of electronic medical records. Another application of the technology will be the storage of large sets of medical images in pathology and radiology, to be used as a reference by physicians and health care professionals. TeleMed now offers such a system (**http://www.acl.lanl.gov/sunrise/Medical/telemed.html**) in the U.S., and claims that the image bank can also be used for teaching and presentations. A major benefit of this technology is that stored images can be retrieved easily for comparison, even from large distances. Since the error rate in reading conventional film is still as high as 30 percent, comparing the radiograph with a reference or control picture offers the benefit of added guidance. Patients can even obtain a second opinion on their diagnostic imaging studies by accessing web sites such as that of the Diagnostic Assurance Professionals (**http://www.voicenet.com/~afried/index.html**) for a consultation.

**Image banks offer ready references for practitioners and patients**

*Global emergency and disease prevention networks:* It will be some years before fully operational global emergency and disease prevention electronic networks become a reality. There is, however, a growing realization that such networks may be not only feasible but also essential in light of the high volume of travel and exchange between countries, the growing number of senior and frail travellers, and the increasing number of adventure expeditions being mounted (with substantial corporate sponsorships), which often bring participants to the extreme edge of physical danger.

## 4.2 Telehealth in the Developing World

The potential for telehealth to improve access to health care for developing nations has been a central preoccupation of international organizations. Developing countries face numerous challenges in the area of health, and many lack the infrastructure and human resources to provide a full range of services. Indeed, acquiring technological apparatuses is only part of

**Telehealth extends developed-country standards to Third World**

While technologic developments cannot and should not be impeded, the economic cost can be significantly curtailed when application is determined by evidence-based medical guidelines. . . . If evidence-based medical standards were to be applied to technology assessment, the cost problem facing developing countries would be significantly reduced.

— Bernard Lown, *Health Technology, the Developing World and SatelLife,* 1997 (http://www.healthnet.org).

the solution; these societies also need to develop institutional capacities and a knowledge base to address serious health problems by means of quality, effectiveness and efficiency of service. In July 1997, the World Telemedicine Symposium for Developing Countries was held in Portugal, organized by the ITU. It was recommended that pilot telemedicine projects funded by the ITU be developed, based on identified needs, and that the ITU identify potential partners as sponsors for such projects in developing countries.

There is certainly no shortage of technology to meet the challenge. Even those countries with little or no telephone penetration are being at least partially served by the Internet and by HealthNet, the latter a telecommunications system using low earth orbit satellites for transfer of health-related information to ground stations in 18 countries. Canada has provided assistance to this project through funding from IDRC, and for some time Memorial University in Newfoundland acted as the gateway to SatelLife. An estimated 4 000 health care workers currently have access to HealthNet (**http://www.bmj.com**) at very low cost.

The shortage lies in content and expertise, and this is where Canadians have the opportunity to play an important role. Most developing-world health care systems are publicly funded. Canada's health care system is internationally well respected, both in terms of medical and health care management expertise. Canada has significant background and a solid reputation in distance education and in tele-learning — in research, content and practice. Canada's Tele-learning Centre of Excellence, for example, gathers together 125 researchers from 29 universities and private companies. There are 16 faculties of medicine in Canada, several offering CME programs in the form of tele-education. Canada is moreover cultivating experience in the knowledge economy. The nation's engineering consulting industry has earned itself a good name for delivering high quality at reasonable costs, and Canadians generally are highly regarded for their technical competence and ability to deal effectively in international environments. The Canadian Consultant Trust Funds (CCTFs) of the World Bank and the Inter-American Development Bank, funded by CIDA, are used to hire Canadian consultants and technical specialists on short-term assignments. These employees assist the banks in project identification, preparation, appraisal, implementation and evaluation work in sectors of developmental and commercial priority to Canada. The funds help position firms and individuals for downstream work associated with project implementation and development.

In August 1997, the Pan American Health Organization (PAHO) produced a report titled *Health Technology Linking the Americas Moving Toward a Vision: Implementing and Using Information Systems and Technology to Improve Health and Health Care in Latin America and the Caribbean*, which provides an excellent overview of the information infrastructure and proposes a vision of appropriate technology implementation in the countries of that

region. Projects are to be implemented in 12 core areas and require investments totalling over US$399 million over five years. Similar needs have been identified for countries of the former Soviet Union, Africa and Asia, particularly China. Canadian capacity, experience and assistance would be most useful in meeting these needs.

**Canadian capacity poised to serve health care projects abroad**

### *World View*

The developing countries have large rural and remote areas and relatively few health care staff. For example, 24 percent of the total population of the United States and 15 percent of Australia's is rural, compared with 64 percent in the developing world and 79 percent in the least developed countries. As well as differences in urbanization, there are major discrepancies in numbers of health care staff: In sub-Saharan Africa, there is only one doctor for every 18 000 people, compared with one for every 6 000 people in the developing world as a whole and one for every 400 in the industrial countries.

— R. Wootton, "The Possible Use of Telemedicine in Developing Countries," *Journal of Telemedicine and Telecare* 1 (3) (1997): 24.

## 4.3 The Bottom Line

Major opportunities and challenges face Canada's embryonic telehealth industry in the following areas:

- identification of consumer demand
- improvement in access to financing
- adoption of best practices in terms of standards, interconnectivity and evaluation of effectiveness
- measures to address shortages in skills among professional users
- measures to deal with skill shortages that constrain development within the industry.

With the Canadian health care system currently undergoing dramatic change, the time is ripe to adopt cost-effective alternatives to traditional health care delivery methods, such as more telehealth-assisted home care, as in-patient hospital care is being reduced. The implementation of these alternatives entails a rethinking of traditional solutions and procedures and a possible re-engineering of care delivery systems. The undertaking of initiatives to meet these ends requires that service, skills and knowledge — the "soft" sides of the industry — be properly addressed. Functioning as components of the telehealth industry, the pharmaceutical and medical industries do in fact rank high as knowledge-based industries. Telehealth systems use

**Knowledge-based industries offer alternatives to traditional health care**

the very tools that can be used to diffuse knowledge, heighten awareness and provide the information necessary to arrive at evidence-based decisions. Tele-learning, distance education and multimedia products and services can and need to be further developed to make future telehealth users more aware and skilled in the use of telehealth technologies.

On the international scene, the embryonic Canadian telehealth industry is small and companies often lack information needed to access capital for expansion, export sales and other exploitation of international opportunities. Canada's venture capital industry is breaking records for amounts of capital deployed, and Canadian telehealth firms must know what financial products are offered and how to access them. The Export Development Corporation (EDC) has created nine specialized customer teams, designed to provide clearer customer focus, satisfaction and responsiveness, but none is focussed exclusively on the telehealth sector.

**Foreign purchasers know little of Canadian capabilities**

Although Canada's medical care system is well known abroad, the capability of our telehealth companies is not. Many new Canadian telehealth companies are being created and other firms are identifying telehealth as one of their activities. However, too few of these enterprises are known to potential purchasers and too little is known about Canadian telehealth capabilities in general. Firms need to know how to find distributors abroad and to publicize their products. Trade missions have made some contribution in this regard in the past, but much more is needed. Visibility of Canadian telehealth companies' capabilities within major international organizations could be raised by circulating profiles of them to delegations or missions to international organizations in the developed world (e.g. OECD or WTO) as well as those encompassing developing regions (e.g. WHO) in order to promote those capabilities through avenues available to them within those organizations.

**Federal program assists alliance formation**

Small Canadian telehealth firms could form strategic alliances with larger foreign telehealth companies to facilitate their access to large international markets for their new, innovative products. Industry Canada's Technology Partnerships Canada (TPC) is designed to encourage research and development and high technology projects in Canada. TPC was created to address the need by established companies in specific industrial segments to ensure that near-market products – those with a high potential to stimulate economic growth and job creation – actually reach the marketplace. One of the fund's focuses is on strategic "enabling" technologies, such as biotechnology, selected information technologies and advanced manufacturing technologies, which make many industries more efficient and productive.

Whether their developmental work is exclusively focussed on the domestic market or includes export markets, small promising Canadian companies increasingly fall under foreign ownership. While foreign alliances and joint ventures are among the keys to success for growth-oriented

players throughout Canadian industry, the telehealth sector recently has experienced several cases involving foreign investors taking majority control of a Canadian firm. This trend may be more a reflection of the difficulty in obtaining growth financing at home than a conscious desire to become a subsidiary of a larger foreign supplier.

**More public–private partnering is needed**

Where unmet needs are glaringly apparent — for example, in value-added services and turnkey systems or in home care monitoring devices and systems safeguarding confidential transactions — there are few made-in-Canada solutions, with the exception of those offered by Canadian telephone companies. U.S.-made technological solutions have been imported by several provinces and retrofitted to meet the demands of a publicly funded system. For domestic trade opportunities, the Canadian telehealth companies need to partner with their public sector counterparts to create a new generation of private and public sector industry. In so doing, they would successfully combine the advantages of both, for the benefit of Canadian companies, care providers and patients.

It has been shown that in Canada and in most foreign markets, governments in one form or another will be the purchaser of the majority of telehealth products and services. In Canada's telehealth projects and programs, hospitals, universities, companies and government agencies are involved. It is very important that their combined professional and technological progress be complemented by the marshaling and analysis of data that will show the cost-effectiveness of the provision of health information and health care services using telehealth technology. This is essential in a market like Canada's where health generally falls under provincial jurisdiction and decision makers need to be shown the economies of scale in moving together toward new methods of advancing health and health care today and in the next century.

**Cooperation among government levels could bring scale economies**

There is scope for such economies of scale in health care delivery if progress is made on opportunities for some standardization of technologies across provinces and territories. Political leaders of provinces and territories have cooperated in a declaration of priority for health care in the coming years. Their agencies and telehealth suppliers could undoubtedly make progress by working together in this field, in the interests of furthering cost effectiveness and improved service to the consumer. In the same spirit that Team Canada and the National Sector Team for Health Industries are working to improve access for Canadian companies to export markets, a team of private and public sector stakeholders in telehealth may be the best mechanism to work toward the cooperation needed to quantify the potential contribution of telehealth toward improved cost effectiveness of the Canadian health care system. The findings are likely to improve the domestic telehealth market and Canadian companies' access to it as a result.

**Difficulties remain in linking components**

Although telehealth system components may appear simple and straightforward, it remains difficult to pull the components together so that each operates with the others smoothly and predictably and at a reasonable cost. This problem is being addressed by some Canadian companies by means of better turnkey systems and services. The telehealth industry also needs to address more vigorously the issue of needs analysis, the human and organizational factors, the design and ergonomic issues associated with telehealth, and also to find ways of increasing the exposure of users to the relevant technologies and their potential.

**Professional IT&T resources are in short supply**

One challenge in accomplishing this goal is that, like other knowledge-based industries, telehealth companies encounter difficulty in finding within Canada the professional resources they need for multidisciplinary teams to design products and bring them to market. This also constrains them in bidding against foreign competitors on major projects. Canada's new telehealth association could work with other stakeholders in the education sector to consider ways to address this.

**Once telehealth system is in place, sales of services are expected to soar**

The growth prospects are strong in both Canadian and foreign markets, demonstrated achievements are there within the Canadian industry, and customers such as fiscally constrained governments are attracted by the cost effectiveness of telehealth services and technologies. However, a number of initiatives are needed to provide the competitive intelligence, support rising skill requirements and develop tools essential to the growth of a new, innovative industry. These actions could be undertaken by industry participants, the health care sector and governments working collaboratively to develop and expand the Canadian telehealth industry. If such things are done, there is a projected sales potential of $1 billion by the year 2000 with employment of 5 000 — a threefold increase from today's level.

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# Annex A
# GLOSSARY OF TERMS

**Asynchronous:** A transmission not dependent on the synchronization of timing or frequency between the two nodes.

**ATM (Asynchronous Transfer Mode):** A type of store and forward two-way telecommunications service. Instead of switching transmissions as a single connection across the telecommunications grid, ATM breaks up the transmission into small 56 bps packets. These packets are transferred across the ATM network according to their priority and network activity. Transfer speeds are typically in the millions to low billions of bps (Mbps to low Gbps). ATM networks utilize different telecommunications media, such as fibre optic and coaxial cable along with microwave transmissions. ATM connections offer great promise for telehealth because they are fast enough and flexible enough to handle the massive bandwidth requirements of advanced telehealth applications such as combined teleradiology/videoconferencing applications.

**Bandwidth:** A measure of the information carrying capacity of a communications channel, usually expressed in kbps (kilobits per second) or Mbps. The higher the bandwidth, the greater the amount of information that can be carried.

**Broadband:** Communications systems such as television or microwave broadcasts, which are capable of carrying a wide range of frequencies.

**CHIN (Community Health Information Network):** An electronic communications system linking health professionals and patients within a community, providing health information and other online services.

**CHMIS (Community Health Management Information System):** An electronic system similar to a CHIN. The explicit emphasis is on building a data repository for use in assessing the performance of health care providers and insurance plans.

**CLSC (Centre local de service communautaire):** Local community service centres. There are 154 in Quebec. Under the direction of a regional health and social services council, the CLSC is designed as a single point of access for patients and offers a coordinated, team approach to ambulatory care, integrating health and social services and emphasizing health promotion and disease prevention.

**Coaxial Cable:** For a long time used as part of telephone networks, its most familiar application today is for cable television to the home.

**Compressed Video:** Video images that have had extraneous information removed in order to render them transmittable by narrowband carriers.

**CT (Computerized Tomography) Scan:** The use of a medical diagnostic imaging device combining X-rays, detectors and a computer to analyze the resulting densities. A cross-sectional view can be obtained using the data.

**Data Repository:** The component of an information system that accepts, files and stores data from a variety of sources.

**Dedicated Line:** Two information systems connected directly together with no switching along the connection. To use the telephone as an analogy, there is no need to "dial" on a dedicated line because it will always connect with the same "number." It cannot call any other number because it has no "switchbox."

**EDI (Electronic Data Interchange):** The application-to-application interchange of business data between organizations using a standard data format.

**Fibre Optic Cable:** Very fine, flexible glass rods allowing the conduction of light impulses over long distances and around corners. Networks based on fibre optic cable can transmit very large amounts of data.

**Hand-held or Palm-top Computer:** A small, lightweight tablet computer, which can be operated while talking to a patient and which requires no special skills to operate. Such computers may have integrated modem cards to communicate via wireless modem to a computer network. The screen itself is a digitizer as well as a display, and a stylus is used like a mouse to pull down menus and make touch-screen choices. More sophisticated versions allow for graphics, hand-made diagrams and handwriting to be captured.

**Informatics:** The science of data management, processing and knowledge.

**Internet:** The largest and fastest-growing international computer network, linking individuals as well as academic and commercial organizations.

**Interoperability:** The capacity of different system components and platforms to work together smoothly and predictably.

**Intranet:** A private Internet service used by corporations to communicate internally or within an authorized group of users.

**IP (Internet Protocol):** The main protocol used by networks making up the Internet.

**Iridium:** A mobile satellite project by Motorola that by 1998 will see 36 LEOS (see below) in space offering inexpensive global voice, fax and data transmission services. This project overcomes the problem of earth's curvature (i.e. no more loss of quality as one goes north). Because the satellites are in low-altitude orbits, transmitters need much less power to get much clearer signal and thus can be smaller and cheaper than those of previous systems. One possible complication for this system is that because Iridium satellites are in low earth orbit, they cannot cover very large areas (like all of Canada).

**ISDN (Integrated Services Digital Network):** A new kind of digital dial-up connection offering high-speed access over a pair of telephone lines and allowing the integrated transmission of voice, video and data. Their speed is 64 kbps per channel, for a total of 128 kbps. ISDN is rapidly gaining in popularity and it is perceived as an affordable telecommunications solution for low-end users who require higher speeds than a normal telephone system modem will allow. In terms of telehealth, ISDN is particularly useful for Internet connections, desktop videoconferencing and lower-resolution image transfers. There is also a broadband version of the ISDN.

**LAN (Local Area Network):** A data communication network that is limited geographically, for example, within a single building. Communications lines link a localized group of computers, printers and servers (see also WAN).

**LEOS (Low Earth Orbiting Satellite):** A satellite designed to provide inexpensive medical and health data services to countries lacking adequate terrestrial telecommunications infrastructures. Satellites normally orbit about 35 600 kilometres above the earth, but a LEOS can travel in orbits only about 960 kilometres above the earth. A LEOS called SatelLife provides Healthnet service to several countries.

**Managed Care (or Managed Health Care):** A vaguely defined term referring to various systems of health care delivery that attempt to manage the cost, quality and accessibility of health care.

**MRI (Magnetic Resonance Imaging) Device:** A diagnostic device that records images by means of powerful electromagnets aligning atomic nuclei in the body. A computer analyzes the radiation picked up from this atomic alignment.

**Narrowband:** The opposite of broadband; a communications medium that can use only a small frequency range of signals.

**Network:** Interconnected communications equipment used to handle voice, video or data. Examples include LANs and WANs.

**POTS (Plain Old Telephone System):** The everyday voice telephone system we all know. Data transmission is performed over this system by using modems (modulator-demodulator units) at both ends of the line to transform the data into sound and then back into data.

**Smart Card:** A card with an embedded microchip. The size of credit cards, these cards function to transfer data when placed within a reader. Smart cards may be designed to carry an entire health record or simply some selected information such as medication, allergies, etc. Although high security is normally required to assure confidentiality, smart cards provide benefits such as preservation of paper and storage space, prevention of duplication and drug interaction errors, provision of the patient and physician with access to all relevant information quickly in emergency situations, and easy transfer of data from one location to another. Several pilot projects using health smart cards are currently under way in Canada.

**SMDS (Switched Multimegabit Data Service):** Equivalent of LAN communications, but in a wide area with speeds of up to 34 Mbps.

**SONET (Synchronous Optical Network):** A fibre optic dedicated connection. Many levels of SONET connections are available: OC1 (51.84 Mbps), OC3 (155.52 Mbps), OC12 (622 Mbps).

**Standard:** A specification or requirement established by recognized bodies such as the International Organization for Standardization (ISO). Standards provide rules, guidelines or characteristics for activities or their results aimed at the achievement of a maximum degree of performance in a given context. Standards should be based on the consolidated results of

science, technology and experience, and are aimed at the promotion of optimum community benefits.

**Switched Connection:** A device used to connect to numerous different sites.

**Switched-56:** Digital data telephone lines with a much greater data capacity than normal telephone lines. Their speed is 64 kbps, although 8 kbps is often reserved for signalling, leaving 56 kbps for data. Switched-56 lines are often used in parallel to achieve higher speeds; for example, six Switched-56 connections running parallel produce 384 kbps of bandwidth.

**Synchronous Transmission:** Transmission of bits at a fixed rate with transmitter and receiver synchronized.

**T1 or SMDS (Switched Multimegabit Data Service):** A dedicated connection consisting of 24 digital signals level "0" and having a total capacity of 1.544 Mbps. This is currently the most popular means of linking large computer networks and, as such, is the *de facto* standard for Internet connections. Remote medical consultations, including videoconferencing and real-time image transfer, are well supported by this type of network. The cost of a T1 line is more than 10 times the cost of an ISDN line for installation alone.

**T3 or DS3 (Digital Signal Level 3):** A very fast and very expensive dedicated connection, consisting of 28 DS1s (i.e. 672 DS0 lines) and having a total capacity of 44.736 Mbps. T3s are most commonly used as "backbone" connections between major Internet sites.

**TCP (Transmission Control Protocol):** An important protocol upon which the Internet is based. TCP is more limited than IP and it is often combined with IP to form a package of protocols called TCP/IP.

**Telecommunications:** A system of communication that differs from broadcast communications in that it is traditionally used for private communications. The Canadian telecommunications infrastructure is said to be the best in the world. Present-day telecommunications technology offers five standard media over which to transmit information: copper wire, fibre optic cable, co-axial cable, satellite and microwave.

**Teleconferencing:** The use of interactive electronic communication equipment between users at sites distant to each other.

**Teledermatology:** A branch of medicine dealing with skin diseases, with diagnosis necessitating examination of the affected area. High-resolution colour television is now being used successfully to obtain consultations from a dermatologist remotely.

**Tele-imaging:** The use of electronic transmission to convey images.

**Tele-learning:** Access to educational or training programs using a combination of online information, multimedia and networks.

**Telematics:** The investigation, monitoring and management of patients and the education of patients and staff using systems that allow ready access to expert advice and patient information, regardless of the location of the patient or relevant information.

**Telemedicine:** The delivery of care to patients anywhere in the world by combining communications technology with medical expertise. Telemedicine encompasses six essential elements: geographic separation, use of telecommunications, use of computer technology, appropriate staffing, development of clinical protocols and development of normative standards.

**Telepathology:** The transmission of microscopic images of slides of specimens obtained from biopsies for diagnosis or opinion by a pathologist in a remote location.

**Teleradiology:** The transmission of radiology images using telemedicine systems. In its oldest form, teleradiology used analog slow-scan to transmit images, a slow process resulting in less-than-optimum reproduction of the transmitted image at the other end. In modern teleradiology, these plain radiographs are first scanned and digitized, the resulting digital information then being compressed and transmitted. Various processes have been developed to accomplish the latter, such as CT scans and MRIs.

**Transmission Speed:** The speed at which a telecommunications message passes down a line.

**Triage:** The intervention of a trained health professional — increasingly referred to as a telenurse in the U.S. — who staffs a help-line. By asking a caller a series of questions, the trained health professional can determine whether the problem is serious enough to warrant a patient's visit to a clinic or an emergency department or, in the event of an emergency, calling an ambulance.

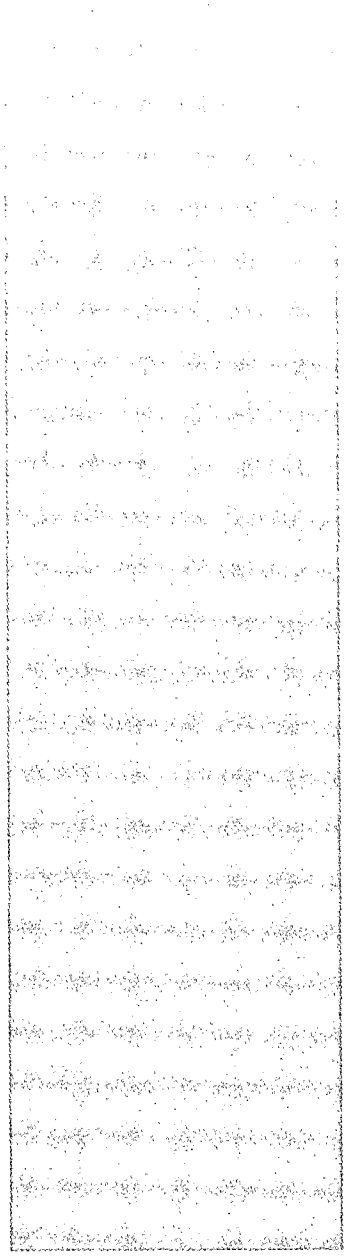
**Ultrasound:** An investigative technique that uses sound waves to study anatomical structures or organs and measure their size, location and shape. This technique is employed to evaluate and diagnose diseases.

**Videoconferencing:** A method of communication using two-way, real-time transmission of video images between locations.

**Virtual Reality:** A technique that creates simulated experience, generally used as a generic term for an entire platform of virtual technologies and products. Key elements of VR systems include virtual environments, interactivity, three-dimensional and stereoscopic simulation and Total Sensory Presence.

**WAN (Wide Area Network):** A data communication network that is not limited geographically (see LAN).

**X.25 and Frame Relay:** A "bandwidth-on-demand" connection similar to ATM in concept, but implementing the packet systems using less expensive technology. Like ATM, it has no fixed transfer speed; however, it is generally slower than ATM.



# Annex B
# TECHNOLOGY AND HEALTH CARE REFORM: KEY INGREDIENTS IN THE RISE OF THE CANADIAN TELEHEALTH INDUSTRY

**Table B-1. Health Care Reform and Its Impact on the Telehealth Industry in Canada, Along with the State of the Art for Each of the Telehealth Applications Mentioned**

| Health reform item | Telehealth application | State of the art in Canada |
|---|---|---|
| Reduced funding; emphasis on increasing efficiency | Some installations demonstrate cost- and time-savings | Some anecdotal evidence, but cost-effectiveness analysis (CEA) tools are needed |
| Hospital closures and reduction in number of hospital facilities and beds; Ambulatory and short-term care increasing | More home telecare and telemonitoring systems; telecare and telephone triage services are on the increase | Few technologies on Canadian market; several provinces implementing these |
| Hospital mergers | Multi-functional networks to link facilities and permit electronic health record transfer are being installed; institutions will require EDI; standards, encryption systems, systems facilitating group purchase | A number of interinstitutional links in development are in place in Canada; penetration of EDI in health not well known; standards under discussion; some companies marketing encryption systems |
| Regionalization | Regional governance with varying degrees of autonomy and power may have negative impacts on economies of scale; regional borders may mitigate against adoption of national or province-wide networks | Adoption of CHINs and RHINs requires decisions made by a larger number of stakeholders; CHINs will be a network of networks |
| Rural medicine on the rise | Currently available are remote telemedicine and tele-learning systems, as well as performance support and services to link specialists and rural practitioners, patients and physicians; more private companies, universities and colleges are developing distance learning content for health and medicine | Being adopted more widely in some provinces and territories, although access is limited in some areas; high costs, reimbursements of practitioners and patient privacy are still unresolved issues; IATV systems are being fitted for medical use; there is the need to retrofit some institutions for data and video communications |
| Privately funded health services increasing | Emphasis on wellness and prevention in order to balance care and cost; potential for private health networks to equip private clinics with the means to communicate with any specialist in the world | Some corporate health intranet applications being developed (embryonic stage in Canada) |

**Table B-1. Health Care Reform and Its Impact on the Telehealth Industry in Canada, Along with the State of the Art for Each of the Telehealth Applications Mentioned *(cont'd)***

| Health reform item | Telehealth application | State of the art in Canada |
|---|---|---|
| Focus on evidence-based decision making | Networks allow greater access to clinical research results, other published and unpublished medical and health information, information management systems, and multimedia content and performance support tools | Some Canadian companies already active in the medical information management market; rise in Internet services |
| Employment of health care human resources reduced | Retraining services for employment in home care, telephone triage, telenursing, information systems and other related functions | Tele-learning, distance education, multimedia course offerings development still in infancy |
| Integration of community resources | Software, hardware and expertise in implementing Health Information Networks, pharmanets, LANs and WANs and Community Health Information Networks | Few turnkey or CPR systems available from Canadian companies; some partnering; strong competition from U.S. companies |
| Alternatives to hospital and emergency room services being offered | Telecare services, 1-900 services, call centres, telenursing, telephone triage; Networks to link doctor's offices, clinics; pharmanets | Some companies marketing systems and services; serious competition from U.S. |
| Increased media and public involvement | Potential market for public and patient education materials available online or in stand-alone multimedia format, and tele-education services | More Canadian colleges, universities and private companies marketing these services |
| Potential shift from illness-based model of care delivery to wellness model | Patient and public health tele-education; self-treatment and monitoring devices; increasing demand for Internet-based health and medical information and services | Phenomenal increase in use of the Internet: little evidence of revenue-generation for health applications as yet |
| Redistribution of specialist services | Need for networks and portable clinical workstations, encryption and compression software, electronic diagnostic tools | Teleconsultation networks are now in place in at least six provinces; most frequent application: diagnostic imaging; clinical and desktop workstations being developed or adapted for Canadian use |

**Table B-1. Health Care Reform and Its Impact on the Telehealth Industry in Canada, Along with the State of the Art for Each of the Telehealth Applications Mentioned *(cont'd)***

| Health reform item | Telehealth application | State of the art in Canada |
|---|---|---|
| Revenue generation on the rise | Networks and devices to facilitate global distribution and sale of medical and health expertise, educational and training services | Slim Canadian experience in not-for-profit sector only; some prospective market development under way |
| Aboriginal health care no longer managed by Health Canada | Potential for territory-wide systems and remote telemedicine to bridge large distances and overcome shortage of doctors in remote areas; potential as well for content relevant to the unique health needs of aboriginals; also for fibre optic, satellite receive and transmit systems, encryption and compression software | Private–public sector partnerships permitting systems for health information management and for telemedicine to be tested; pilot projects under way |