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Information Technology, Health and Health Care: A View to the Future

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Foreword

Time has changed Canadians' perception of what constitutes health. At the turn of the last century, the main concern was sanitation and public health. By mid-century, the preoccupation became access to quality hospital and medical services. In the 1970s, attention began to shift to the importance of life style and the environments in which citizens live. More recently, both researchers and policy advisors have come to recognize that inequalities in social and economic conditions have an important bearing on the health of different population groups.

In 1998, the Health Network of the Canadian Policy Research Networks launched a major study entitled Towards a New Perspective on Health Policy. Our objectives were to explore the different streams of thought that have shaped our understanding of health and to assess the way in which new ideas about health come to shape health policy and the delivery of health-related programs and services. Sholom Glouberman, the Director of the project, has done extensive investigation of the ways in which the four perspectives on health described above interact and support each other. These results will be reported in a number of publications planned for 2000. The work is being monitored by an Advisory Committee, and a list of the funding organisations appears at the back of the paper.

This paper, by Trevor Hancock, a consultant to the project, and Philip Groff, a member of the CPRN staff, forms part of the overall research design. It examines the potential impacts of information technologies on the determinants of health and on health care, looking ahead to the 2020s. Trevor prepared a broad scan of the literature on how information technologies are reshaping health and health care. He and Philip then constructed four quite different futures, building on previous scenario exercises. These four scenarios were then reviewed in a workshop in November 1999. Details of the scenarios are provided in the Appendices, while the lessons learned from the examination of the scenarios are reported in Section 4.

Three notable conclusions emerge from this exercise. First, information technologies will transform the way we live and work and the way in which health care is delivered. Second, there is no predetermined way of life embedded in the technologies. Canadians and their leaders will face important choices that will determine the kind of future that lies ahead. And third, these technologies will transform the way health care providers do other work and the way they interact with patients. The paper is put forward as a means to provoke wider discussion about the society we want to construct with these technologies, and the way in which we want these technologies to shape the design and delivery of health care.

Judith Maxwell
President

Executive Summary

In the next 25 years, the information society and the information economy will change our way of life, including some of the most fundamental cultural, social, economic and other determinants of our health. It also will dramatically alter the way in which health care is delivered and medicine is practised.

Recognizing these profound impacts, CPRN's Towards a New Perspective on Health Policy project included a look at some of the ways in which information technology may affect health status and the delivery of health care in Canada in the 2020s. This part of the project involved a scan of the literature and a one-day workshop in which participants considered a set of four alternative societal scenarios, and the implications for health and health care of the deployment of information technology in each of these scenarios.

Information Technology (IT) includes computer-based technologies and the communications technologies that make computers available to people in their homes, workplaces and communities all over the world. Because the capacity and speed of computers per unit cost doubles every two years (Moore's Law), the cost of connection, computing power, memory and sensing will become trivial, while the methods of sensing and connecting will be beyond count.

By looking at the leading edge of technology today, we can begin to anticipate the technologies that will be fully deployed by the 2020s.

This paper is designed to help readers imagine the consequences of this technological revolution for the world in which we live. It focuses especially on the way these technologies are likely to transform the economic, social, and biological determinants of health and to revolutionize the practice of health care.

The Scenarios Workshop

Building on previous scenario exercises in Canada and abroad, the CPRN team developed four alternative scenarios for use in the workshop:

- "The Market Triumphs," a future dominated by powerful private sector corporations;
- "Evidence-based Government," a future of rational and regulated change;
- "Healthy Communities," a more decentralized, environmentally sustainable and diverse future; and
- "Harder Times," in which the worst fears of the pessimists of the late 1990s have come true.

Through a consideration of these four alternative scenarios, workshop participants were able to consider the implications of information technology for health and health care in very different value contexts. Nonetheless, certain common themes emerged:

- There will be continued technological change and continued social inequality, with tension between local values and local control on the one hand, and global values and global control (corporate or governmental) on the other.

- While information technology holds out a hope of greater knowledge, power and participation – its liberating potential – there is also the potential for either the government or private sector to play a Big Brother role.
- Above all, it is not possible to look at information technology in isolation without recognizing that it is contextualized by societal values and by social and economic conditions.

The dialogue in the workshop made it clear that there is no pre-ordained future embedded in these technologies. Much will depend on how we choose to use them. The exercise does serve to highlight the nature of these choices and can, therefore, be used to anticipate key turning points in public policy and in social and economic decision making. These implications are divided into two groups: "socio-cultural" issues, and a set of health care system issues.

Socio-cultural Issues

Information technology has the potential to heighten inequality in knowledge, power, wealth and access to services. At the same time, IT could increase access, particularly in remote rural and northern communities.

- New forms of non-spatial and virtual communities, and increased connectedness, are emerging, although, at the same time, there may be increased social isolation for some.
- Knowledge and power will increase for people in their communities and society as well as within the health care system. However, this raises the spectre of information overload.
- The role for the private sector in health care will increase because of its domination of the information technology sector. Not only does this threaten universal access to health care, it may also reduce access to technology and databases that the private sector considers to be proprietary. Simultaneously, the private sector may be in the best position to provide universal access to the IT demands of the health care sector, and fostering such linkages and exchanges may be an important direction for future policymakers to consider.
- Information technology will increase choice and customization of products and services for individuals in society as a whole, and in health care in particular.

The potential for abuse of information technology by both the public and private sectors increases because of their ability to control access, and increase monitoring and surveillance of individuals and communities.

Health Care System Issues

The key driver for change in the health care system is the ability to know what is happening and what works. For example:

- Increased knowledge of what is happening and what works may lead to better system management through better outcomes and lower costs.

- The availability of better information could lead to significant shifts in power and control within the system, and to changes in the ways that health professionals do their work, are educated and trained, and conduct research.
- The quality of information will become a concern for both providers and for patients, with attention focused on information within the system itself as well as the information provided through the Internet and other sources; how valid and reliable is the information, and who decides?
- This also raises issues of liability – in a global system, how is it possible to manage and control liability and ensure accountability within provincial and national contexts?

Policy Concerns

The current momentum in the development of information technology suggests that rapid changes in society are going to happen, and that they could accelerate beyond anything we currently experience or can even imagine What then are the policy choices facing countries like Canada? These choices have to do with how information technology is used, to what end, and what values and principles will guide its use. Some of the significant policy considerations are:

- How can we avoid the potential negative impacts of information technology on mental and social well-being?
- How can information technology be used to enhance local democracy, social networking and social support?
- How can we ensure that information technology enhances rather than harms the health of the workforce? This has implications for labour and occupational health policies.
- How will the wealth that is created by technology be redistributed in society, if there is indeed a reduction in the amount of time spent working and if automata increasingly replace workers?
- How will public policy avoid the further polarization of income in society that may result from the development and application of information technology?
- How – if at all – will the content of the Internet be judged both in terms of its content and its values? Is there a role here for public policy?

In the health care sector, some key policy issues include:

- Since a universal health care system in the future will require universal access to information technology, will it be necessary to amend or re-interpret the *Canada Health Act*? How will universal access to information technology be ensured?
- How will the potential for enhancing the capacity of Canadians for self-care be realized? What changes are needed to public education, what policies are needed to support the development of the appropriate software and hardware technologies?
- Can and should the funding of self-care be included as part of the publicly funded health care system and how can funds be shifted from professional care to self-care?

- What standard national databases and information collection systems will be needed to ensure local flexibility and autonomy, and strong safeguards for confidentiality?
- What support is needed, in the form of education and incentives, to ensure that health care providers actually use the information technology that is available?
- How will issues of transnational regulation, accountability and liability for health professionals and providers of health information and services be addressed?
- Since information technology will change how services are provided, where and by whom, how should policies governing the payment for such services be changed?

In summary, this effort to anticipate future impacts of information technology on health and health care has revealed a number of apparent contradictions:

- between the maintenance of public sector involvement in health care and forces pushing toward increased private sector involvement;
- between individual privacy and confidentiality of information on the one hand and the public need to know, through access to aggregate data, on the other;
- between the old primacy of location and geographical determinism on the one hand and the fact that cyberspace is not geographically located or clearly demarcated with borders;
- between the potential for increased democratization and empowerment and the threat of greater social control by either government, big business or both; and
- between the old view that more information leads to greater uncertainty, and our growing understanding that increased information, while often leading to a greater depth of understanding, does not necessarily lead to precision or certainty.

Canadians should be reassured that they can influence the extraordinary forces for change unleashed by information technologies. There is no predetermined future in these scenarios. At the same time, it is essential for the public and for policy advisors to begin to think through what values and principles, what priorities and constraints we wish to impose on the implementation of these technologies to ensure that they lead to the greatest possible good for future generations.

1. Introduction

1.1 The "Towards a New Perspective on Health Policy" Project

The Health Network of the Canadian Policy Research Networks (CPRN) is undertaking a project to examine a new framework for health and social policy in Canada. The objective of the series of research studies is to provide Canadians with a new and richer basis for the direction of health policy in the 21st century.

The project looks back 25 years to the 1974 Lalonde Report, which marks the last major change in Canadian health policy. The project uses this 25th anniversary as an opportunity to review and assess the evolution of Canadian health policy, to consider the current status of health policy and our current knowledge of health and its determinants, and to look forward 25 years and prepare for future developments in health policy. The project has several elements, including:

- Snapshots of Canada: baby boomers at 25, 50 and 75 – an examination of health status and health determinants in 1974, in the late 1990s and, looking ahead, alternative scenarios for health in the 2020s.
- A conceptual account of the ways in which ideas about health and health care have shifted over the last century.
- A history of the four building blocks of health policy over the last hundred years – public health, health care, health promotion, and inequalities in health, focusing on both federal policy and developments in four provinces.
- A history of the Lalonde Report, which was the last major transition in thinking about health policy in Canada, including interviews with those involved in the development of the 1974 Report, other key health policy frameworks, and the impact of the Report on Canadian health policies.
- International perspectives on health policy – including a symposium involving senior health officials from abroad and policymakers from Canada to reflect on future directions for Canadian health policy informed by development in other national contexts.
- Operationalizing a new platform for health policy – based on the previous three elements, the final product of the project will be the elaboration of a new platform for health policy in Canada.

1.2 The "IT and Health" Project

The IT and Health Project, as one part of the overall project, contributes to the "snapshot" of Canada in the 2020s, focusing on a particularly significant aspect, namely the impact of information technology on health and health care. This perspective is examined in the context of a set of alternative scenarios for 2025. The elements of the "IT and Health" Project include:

- a scan of the literature, focusing on some of the implications of information technologies (ITs) for health and health care.
- a one-day experts workshop, held on October 18, 1999, which considered the implications of IT for health and health care – and for health policy – over the next

25 years. A review of the day's activities and findings comprises Section 3 of this document.

- This final report is intended to pull together the key themes and issues from the literature and the workshop, and identify significant policy issues that will need to be addressed. A reflection upon the lessons learned through this whole project is presented by Philip Groff in Section 4 of this document.

1.3 The Workshop

The workshop focused on four alternate scenarios for the future. The advantage of using scenarios in such an exercise is that they allow one to consider the implications of several different trends visible in current society. While acknowledging the impossibility of accurately predicting the next 25 years of social and technological change, such an exercise does permit the examination of a few extreme scenarios to insure that policy development is occurring within a broad range of possible contexts. The four scenarios employed in this workshop were based upon extreme extrapolations of current trends of consumerism, rational planning, community development, and economical upheaval.

In considering these four alternatives, several common themes and concerns began to emerge. Perhaps more striking than any of the themes themselves was the fact that so many of them seemed to be expressed in contradictions – contradictions that were understandable in light of the current changes in the ways that information is generated, transmitted, processed and stored. It became apparent that we were having to prospect toward the future of health and health policy in a climate of change in information technology, comparable in scale to the recent upheavals in the physical sciences.

2. A Scan of the Literature

> As far as any outlook on the future of technology can reach – well into the next century – the ability to gather, record, organise, analyse and act upon information is going to be a dominant factor. What steam, steel, electricity was to the 19th century, information management and exploitation will be for the next half century, if not very much longer. Not only is it the new "raw material" of technology, it will inevitably become an essential ingredient of the fabric of the human society. (Maddock, in Introduction to Barron and Curnow, 1979)

When the Lalonde Report – "A New Perspective on the Health of Canadians" – was published in 1974, neither Apple Computer nor Microsoft existed, the PC had yet to be invented, the Internet was primitive and unknown outside the US military and a few academics, and CD-ROMs and Web sites, if they existed at all, only did so in the minds of a few researchers. Today, all of these are so much a part of our way of life that it is hard to imagine life without them.

In changing our way of life, these technologies have also changed some of the environmental, social, economic and cultural determinants of our health. And, of course, they have changed the delivery of health care as well. CAT scanners, the human genome project, robot-assisted hip replacement surgery, tele-medicine consultations in the Arctic, implantable cardiac rhythm monitors programmed to administer corrective shocks, comprehensive patient files

and research databases, Medline on the Web and tens of thousands of health Web sites – these are but a few of the many new services and procedures that depend upon the power of the new information technologies.

But the development over the past 25 years will pale in comparison to the changes in the next 25 years, as the power of the information revolution multiplies while its costs plummet. Information technology will transform our homes, our work lives, our social networks, our communities, our environment and, inevitably, the delivery of health care.

In a recent article, information technology and health futurist Joe Flower suggests that

> health care has not essentially changed in at least half a century (but that) . . . in one generation or less, every element of it, every assumption behind it, will be changed or gone.

The three forces that will transform health care – the tsunamis, as Flower puts it – are:

- the century of biology (particularly genetic and immunologic research)
- the century of technology "spawned by the confluence of imaging, databasing, computing power, electronic storage, electronic commerce, robotics, and nanotechnology"
- the century of the new health management.

However, since each of the biological and managerial "tsunamis" that Flower identifies are reliant to a significant extent upon ITs, it is upon ITs that this project has focused.

This does not attempt to be a comprehensive and in-depth review of the massive literature on information technology and its implications for health and health care. Rather, a scan of that literature was undertaken and selected books (and a few articles) were reviewed. The scan focused on four elements:

- Where is the technology going?
- What are the implications for health?
- What are the implications for health care?
- What are some of the policy issues?

2.1 Where Is the Technology Going?

> It has long been agreed that attempts by so-called experts to "crystal ball gaze" and predict the future, results in the identification of developments that are known to be possible, because they are based upon what we already know, whereas the real developments arise from the things that we do not yet know, and hence are unpredictable. (Delpy, 1998)

Information technology (IT) is taken here to include the combination of computer-based technologies and the communications technologies through which they are linked to each other and made available to people in their homes, workplaces and communities all over the world. So rapid is the evolution of these technologies and their penetration into our lives (see Box 1) that it may be difficult, if not impossible, to anticipate where they will be in 25 years' time. This rapid evolution is neatly captured by Moore's Law.

Gordon Moore was one of the founders of Intel. He noted in the 1960s that the density of transistors on integrated circuits was doubling every 12 months (an estimate he later revised in the 1970s to 24 months), a rate that seems to remain consistent to this day – this is Moore's Law (Kurzweil, 1999). It means that both the capacity and the speed of computers per unit cost doubles every two years (thus over the period of 26 years, from now to 2025, their power would increase some 8,000 times), although Kurzweil notes that this may be limited by the fact that transistors would need to be only a few atoms in size by around 2020. However, Kurzweil also points out that other technological innovations already under development such as multi-layer computer cubes, nanotube circuits created from carbon atoms and optical, crystalline and molecular computing will mean that the power of computers will continue to evolve. For example, Flower (1999) reports that one paper from the NASA Ames Research Center has suggested that by using individual atoms to represent bits it may be possible to pack 1 million gigabits of information into a square centimetre.

Box 1

IT's Rapid Spread

In its July 1999 edition on Culture, the National Geographic *provided some data that help capture the rapidity of the spread of IT:*

- *it took TV 13 years to reach 50 million users but only 5 years for the Internet to reach that many users*
- *in 1964 there was one television for every 20 humans, now there is one for every four*
- *the number of Internet hosts has grown six-fold between 1995 and 1999.*

Ray Kurzweil has led pioneering teams in the development of several text and speech recognition and synthesiser systems. His recent book, *The Age of Spiritual Machines*, explores the implications of the further evolution of computing power. In a recent article, Kurzweil (1999) proposes that such technological evolution will continue to grow exponentially because of what he calls the Law of Accelerating Returns, a law that has governed both biological and technological evolution. In essence,

> An evolutionary process accelerates because it builds on past achievements, including improvements in its own means for further evolution.

Thus the growing order, complexity and sophistication of the technology provide the basis for its further and accelerated evolution. Kurzweil illustrates this in a projection that shows the growth in the amount of computing speed that $1,000 (in constant dollars) can purchase. He predicts that by 2019, $1,000 will buy the processing power of the human brain (20 million billion calculations per second), that by 2029 that same $1,000 will purchase the processing power of 1,000 human brains, and that by 2055, $1,000 will buy the processing power of all the human brains on earth!

Another indication of the rate at which the technology is evolving can be found in a recent newspaper article on the creation of nanotech computers, which now seem to be within reach (Locke, 1999). As was the case with the human genome project, which has been accomplished more swiftly than anyone first believed possible, it may be that the development of nanotechnology may move more swiftly than anticipated – perhaps another example of Kurzweil's Law of Accelerating Returns. Locke reported on the work of Kris

Pister, an Associate Professor of Electrical Engineering and Computer Science at the University of California, Berkeley. He is working on what he calls "smart dust" and hopes to have within two years "a device the size of a grain of sand with a sensor, power supply, analogue circuitry, two-way optical communication and a programmable micro-processor." Eventually, he believes these will cost as little as 10 cents each.

In addition to this massive increase in power, improvements in software such as neuro-nets and evolutionary algorithms will mimic and, in time, surpass human intelligence by copying the human brain itself. Kurzweil suggests that "By the third decade of the 21st century, we will be in a position to create complete, detailed maps of the computationally relevant features of the human brain and to recreate these designs in advanced neural computers."

Moreover, these computer brains will have a dramatic advantage over human brains – whatever they learn, they can rapidly download to and share with other computers. This combination of vast computing power and intelligence, and the ability to download readily and swiftly share the acquired knowledge leads Kurzweil to state: "Once computers achieve a level of intelligence comparable to that of humans, they will necessarily soar past it."

How far past it they may soar is hinted at by Hugo de Garis, an Australian specialist in artificial intelligence working at Japan's Advanced Telecommunications Research Institute. In an article about the latest robot pets produced in Japan, Parry (1999) raises concerns about what he calls "artilects" (short for artificial intellect). An item cited from his Web site warns, "Asteroid-sized, self-assembling, nanoteched, one bit per atom, reversible, heatless, 3D, quantum-computing artilects could have intelligences literally trillions of trillions of trillions of times the human level."

In such a situation, admittedly many decades, perhaps centuries away, de Garis suggests that "human beings would be to the artilects about as significant as amoebas are to humans."

While this apocalyptic vision may seem fanciful, the fact that it can be seriously discussed by experts working in the field at least gives us some pause for thought. What would be the implications of this development for human health – indeed for humanity's role and survival?

This is the technological context within which we need to consider the impact of information technology on health and health care. If Kurzweil is right, by 2024 – 25 years from now and 50 years after the Lalonde Report – we should be able to purchase for $1,000 the equivalent computing power, and presumably the intelligence, of somewhere between 10 and 100 human brains. What that may mean for health and health care is perhaps literally beyond the imagination of most of us, and hence, as Delpy argued, unpredictable.

2.1.1 Scanning the Leading Edge of Biomedical IT

Flower (1999) suggests that "electronic devices 100-750 times smaller than the devices in current computer chips suggest an array of possibilities for using computer computational power, connectivity, sensing and memory inside the body." The Fall 1999 edition of *Scientific American Presents* is concerned with this bionic future. The editors suggest that the "merger of the biological with the microelectronic is at the heart of most of the coming advances in technology." They present a series of articles, many of them focused on biotechnology but some focused on the combination of biotechnology and IT, that in their

opinion "extrapolate conservatively into the near future." Among the IT-related developments that are discussed:

- cochlear implants, already in use to partially restore hearing in humans
- retinal implants, already at the testing stage in humans, although still fairly crude
- a "nose on a chip," used already by food companies to monitor food quality, which may in time be used in humans
- an "e-tongue" that can "taste" is at an early stage of development
- neural prostheses that already enable people to use motions in one set of muscles to control movements in other sets of muscles
- chips that respond to brain wave patterns and enable people to move a cursor on a computer screen just by thinking it
- multiple, independently operating fingers on prosthetic hands are already available
- "touch receptors" in a prosthetic hand are already available and allow a computer to adjust grasp
- a ring worn on the finger that monitors pulse rate and blood oxygen levels and transmits the data by wireless to a receiver and thus to a computer and to the physician's office
- neural implants are already being inserted into the brains of people with Parkinson's disease or cerebral palsy to control tremor
- add to that the fact that virtual reality is even now being augmented with smell and touch and it is small wonder that Kurzweil (1999) comments that "in the 2020s, neural implants will improve our sensory experiences, memory and thinking." And this is only some of what is already emerging from the labs and beginning to be used in humans.

2.1.2 Deployment of the Technology

An attempt to understand how this startling technology will actually be used in 20 to 25 years depends upon an understanding of what the technology will be, how readily available and easy to use it will be as well as how it will be deployed. However, Barry Burk (a participant in the CPRN workshop and General Manager for the health care industry for IBM Canada) made the interesting observation that in 20 years or so we will be fully deploying the technology that is now just emerging from the labs. This makes our task easier in that it suggests that we would do better to explore the implications of the full deployment of current leading-edge technologies rather than try to anticipate the technology that will be emerging from the labs in 2020.

Not only is the increase in computer power accelerating exponentially, so too is the rate of deployment of these new technologies, their penetration in the market and in everyday life, as noted earlier. This is a function of both their low – indeed, in time trivial – cost and their increasing ease of use. Flower (1999) asks us to "picture a world in which:

- the cost of connection is trivial . . .
- the methods of connection are countless . . .

- the cost of computing power is trivial . . .
- the cost of memory is trivial . . .
- the cost of sensing is trivial, the methods beyond count."

As the software has become more sophisticated, less intellectual prowess is needed to operate it. Voice recognition and voice commands will make this even easier in the years to come, to the point where the keyboard may become obsolete.

In short, in 20 to 25 years (or sooner), we should expect a very widespread use of what today are leading edge technologies such as those described in the previous section. But as Barron and Curnow (1979) pointed out 20 years ago:

> The technology available within the next five years will be more than adequate to generate great changes in the economic and social order. The sequence and timing of these changes will be determined not by technological factors, but by social and economic factors, and to establish a view of the future it is these that need to be studied rather than technological developments.

In other words, how we actually use information technology in the future – whether in health care or in the wider society – will depend more upon social, cultural, economic and ideological factors than on technological factors. This is why the workshop used four alternative scenarios, with very different value bases, to explore the implications of these technologies. This scenario-based approach enabled participants to explore the significance of different values and the potential costs as well as the benefits of IT.

2.2 What Are the Implications for Health?

> . . . While it may be true that ICTs [information and communication technologies] affect everything from working hours to home movies to the balance of trade between some countries, such a grand statement is only true at such a high level of generalisation as to be meaningless. We need to be more precise. (Howkins and Valantin, 1997)

While information technology will have enormous impacts on health care, the more profound effects on health may well be due to the impact of IT on the broader determinants of health, since it is now widely recognised that health care is not the most important determinant of health (Evans et al., 1994). Thus both this scan of the literature and the workshop had a significant focus on the implications of IT's impact on some of these broader determinants of health. Understanding how our social relations, our built environments, our working lives, our economic conditions, our cultural processes and even our international relations may be affected by IT is an important part of understanding how they may affect our health.

The major determinants of health can be broadly grouped into socio-cultural and environmental determinants. Socio-cultural determinants include cultural values and beliefs; international relations and security; education, the media and public awareness; social roles, including the work role; social connections and networks in the community; participation in governance; and economic determinants such as the level of economic development, income and its distribution. Environmental determinants include in particular the built environment of home, school, workplace, institution and community (we are 80 percent urbanised and spend 90 percent of our time indoors [Leech et al., 1996]) and the broader natural

environment of ecosystems and the global biosphere. All of these are impacted to a greater or lesser extent by information technology. Moreover, these changes are often interrelated.

In the sections that follow, the impact of information technology on some of these socio-cultural and environmental determinants is examined, beginning with culture itself.

2.2.1 Socio-cultural Determinants

Cultural Myths

In a chapter on the cultural impact of these new information technologies, Balsamo (1998) notes that the epicentre of the information age is the United States and that, therefore, "the underlying set of beliefs that circulate in contemporary US culture about the power of new information technologies are of great importance." The defining characteristics of the attitude towards IT in the United States are:

- an economic philosophy that asserts that information access represents power, and related to this, that we have moved from a gold standard economy to an information standard global economy.
- a business logic that focuses on the accumulation, production and management of data.
- media claims that availability and access to information technologies represent an increase in choice and freedom for individual citizens.
- political projections that computer-mediated communication networks can solve the problems of democracy in the United States.
- a quasi-religious hope that technology can save us from our own excesses. (Balsamo, 1998)

For Balsamo, these beliefs "function as a set of contemporary mythologies that circulate in everyday life." She suggests that there are two "guiding myths of the information age," which provide us with "stories" about how these new technologies will impact on individuals and on our collective political life. These two myths, discussed later in more detail, are

1. the belief that new information technologies will empower individuals, transforming both work and leisure.
2. the belief that new information technologies will augment democratic practices.

In addressing these two myths, Balsamo points out that "access to technological networks of information cannot substitute for education about the process of knowledge construction," while with respect to electronic democracy she wonders

> How (exactly) does access to greater amounts of information enable people to act in socially responsible ways such that desirable social changes are enacted? It seems just as likely that such access could be counter-productive, disabling and overwhelming to a person's ability to discern important information and act accordingly.

Balsamo notes that the cultural myths that are emerging about the information age have more to do with where we would like to be than "realistic accounts of where we are." She is particularly critical of "the myth of technologically assisted democracy," which

> obscures the process whereby choices are constructed for people. Whereas the guiding myth of the information age proclaims that citizens have access to all the information they need, what is rarely discussed is the mechanism whereby information is encoded, manipulated, packaged, and selectively disseminated. In short, we often fail to appreciate how our choices are already constructed for us by the kind of information made technologically available. (Balsamo, 1998)

Given that our cultural beliefs and myths shape our interactions with the world and our attitudes towards health, disease and death, what are the implications of these myths for our overall health and well-being? How and to what extent will information technology truly allow us to use the vast amount of information that will be available to improve our knowledge and practices with respect to health and health care? And to what extent will IT allow citizens to participate more fully in decisions about health and health care at both the local and societal level?

International Security and the Primacy of the State

For the past 200 years or so the nation state has been perhaps the most significant force for social and economic development and for the establishment of the conditions necessary for good health. And the conflicts, compromises and alliances between nation states have been the basis of international security – or insecurity – for centuries. But in writing on the impacts of IT on international actors and the international system, Papp (1998) suggests that "the advent of advanced information and communication technologies challenges the primacy of the state from three directions":

- With respect to the state's role in providing security for its citizens, disruption of financial transfers and communications can have a very destabilising effect (witness the result of the recent Bell switching station fire in downtown Toronto and the feared Y2K problems). This also raises the potential for information warfare against such systems.
- The growth of global trade, the increased role of multi-national corporations (MNCs) and of international actors such as the World Trade Organisation (WTO) diminish the state's ability to provide economic well-being for its citizens.
- Third, the globalisation of information and culture, combined with the re-emergence of narrow forms of nationalism means that the state is less able to provide a sense of belonging to a dominant nationality: "Nations have not always needed states to consider themselves nations."

This leads Papp to conclude that while states may not soon necessarily disappear,

> With advanced information and communication technologies helping to raise questions about all three primary reasons that the states exist, the transformation that is occurring in today's international system may be more significant than the collapse of the bipolar international system.

This conclusion is strengthened by Papp's analysis of the implications of information technology for international governmental organisations (e.g., the WTO) – "These technologies may lead to the migration of more responsibilities from states to IGOs," their impacts on multi-national corporations, where these technologies "will enhance the already significant role that MNCs play in international affairs (which) . . . could place state

sovereignty at bay"; and the implications for NGOs, for whom these technologies will enhance their international roles.

Overall, Papp sees three impacts on the international system arising from the use of advanced information and communication technologies:

- the disruption of current power relationships, with state sovereignty increasingly challenged and an increasing role for MNCs and NGOs. As a result, the whole international system will be "more diffuse and ambiguous."
- enhanced globalisation and regionalization is probable but not inevitable.
- there will be increasingly skewed patterns of distribution of wealth both within and between the various international actors. This has the potential to exacerbate north/south conflict as well as internal strife and conflict, and this will be compounded by the potential for information warfare, which can be easily carried out by small groups, even individuals, in an attempt to redress (or seek revenge for) inequalities in the distribution of wealth and power.

These impacts on both the continued existence and the capabilities of the nation state, on the power and role of the MNCs and IGOs in the process of governance, as well as impacts on the production and distribution of wealth, together with the potential for disruption of IT systems, all have profound implications for our future health and well-being, as well as for the provision of health care by nation states.

The Meaning of Community

In addition to the importance of our cultural values and myths and the role of the nation state as factors in determining our health, the community plays a vital role. We are, after all, social animals, and the importance of social connection – indeed, the meaning of community in our lives – is of great importance.

Some of the points raised in a discussion on the future of community at the Third Annual Aspen Institute Roundtable on Information Technology in 1994 revolved around "new forms of community that are technology-mediated" (Bollier and Firestone, 1995). These include supportive on-line networks such as SeniorNet, in which people use computers to "overcome the sense of isolation that often afflicts elderly people," and other virtual communities that link people. But concern was raised as to whether these information technologies would also promote isolation and alienation. Some participants considered this both a possibility and a danger, while others saw the technology as enhancing connections. It seems that being geographically close to one's neighbours is less important now in terms of building community, or rather that the geographical community is now extended. As technology leads to "greater control over space and time," it also erodes "the notion of location-driven communities." (But see the discussion that follows on public and private space.)

Bill Mitchell, Dean of the MIT School of Architecture and Planning, "foresees a recombination of place-based activities with activities that occur in virtual places." These are very different sorts of communities. In conventional communities

> People share the same geographic location, common experiences, face-to-face encounters and a fairly heterogeneous mix of values. But cyber-communities do not necessarily share any of these features.

John Seely Brown, Chief Scientist at Xerox, expressed concern that

> It is not always clear where accountability and responsibility reside in virtual communities. By contriving a collective whose members may or may not share meaningful personal ties with each other, electronic technologies could be fostering behaviour that is careless, irresponsible and even anti-social. . . . the*sine qua non* of a real community is a mutual respect among its members, shared values and commitments. By this standard, many cyber-communities cannot really be considered authentic communities. There must be an ethos of responsibility and a means of accountability.

This view was countered by Dr. Marc Porat, President and CEO of General Magic Inc., who suggested that people are using these new technologies in new ways to improve communication:

> The benefits and joys of maintaining relationships through technology outweigh the anxiety, fear and resentment.

But Peter Schwartz, President of the Global Business Network, cautioned that in developing the infrastructure for information technology, Americans may be embracing a system "whose long-term consequences could be the exact opposite of what this Administration says it wants, namely the recreation of family and community. We may be creating the most powerful force for tearing them apart that we've ever seen." The "centripetal" impacts of this technology "may result in new stresses on family cohesion . . . (which) may be the most fundamental question raised by any new national information infrastructure policies" (all from Bollier and Firestone, 1995).

Clearly, the impact of IT on the role and function of community, as well as our sense of community and of family – some of the most basic determinants of our health – may be profound, if as yet largely unknown.

Public and Private Space

The impact of IT on physical space – specifically, on the relationship between the public and the private realms – is explored by Bandini (1998). She ponders whether the use of the Internet, cash machines, telephone banking and similar technologies means that Western society is "inadvertently sliding into culture patterns that make us less and less dependent on the physical environment for the necessities of daily life."

This technology, when combined with the growing retreat (at least in the United States, and perhaps increasingly in Canada) into "gated communities" raises an even more disturbing question. The isolation and alienation that such seclusion fosters is a further sacrificing of social responsibility to individualism: "Within this scenario, how are we going to learn to co-exist with 'the different,' a prerequisite for the establishment of a pluralist and tolerant society?"

This holds out the prospect of further increasing the divisions between the suburban middle class and less affluent neighbourhoods. While the former retreat to their homes and gated communities, the latter, perhaps lacking "that vital cable connection . . . will have to occupy public spaces they cannot afford to implement, renew or maintain." How will those who are accessing "the outside from the safety of their homes remain committed citizens, interested in a public realm they rarely use?"

Another aspect of this distancing of people from their physical environment may be that people become increasingly divorced from the natural environment that is our ultimate home; as it is, North Americans today spend only 5 to 6 percent of their time outdoors, about the same amount as they spend in their cars (Leech et al., 1996). Reportedly, urban children often do not know where milk or other aspects of their daily needs come from. As our experience of the natural environment becomes increasingly mediated by information technology, will we as a society feel less connected and less caring? If so, what will this mean for the way we treat the environment – and what will that mean for both ecosystem health and human health?

Social Roles: Work

The social roles we play are an important part of our lives, providing meaning and purpose. In our modern society the work role, rightly or wrongly, has come to assume great importance in our lives. Being without work – unemployed – carries great social stigma. Yet as more and more work is done by automata, many people will be left without a job, in the sense of regular work hours and pay. Whether the results are beneficial or harmful will depend on the social and economic policies we put in place to deal with such changes.

Porter and Bostrom (1998) point out that in the United States today, approximately 4 out of 5 workers do not directly produce goods, and that by 2020 only 5 percent of workers will be producing material goods. They estimate that today some 60 percent of all work in the United States is information work. Citing Joseph Coates, a leading American technology futurist, they identify four IT and work-related projections for the next 25 years:

- a broadband network of networks, providing voice, data and graphics worldwide
- automation will be commonplace inside and outside the factory
- ubiquitous computing
- virtual reality technology is commonplace for training, recreation, planning and product design.

York (1998), writing on the psychological implications of these workplace changes, notes that "For many technical professions, radical career change has become a way of life that increasingly requires retraining and occupational mobility." This implies – indeed requires – a process of continual retraining and redeployment of staff. This also will result in a shift of the distribution of control over subordinate behaviour, "from a control model to a commitment model that honours work motivation."

York also considers that job stress and strain and personal injury problems such as repetitive stress injuries (RSI) are on the rise. He ponders whether information technology has either reduced or exacerbated stress, but notes that there are a number of promising stress-reducing strategies available.

Beyond the workplace, as others have done, Porter and Bostrom foresee a polarisation of work (the "gods and clods" scenario) "leaving a nasty gap in the middle where once lived a robust middle class." Since both poverty and social inequality have adverse impacts on health (Wilkinson, 1996), the implications of such a polarisation for the health of the population, and especially for the health of low-income populations, may be serious.

Box 2

IT and Workplace Stress

A brief news item (Andrews, National Post*, June 22nd) notes a study commissioned by Pitney Bowes and conducted by the Institute for the Future and the Gallup organization. This study reportedly found that technology is contributing to work stress. In a survey of office workers in four countries about how much and how often they use technologies such as e-mail, voice mail, fax machines and cell phones, it was found that "workers are interrupted on average every ten minutes by these tools." In Britain, the study found that 38 percent of those surveyed reported feeling distracted by this information overload, while US workers on average received nearly 200 e-mails a day – of which about half came from people in their own departments.*

They anticipate an increase in both contingent work (non-permanent employment or contract work) and distributed work (working at home, working out of satellite offices). Again citing Coates, they note a projected increase of contingent and distributed work to 40 percent of the US workforce by 2020. They make the interesting observation that "both contingent and distributed work are conducive to a pre-industrial age village, blending work with home environments."

This has obvious implications for such determinants of health as family life, social networks, working conditions, commuting patterns and air pollution, neighbourhood life and urban design.

Finally, they suggest that three industrial-age premises do not hold for the information age:

- the labour theory of value, which, by recognising labour as the key factor of production, serves as the main mechanism for income allocation
- the work ethic
- consumerism, in the sense of the acquisition of more and more material goods.

When coupled with increasing length of life, this anticipation of less labour has interesting implications for how we will spend our time. Porter and Bostrom suggest that less labour and longer life will mean more time spent in community work, home work, learning and play. But in order for that to happen, they suggest three key policy steps:

- a safety net that provides for basic human needs independent of the job (something like a guaranteed annual income)
- expanding community work by re-orienting the reward system to encourage such work
- a value shift towards a "care economy" with a shift of our focus from consumption to community goals.

They conclude:

"One key is to let go of the job as the centrepiece of income distribution and meaning of life. Another is to recognize that our present income and activity arrangements cannot work with 62 million folks [in the United States] aged 65 and over by 2020. If we act briskly and creatively, we can integrate seniors into a caring society. Fluid work activity patterns can blend with life-long learning and other activities both to meet basic needs and to provide rich opportunities for deeper fulfilment."

Overall it is apparent that the relationships between information technology in the workplace in the wider community and in society as a whole will have a significant impact on our health in the future.

2.3 What Are the Implications for Health Care?

In addition to the influence of information technology on the broad determinants of health, IT will have – indeed, is already having – a massive impact on the delivery of health care. A group of vice-presidents in the New York and Los Angeles offices of The Boston Consulting Group, in an article on the group's Web site entitled "Managing for a Wired Health Care Industry" (Broshy et al., 1998), anticipate that the convergence of media, computing and communications will create a "wired health care market in which information availability and connectivity is vastly increased." In their view, this convergence will result in four interrelated changes in health care:

- more activist consumers
- better informed care providers
- lower cost care delivery
- more efficient health care administration.

Among the key digital health care changes that Flower (1999) anticipates are:

- clinical assistants/expert systems that will enable physicians to provide "just-in-time knowledge"
- clinicians connected to each other, which enables them to better care for their patients
- electronic medical records and evidence-based medicine, which will increase "the amount of science in the craft of medicine" and thus will reduce mistakes while increasing accountability
- imaging, which by combining a variety of techniques will allow virtual reality, three-dimensional viewing of the body and its parts from inside

Box 3

HealthSmart 2010 – The NHS at 62

As part of the 50th anniversary celebration of the National Health Service in the United Kingdom, the NHS commissioned a "work of science fiction based on how the health service might look in twelve years." The story, which is told in monthly chapters on their Web site (http://www.nhs50.nhs.uk) under the heading HealthSmart 2010, is based on a set of interviews with knowledgeable people. In introductory comments to the scenario, they note the following:

"The overall consensus of our research was optimism, that the IT revolution does offer ways to deliver health care more widely and more efficiently than today. . . . A down side also emerged – a risk of widening the gap between people who have access to the new technologies and those who do not. There are also important questions about privacy and other civil rights in an information society.

If a single consensus emerged from (the) research, it was that information technology is changing the relationship between health services and the people who use them.

. . . the availability of hard facts will shift the balance of power between doctor and patient, changing the practice of medicine in ways that are hard to predict."

- robotics, with everything from delivery carts and security to surgery being conducted or assisted by robots
- enterprise management, through the more effective collection, manipulation, display and use of information about all aspects of the health care system
- medical information available to the public through the Web – "already, in 1999, some 68 percent of all on-line users use the Web to search for information about a medical or personal problem"
- tight links between the consumer and the system, allowing for "day to day, low-intensity contact," which has already been shown to be both effective in terms of health outcomes and efficient in terms of cost savings in the management of chronic diseases.

In this section, the implications of IT for health care are addressed in terms of biomedical applications; patient/provider issues (i.e., the relationship between them); provider issues and system management issues.

2.3.1 Biomedical Applications

Four important areas of biomedical work that will be particularly impacted by IT are imaging, sensors, robotics and the impact on the lives of people with disabilities.

Imaging

Delpy (1998) anticipates that over the next 10 to 20 years the technology will allow for "high resolution, high sensitivity, ultra-fast image generation" that will make 3D images commonplace, using a wide array of imaging technologies that can be integrated. Flower (1999) agrees, and adds that such images will be capable of transmission over the Internet, will be able to be viewed through specially adapted glasses, and will allow for remote diagnosis and even remote treatment, including surgery. Flower also believes that this technology is one that will continue to be located in hospitals and that this will require expensive investments in hardware, software and support.

Delpy also raises a couple of cautions here: the need for a better understanding clinically of what the images reveal and the need for technical support not just in terms of radiographers and physicians but in terms of physicists and engineers.

Sensors

Delpy (1998) foresees several advances in sensors that will permit "real-time continuous monitoring systems" for both the critically ill and for the chronically ill. This will allow for "closed loop, computer-controlled biofeedback" with multiple external, partially or fully implanted monitors capable of continuously measuring an array of parameters. Such information could be relayed to a centralised ICU monitoring system (described later) as well as external or implanted devices to provide treatment/intervention (e.g., artificial pancreas, kidney, etc.). In addition, Delpy anticipates the development of sophisticated but cheap and disposable quantitative dipstick sensors for use in home and community settings that will provide "direct electrical readout and quantitation with minimal operator input" of multiple biochemical parameters.

Ultimately, Delpy anticipates that the availability of cheap, digitised home "dipstick" kits, particularly when linked to Web-based expert systems, will allow patients to "completely by-pass the conventional health care providers," while implanted monitors, linked through the hard-wired "Smart House" of the future to expert systems and providers would allow for automatic monitoring, feedback and intervention.

Flower (1999) sees an even wider role for sensors including their use to remotely identify individuals, analyse body chemistry by "smell," and even to allow a bed sheet to "tell if they have been used on a bed because they can sense the pressure of being folded under a mattress." When the cost of sensing, memory, computing power and connection is trivial, such sensors could – and probably will – be everywhere.

Robotics

Delpy (1998) defines a medical robot as "a programmable powered manipulator that can carry tools and move them with pre-planned motions and forces to execute surgery, therapy . . . or diagnostics." Such robots may be "active," that is to say, autonomous or "synergistic," requiring interaction with, for example, a surgeon. Already, robots are being used in hip replacement surgery, and Delpy anticipates a bright future for computer-assisted surgery, although he cautions that cost and complexity will limit their deployment to regional centres of excellence. He also anticipates that eventually the nanotechnology may lead to the development of "nano-robots" that would work inside the body to "repair damaged tissue and correct cellular abnormalities."

Flower (1999) sees a much broader role for robots in health care. He anticipates they may deliver supplies, meals and pharmaceuticals and envisages "free-roaming HighSanit carts seeking out and destroying infestations of bacteria." But perhaps the biggest impact of robots may be on the lives of people with disabilities or requiring long-term care at home.

People with Disabilities

Information technology holds out significant promise for people with disabilities. A combination of sensors and implants will make it possible for people with visual and auditory disabilities to see and hear – at least to some extent – and other senses may also be enhanced (Kurzweil, 1999). People with all manner of physical disabilities will be able to live more independently, while robots may be a real boon as always-present and alert attendants.

Delpy (1998) anticipates a number of benefits for people with physical disabilities. These include improved "smart home" technology that will allow people to control and operate functions in their home and to communicate with others via the Internet, thus allowing them to live independently at home; improved wheelchair technology that will improve accessibility; improved prostheses that will allow for better walking, handling of objects, etc.; neural-net technologies combined with "wearable" computers and even direct brain-machine interfaces, allowing people with multiple and severe disabilities to communicate more directly; implantable nerve stimulators to restore at least partial functioning to quadriplegics; and implantable brain stimulators that could help control the symptoms of patients with movement disorders such as cerebral palsy.

In addition, an issue raised in the workshop was that robots could play an important role in providing a wide range of support services in the home for people with disabilities, including

food preparation, feeding, toiletry, bathing, turning and a variety of other functions that would provide care on a 24-hour-a-day basis.

2.3.2 Patient/Provider Issues

> Health care, at its base, is about a deep, ongoing series of connections, between the patient, the doctor, the doctor's colleagues and peers, the institution, the pharmacy, the vendors, the patient's family and support network, the home health providers, the emergency medical technicians, the public health network, and the whole world of knowledge about health, disease, medicine and prevention. All of those connections will become closer, more intimate, deeper, wider, more easily navigated and searched. (Flower, 1999)

Information technology will alter the relationship – and the balance of power – between patients and providers. IT will result in more empowered consumers, enhanced self-care capabilities (especially when linked to expert systems) and increased connectivity. The need to understand and sort through the vast amount of information will lead to the need for new intermediaries (info-mediaries) to help people navigate through the system.

Informed Consumers

With respect to consumers, Broshy et al. (1998) suggest that two types of information will be of primary importance:

- information about managing wellness and chronic disease
- information concerning provider quality and cost.

This information will enable consumers to become more knowledgeable and more empowered in terms of managing their own and their families' well-being, as well as being able to manage or at least review critically the health care they receive.

Flower (1999) notes that already in 1999

> . . . Some 68% of all on-line users use the Web to search for information about a medical or personal problem. (In 1998) more than 60 million Americans looked for health information on-line – and more than 90 percent of them found what they were looking for, according to a Louis Harris survey. . . . AOL's Health Channel alone entertains more than 2 million visitors per month, and a dozen health sites count more than 250,000 per month.

As the Web expands, those numbers are going to increase massively, but this raises the issue of whether the information they access is reliable or useful.

The New Intermediaries

Broshy et al. (1998) suggest that in the face of the massive amounts of information available to them from a vast and diverse set of sources, people will need

> . . . an "agenting" process to locate information, filter it in desired ways, and synthesise and interpret it in a trustworthy fashion. There is little question that new electronic intermediaries will arise to fill this void. As they do, they will begin to reconfigure existing patterns of commerce, political power, civic life and community formation.

A discussion of the new "intermediaries of reconfigured communities" at the Third Annual Aspen Institute Roundtable on Information Technology (Bollier and Firestone, 1995) led to a core insight:

> The complexion of technology-mediated communities will depend critically upon the kinds of new intermediaries that arise to bring disparate people and institutions together.

In the past, those "intermediary institutions" have included newspapers, schools, churches, community organisations, government agencies, professional associations and so on. But with the growth of IT, people no longer need to rely upon these intermediaries, who have functioned as "gatekeepers." Instead, they can get information on their own, which "diminishes the presumptive authority of traditional intermediaries"; clearly, this would include physicians and other health professionals.

A key role for these intermediaries is not just to "navigate content . . . they really add value by providing context," according to Max Hopper, Chairman of the Sabre Group (in Bollier and Firestone, 1995). While they may help us move from data to information, knowledge, and ultimately – we hope – wisdom, these new intermediaries may also be a problem, because with so much information available ". . . everyone has access to the same information in very superficial ways . . . (so that) what results is a uniform superficiality of knowledge, rather than diversity or depth."

Care Delivery

> Information technology has the potential to dramatically sharpen the focus of the health care system on patients' needs and preferences. (Kendall andLevine, 1998)

As long ago as 1976 a far-sighted physician, Dr. Jerrold Maxmen, in his book *The Post-Physician Era*, anticipated the profound changes in the delivery of care (and in many other aspects of health care) that would result from the development and application of IT (see Box 4). Almost 20 years after Maxmen, Kassirer (1995) suggested that the application of information technology would be "likely to induce cultural changes in the delivery of care even more revolutionary than any restructuring that is going on today." Major areas of concern will include the quality of care, the continuity of care, the validity and consistency of the available information, privacy, and effects on the physician-patient relationship. He anticipates the provision of authoritative on-line information by medical centres; on-line consultation with physicians and other providers, functioning as a "virtual physician"; and the development of a mechanism to "foster appropriate patient-centred responsibility while providing protection against dangerous self-diagnosis and self-treatment." On the other hand, he does not foresee artificial intelligence systems that would be capable of delivering care; he sees the computer "principally as a communication device (while) the cognition would be supplied by a physician"; he anticipates a continuing need to hear a human voice, have a personal relationship with a physician – including the laying on of hands – and the need to maintain privacy with respect to sensitive personal information.

Kassirer also raises the problem of affordability, commenting that "the expense of new technology will further widen the gulf between those who have access to care and those who do not." This means that "it will be critical to find a way to protect and treat those unable to use or pay for an on-line system."

Box 4

The Post -Physician Era – the View from 1976

In his 1976 book The Post-Physician Era: Medicine in the 21st Century*, Dr. Jerrold Maxmen made some very bold and far-sighted predictions that – more than 20 years later – seem prophetic. Specifically, he anticipated that "all of the functions currently performed by physicians can be accomplished by a partnership of para-professionals and computers." These functions include the technical ones of history taking, physical examination, ancillary tests, diagnosis, treatment and prognosis, as well as the supportive functions of empathy and education and such other functions as prevention, prophylactic care, public health, research, education and administration.*

More profoundly, he anticipated that as a result of these changes physicians would have less political power in the future and that this would " . . . afford consumers a greater opportunity to control the operations and structure of the health care system." Noting that "physical mobility may be giving way to electronic mobility," he foresaw a future in which the electronic house-call, will be made possible through the use of videophones and interactive TV, home sensing devices and home computers. Home psychotherapy, supervision of care for the elderly and provision of care to rural communities and urban ghettos would all be easier as a result, he wrote.

For Maxmen, all these changes would result in the emergence of new medical careers, specifically what he termed (perhaps unfortunately) "medics" – essentially, nurse practitioners – while physicians and pharmacists, among others, would decline in numbers. However, Maxmen also believed that

". . . . The medic will not have to possess a basic understanding of health and disease concepts [since the computers will have this technical knowledge] . . . .[Instead] interpersonal talents will replace scientific sophistication as the major admission criteria . . ." for the training programs.

The 12 - 18 month training program for medics would focus on enhancing their innate interpersonal relationship skills, with an emphasis on personal and group psychology, sociology, ethics and patient management and "the technology of supportive care." These medics would provide, in effect, the "high-touch" component of a system of care in which the "high-tech" component is provided by IT. They would be the carers, the supporters, the info-mediaries as we would say today, and the result would be a system that is both more technically sophisticated and effective, and yet at the same time more caring and supportive.

Twenty-three years later, Maxmen's prophetic views remain a provocative and yet plausible vision of the future of health care delivery and the future role of the health care professions as we enter the 21st century.

2.3.3 Provider Issues

In addition to the implications for the changed relationship between patients and providers, providers themselves will face dramatic changes within their own practice. This will result in part from the much greater connectivity that they enjoy, but also changes in roles as expert systems enhance the potential role of nurses and other non-physician staff. This will result in changes in roles and power among the professions, as well as changes in education and training (see Box 4).

Increased Connectivity

> In an important sense, information is the only resource we have to bring to bear in attempting to assess, and influence, the efficacy and appropriateness of medical practice. (Moran, 1998)

With respect to better informed care providers, Broshy et al. (1998) note that at present "physicians provide care with remarkably little information support." However, they anticipate that the main challenge "is not creating reliable information . . . (but) creating easy-to-use formats and increasing connectivity." Health care systems and pharmaceutical companies are already developing network-based information systems that give physicians access to information about patients, lab test results, medications and many other issues. Electronic continuing medical education (CME) and customised literature searches will help physicians stay on top of the knowledge development in their area of speciality. Both the locus of care and the provider of care will also be impacted, with significant reductions in physician encounters (40 to 60 percent in diseases such as lower back pain and asthma) and the triage and management of patients by nurses over the telephone.

Telemedicine will make it possible to provide both primary care and speciality care not only to remote locations but to international markets. Information networks can also be used to increase patient compliance with filling and properly using prescriptions. Klemm and Snell (1995) state that in the future "practitioners will use modern communications technology to consult with each other and with their patients in a way that liberates everyone from the constraints of time and place. . . . there is no technical reason why practitioners will not be able to set up world-wide consultant teams, customised for each difficult medical case."

Changing Roles

Marinker (1998) notes that the combination of diagnostic software, artificial intelligence and bio-sensing technology will mean that "a very powerful clinical problem-solving machine is placed in the patient's own hands." The result, he anticipates, is that patients will initially contact "socio-nursing professionals operating from small primary units located in high streets and hypermarkets, business and commercial centres, central transport terminals, and schools." From here, appropriate and direct access to specialist services will be possible, which leads Marinker to wonder whether there will be a need for "clinical generalists" in the future. He believes that there will be a need to create what he calls "the New Generalist," a physician who is both a generalist consultant and a case manager, a role that sounds remarkably like the "medic" described by Maxmen 22 years earlier.

Peckham (1998) similarly sees a threat to the current role of medicine, the result of several factors including an increase in the use of complementary and alternative medicine, an

increasing role for nurses and other health professionals, increasing specialisation within medicine, and an increasingly informed and educated public. He believes that, unless the profession changes its mainly defensive position, physicians could be relegated to the "high-tech speciality care" while patients deal directly with non-medical staff for their other care: "The doctor would then become as remote from his patients as the airline pilot is from his passengers." Kassirer (1995) similarly anticipates that "If much care is handled on-line, personal encounters will focus principally on the most serious problems. In that case, we might need fewer primary care physicians, nurse practitioners, and even specialists than is being predicted today."

Education and Training

Marinker (1998) suggests that "the use of future technology will not require the same degree of long and in-depth training as that currently required of doctors," because as the technology becomes increasingly sophisticated it also becomes increasingly easy to use. Moreover, the rapid pace of change will require a constant re-training throughout the career. Peckham (1998) suggests that a radical restructuring of medical training will be required. He anticipates a more broad-based "enlightened and enlightening education" which would include the social sciences and the arts, would focus on problem analysis and the use of knowledge, would take place in a wide range of settings and would involve extensive contacts with patients and their families before, during and after their contact with the health care system.

Kaufman and Paterson (1995), from the Dalhousie Medical School in Halifax, discuss how medical schools will meet the challenge of preparing future physicians. The seven key areas that they address are:

- computer literacy – the ability to use general purpose computer software packages
- communications – the ability to use electronic networks both to access information and to communicate with other professionals
- information retrieval and management – the ability to search, retrieve and organise information from a variety of computerised information sources
- computer-aided learning – the ability to select and use such materials for self-directed learning
- patient management – the ability to both use database systems and statistical software for patient management (biomedical computing) and to use expert systems and knowledge databases in patient care (decision support)
- office practice management – using the computer to support good practice management
- hospital information systems – understanding and using information systems for hospital practice.

They anticipate that in the future "decision support software will be important in medicine; imaging will be essential in surgery and radiology; computer-aided learning will be helpful for patient education in family medicine; and communications and information retrieval will be essential for rural medicine." Virtual reality, with the ability to provide life-like

simulations for learners, will become important for both medical education and patient education.

2.3.4 System Management Issues

In his book *A Design for the Future of Health Care*, Dr. Larry Bryan, former CEO of the Calgary Health Region, identifies what he considers to be the most important elements in a health information system. These are:

- a broad information infrastructure that supports the health framework;
- an effective and user-friendly health service system that provides people with the information they need to protect and promote their own health;
- easily available points of entry to the system, allowing access to all health information or to major subsets;
- privacy and anonymity;
- the ability to link any piece of health information from any entry point by including in it: a common backbone for information transmission; unique identifiers for users; software interface standards that give ready access to databases; common definitions; priorities for critical data within database fields; and priorities for crucial software programs (especially databases): and by taking full advantage of the opportunities in electronic information dissemination;
- recognition that publicly defined health outcomes are the most important information sets in the system;
- extensive access to health information by linking existing elements of value to providers and the public, with enhancements being added, according to their importance, as they are completed;
- the use of real-time information in databases (Bryan, 1996).

Such information systems promise to change dramatically the way in which health care systems are managed. This will include changes in the design and operation of individual facilities as well as total systems. Information systems will show their worth in terms of improved outcomes and quality of care as well as reduced costs.

Facility Design and Operation

As many other authors do, Peckham (1998) anticipates that information technology will have an important impact on where diagnosis and treatment will occur, with a shift to the home and to a wide range of non-medical community settings, as noted above. As a result, he anticipates that this will "reduce the need for buildings, facilities, and personnel," with specialists and their diagnostic equipment concentrated in a smaller number of specialty locations linked by IT to community settings and non-physician providers.

Bobroff and Wang (1995) give some sense of what a community health centre may look like in the future. They describe "the layout and function of a 21st century ambulatory health centre. The heart of the centre will be a multi-purpose patient room that combines functions currently performed in separate spaces." Among the key features of this 21st century facility,

which provides health care, education and social services to a small community, are the following:

- instantaneous access to patient records
- automated patient history taking
- expert system recording, interpretation and encoding of patient interviews, with flagging of unusual symptoms
- "Increased delegation of responsibility to computer-assisted providers allows many simple diagnoses and treatments to be performed in the consultation rooms by non-physician health care providers."
- computerised prescribing and automated pharmaceutical delivery
- patient exam rooms, which contain a "function wall . . . a prototype enclosure designed to hold the instrumentation needed for most clinical services." This function room is modular and flexible so that "equipment can be easily removed, augmented or replaced by new equipment." Both mobile and fixed equipment use sensors extensively, the latter receiving input from sensors located in the room or from hand-held probes.
- a recessed robotic arm in the ceiling, which is the basis for a variety of detachable imaging modules, probes and lighting
- wall monitors that display the results of the imaging activities, display patient data and stored images
- a three-dimensional imaging unit that allows for real-time or stored images of the patient to be viewed
- sensors, which include microphones, cameras, staff ID badge sensors and so on
- the function wall, which includes an automated delivery system, primarily to facilitate exam room preparation (sterile instruments, linens, disposables, etc.) as well as pharmaceuticals and other supplies. This is all supplied by an automated robotic storage and delivery system, with automated monitoring of inventory and ordering of supplies.
- the health centre, which is also "an information source and social resource for the general population." Included are an education centre, counselling suites, group therapy rooms and a cafeteria/snack bar, as well as a conference room.
- an on-line library that can be accessed on site or remotely from home or work, 24 hours a day. Data on clinic or professional performance and outcome measures is available as well as information and education on health care, self-care and healthy living.

System Design and Operation

Information technology will result in a significant change in the way that health care systems are designed and operated, as is apparent throughout this scan of the literature. Peckham (1998) identifies a number of ways in which information systems will be important, including informed consumerism; information on individual patients and on the performance of individual professionals and institutions; information on the quality of care, the outcome of

care and the costs of care; and population-based health information systems that will allow sophisticated monitoring of population health status.

Kleinke (1998), Chairman of the Health Strategies Network in Denver, Colorado, argues that the "Holy Grail of health care industrialisation" is that "every clinical situation, no matter how unique, can be digitised" and that both clinical decision-support systems and clinical expert systems are the way of the future. However, he identifies a wide variety of problems with the development of such systems, some due to the fragmented nature of encounter, admission and episode data; some due to classification problems; some due to the fact that much of the current information that is collected is administrative and reimbursement oriented rather than clinically oriented. Moreover, he argues that thus far the development of useful health IT products has been constrained by their failure to recognise and account for the way in which such technology fits – or more often fails to fit – with the "culture" of physician practice: "Despite the billions of dollars invested in information technology generally, we have a dearth of good research into how such technologies mesh within their broader cultural context – a sort of techno-anthropology."

For Kleinke, the electronic medical record (EMR) is the essential technology. He argues that such technology cannot be uniform, but rather has to be tailored to the local and system characteristics within which it is implemented. While at present the costs of such development are prohibitive, he believes that we "may be reaching the point at which custom EMR development . . . will be affordable to smaller organisations early in the next century." Such information will provide the basis for the development of the databases, decision support systems and expert systems that will be needed if health care is to make effective use of information technology.

In a paper prepared for a conference on Fundamental Questions about the Future of Health Care organised by the Netherlands Scientific Council for Government Policy, Branger et al. (1996) identified four major problems with respect to health care and information technology:

1. The health care sector consists of a large variety of independent parties, each with their own responsibilities, priorities, and interests;
2. The primary process is very complex to support by automation;
3. Present user interfaces do not support the requirements of physicians;
4. For IT suppliers, the health care market is a limited one, which implies that large investments in product development are risky.

Like Kleinke, Branger et al. (1996) believe that the time is coming when software can be customised for small organisations, which will overcome the problem of standardised software that has been part of the first generation of health information systems. The new software will be generated from a relatively simple model of the organisation's working methods and procedures, yet "the software generated can be very complex, in fact too complex to be built by a programming expert."

Integrated systems of care provided by individual practitioners and teams linked in networks and supported by integrated information systems will allow for a dramatic improvement in "enterprise management." While health care will remain a complex business operating in a

turbulent environment, and while "nothing can bring the health care executive true control," IT will "bring the executive far more relevant data far faster, in a format that is far more easily understood, presented and discussed" (Flower, 1999). This will allow for more responsive, tailored and effective management based on evidence of quality, cost and outcomes.

Lower Cost Care

Delpy (1998) comments that just as we expect our home electronics to work properly the first time and every time that we use it, so "medical equipment in the future will have to be designed with exactly the same expectations – 'right first time'." This "right first time health care" will depend upon information technology to provide very precise diagnostic and treatment based on good data and expert systems. He believes that "if the end result . . . is to get the whole treatment right the first time, the overall cost will be lower . . ." because there will be less misdiagnosis, less over-investigation and less mis-treatment or over-treatment.

Flower (1999) provides several examples of ways in which IT can reduce health care costs. These include:

- an advanced intensive care unit (ICU) tele-medical system developed by IC-USA that integrates "knowledge-base" software and two-way audio/video communication of continuous real-time clinical information that enables intensive care specialists in a central "command centre" to monitor multiple ICU sites. Initial results have shown a 61 percent reduction in mortality, a 42 percent reduction in complications and length of stay, and costs down by 25 percent. They estimate that "a single hospital system with an ICU census of 40 patients would save 150 lives [and $6 million per year] annually" (cited in Flower, 1999).
- a program called LifeMasters that uses information technology to connect patients with diabetes, congestive heart failure and chronic obstructive pulmonary disease to nurse trainers. The result for patients with congestive heart failure is a 31 percent reduction in emergency room (ER) visits, a 48 percent reduction in in-patient days, a 25 percent saving in costs and a 16 percent increase in functional status.

The significant cost-savings that can be realised are summarised by Broshy et al. (1998):

> A visit to a primary care physician's office costs approximately $100, including the cost to the patient. Substitute home video for a trip to the office and the cost is $80. The cost drops to $60 if one sees a nurse instead of a primary care physician. Using a phone instead of video reduces the cost to $40. Replacing the nurse with an expert system squeezes the cost to $30.

Electronic medical records will not only enable physicians to access information, they also have the potential to significantly reduce administrative costs, including the costs of claims processing, a particularly important factor in the US market.

Broshy et al. (1998) identify some of the potential annual cost savings in the US health care system that may result from information technology used in these ways. In 1998, national health expenditures in the United States topped $1.1 trillion according to the Health Care Financing Administration (http://www.hcfa.gov/stats/nhe-oact/hilites.htm), while in Canada total health expenditures in 1998 were forecast to be $81,8 billion

(http://www.cihi.ca/facts/nhex/tabsum.htm). For purposes of a rough comparison, the potential savings in Canada if this proportion of savings were the same (which is by no means certain) is shown in brackets below.

- $25-40 billion through giving consumers the right information, which could lead to better medical outcomes ($1.9 to $3.0 billion)
- $6-7 billion more sales for the pharmaceutical industrial, together with less hospitalization and a higher quality of life, resulting from a 10 percent increase in patient prescription fill-rates; currently, "thirty per cent of drug prescriptions are not filled at all" ($446 to 520 million)
- $30-40 billion resulting from more informed decision making leading to more efficient use of medical resources ($2.2 to $3.0 billion)
- $30-40 billion from the use of electronic channels to replace primary care physician visits ($2.2 to $3.0 billion)
- $15-20 billion in annual administrative cost-savings by eliminating the need for caregivers to recreate records each time a patient moves or switches plans ($1.1 to 1.5 billion)
- a drop in the cost of claims processing from $10-15 per claim to $2-4 per claim with electronic processing.

2.4 Policy Issues

> True health care reform will require a health care information revolution. (Health Policy Expert Lynn Etheredge, quoted in Kleinke, 1998)

The November/December 1998 edition of *Health Affairs* included a section focusing on the health information revolution and some of the policy implications of this revolution. Moran (1998) noted that "The great majority of product innovation and development activity that will build and install the emerging health information infrastructure will arise from the motive for profit." He pointed out that spending on information technology in health care (in the United States) is currently around 2 percent of industry revenues, well behind the amount of spending in such information-intensive industries as banking and insurance, which spend 7 to 10 percent of their revenues on IT.

Both Moran and Kleinke argue that it will be the power of the market sector that will drive development and innovation in this sector and that a significant policy issue – perhaps the overriding policy issue – is how to effect policy without dampening that innovation and the promise that it holds for both better quality outcomes and reduced costs – and the diffusion of such knowledge to both providers and consumers of health care. Moran argues that "we should proceed from the assumption . . . that 'more is better'." but identifies three key policy issues that need to be resolved.

- *Privacy*: While the principal of confidentiality of information about "individually identified patients" needs to be respected, the acquisition of data that would allow for the proper assessment of the efficacy of interventions is essential. While some of this can be done with "blind" or "scrambled" information, it will nonetheless be necessary to move a lot of identifiable patient information around in the assembly of databases. Moreover, the

use of patient-specific information for commercial, profit-oriented purposes (e.g., reminding people to refill prescriptions) needs to be controlled or eliminated, although other such "push" approaches may be necessary for patient-specific disease prevention and disease management strategies. Failure to address and deal with these and related privacy issues will constrain the effective development and use of information intended to improve outcomes and reduce costs.

- *Software regulation*: A debate is underway as to the necessity and the means to regulate clinical decision-support software and expert systems. In the United States, the Food and Drug Administration has the power to regulate computer software that is "embedded in a technology that (is) clearly a medical device." While decision-support systems and expert systems are not "embedded" in a medical device, clearly their use, to the extent that it affects patient care and patient outcomes, may require regulation. However, it appears that at present the basis for regulation is unclear, and it will be necessary to "begin work on a *de novo* regulatory model that bears greater relevance to the design and development of software applications."
- *Telemedicine*: One policy concern here is that the widespread use of telemedicine, especially in the absence of good evidence on its safety and effectiveness and in the absence of standards, has the "capacity to break the bank were it to diffuse widely under a regime of unmanaged fee-for-service financing." Beyond this issue, Moran considers that "in the longer term the issues regarding licensure and liability are likely to prove far more important than short-term concerns about reimbursement," as it becomes increasingly sensible to use practitioners who are geographically remote.

Moran argues that improvement in quality assessment that enables us to identify efficacious interventions (and perhaps even more important, to identify interventions that are less effective) and the need to rapidly diffuse such knowledge to providers and consumers argues for "a major leap forward in our health information infrastructure." While he characterises our historical approach to new technologies as "highly conservative of medical privacy, cautious about the introduction of new technologies on safety grounds, and incremental in the approach taken by payers and regulators to material changes in the economic organisation of the health care system," he concludes that

> We should err on the side of caution in the face of policy options that would have an effect of materially retarding the development and dissemination of major improvements in the [American] nation's health information infrastructure.

Kendall and Levine (1998) identify three key areas that are important for policymaking:

- *Information on quality*: They argue that both consumers and payers have an interest in and a need for information on quality and that indeed "just as public policy should subsidise health care based on need, it also should provide the information by which people can use their subsidies efficiently." In other words, public policy should ensure that information on quality is widely and publicly accessible.
- *Information networks*: The challenge here is to "create the public trust needed to handle very personal health information" if the public is going to allow their personal health information to be used for the purposes of improving quality. They suggest that as no institution today is sufficiently trusted by the public to handle this information, a new

form of organisation is needed. They suggest looking to the model of VISA as an example of a database that is highly protected, trusted, and has emerged from "a unique blend of competition and co-operation" in the private sector. They point to a couple of California-based organisations that are already developing health information networks along these lines.

- *Decision-support technology*: They argue that the knowledge base for health has grown to the point where it is already "well beyond the capacity of individuals and professionals to manage it without decision-support systems," and that "information technology produces information chaos unless it has the capacity to filter and seek information based on individual characteristics." The challenge is that the profit motive may not work so well here because much of the information that is needed is held by professionals, whose ethic is "sharing important new knowledge instead of profiting from it."

Kendall and Levine conclude that the factors they have identified "argue for significant public investments in technology development through collaborative research efforts among commercial firms, university-based or federal research centres, and users of the technology."

3. The Scenarios and the Workshop

The one-day workshop used a set of four alternative societal scenarios set in the year 2025 to explore the implications of IT for health and health care. In this section, the scenario methodology and its benefits are first described. Following this, the four scenarios are presented, followed by a summary of the workshop and the key implications and themes.

3.1 The Scenarios Approach

One of the key elements of the CPRN "IT and Health" project has been the development and use of a set of four societal scenarios for Canada in 2020. Scenarios are coherent "stories" that assemble a large number of trends and forces, or plausible events, in a way that shows their interaction and their implications. Based usually on a set of tables that explore how different forces or trends and different sets of issues might play out in different plausible alternative futures (see Appendix A), they are often presented as a narrative story.

Futurists use scenarios for several reasons:

- they are useful ways of ensuring that a *range* of plausible alternative futures is considered, so that we do not become too fixated on *the* future. This helps us realise that the future is "plastic," that we have choices.
- because they paint a picture of the global and societal contexts, they help us realise that these contexts shape the sector that is the focus of our concern (in this case IT, health and health care and medicine), rather than the other way around – the tail does not wag the dog!
- scenarios help us to understand the values that underlie the choices we have made and might make. By presenting alternatives to which we respond emotionally as well as intellectually, they help us clarify our own values and thus to choose a preferred future.

Scenarios are, to an extent, caricatures of the future. They serve to heighten the contrast between certain sets of values and the consequences of those value sets if played out to their logical conclusion. At the same time, they are – or should be – plausible. We should be able to agree that this *could* happen if things developed this way, whether we like it or not.

In practice, however, the future may be more like a mosaic, not the clear-cut distinctions that the scenarios draw. If each scenario was represented by a colour, we might be able to see the separate colours close up, but from a distance one hue (future) would predominate. Thus a "business as usual" future may well contain elements of market triumph, decay and decline, and a more green or transformed society. The key issue is what "colour" we want to be predominant in our future.

Scenarios also both allow for and, in fact, encourage flexibility and adaptability. Preparing only for the "probable" future may leave us too rigid in our planning, whereas by considering a number of alternative plausible scenarios we can be prepared for adversity, and, in addition, we can identify those robust forces, trends and strategies that will enable us to adapt to and deal effectively with a number of different futures that we may face.

3.2 The CPRN Scenarios

The four plausible alternative futures that were developed for this project were based in part on scenarios developed in other societal and health care futures exercises, including the Institute for Alternative Futures (Bezold, 1992); the World Health Organisation (Bezold and Hancock, 1993; WHO, 1997); the Kings Fund (1992); the Canadian Medical Association (Hancock, 1999); and The Change Foundation (1999). Two other groups have also considered alternative scenarios that relate to IT and its use both generally and in the health sector – see Appendix B. Philip Groff drafted the final texts of the four scenarios.

3.2.1 The Market Triumphs

The world of 2025 is one of stark contrasts, between the "haves" and "have-nots." Worldwide, governments have had to weaken under economic pressures from multinational corporations. Coca-Cola, Microsoft and Disney join the United Nations (UN) as its first transnational corporate members in 2010 and the new *Baywatch 2020*, complete with virtual reality (VR) sand, surf and optional tactile interface, is the most popular form of entertainment. As national boundaries dissolve, populations become increasingly migrant, following the money from one corporate contract to another. In Canada, both federal and provincial governments have greatly weakened, and the First Nations have been completely assimilated – except for those performers in the wildly popular "True North Theme Park," a wholly-owned subsidiary of Disney.

Economic sustainability and profit maximisation are the chief determinants of societal form. Cities have grown by suburban sprawl, while glittering office towers crowd one another in the bustling financial districts downtown. There are more rich people, and they are relatively richer. The income gap between rich and poor has widened, as has the health gap. Women reached pay equity by 2015 and have joined the plutocratic elite in increasingly long hours of hard work. Seniors of means have registered medical savings plans (RMSP) while those without are left to their families for care, while child care is subsidised through tax credits. Crimes are mostly white collar and corporate, with occasional crimes of envy by the

underclasses. Technology is present everywhere, for a price, as numerous corporations compete for a share in the 5,000 channel multi-media universe.

The health field has changed dramatically. The 12 percent of GDP spent on health care is an approximately equal split between public and private sources, particularly since the tobacco companies have begun selling comprehensive insurance packages to smokers. Health promotion is largely the domain of corporate fitness programs mandated by efficiency and productivity analysts. Medical breakthroughs involve expensive new patent medicines and automated diagnostic scanners and self-care appliances for the home. There have been some increases in community services to prevent expensive admission to high-tech institutions, and to facilitate early discharge. By and large, community health providers sell social care to local authorities.

Corporate research firms have made many discoveries in human physiology. Anti-plaque and cancer prevention therapies as well as cosmetic neural tissue implants promise the rich somewhat longer, healthier lives. For those who cannot afford this, there are commercial euthanasia clinics offering release from pain, for a low fee and the right to harvest donor organs – for transplantation into those who cannot afford to have their own tissues cloned. All in all, many people feel healthier. However, the unemployed or unskilled underclasses are in worse health than ever before, and even those with only corporate benefits packages suffer compared to the well-off. Deregulation and deprofessionalization of health care severely limit the role of the ministries of health.

3.2.2 Evidence-based Government

The future is one of rational and regulated change. Sustainable development is the watchword and strong governments, including a greatly expanded UN, work to maximise risk reduction. A North American Union modelled upon the European Union (EU) has recently been formed while within Canada federalism has grown, as boundaries between provinces and newly created Aboriginal homelands are softened.

Society is a meritocracy. Class disparity has decreased as minimum wages, good unemployment insurance and income equalisation programs have been created to reduce inequalities. Women reached income parity by 2005 and have increasingly joined the workforce as state provided and regulated child care has become available. For seniors there is the choice of licensed private institutions, partly funded by expanded Canada Pension or publicly run retirement communities. Population health research has convinced the government that policies aimed at reducing social inequities are the best steps for health promotion. The workplace has become less hierarchical as demonstrated health benefits of worker control are acknowledged. The 30 hour work week has greatly increased free time and thus voluntarism is on the rise both before and after retirement.

Greater dissemination of clear research findings has resulted in further improvement in the Canadian diet and exercise patterns. Meanwhile the tobacco companies face a second wave of lawsuits, this time from employers claiming compensation for reduced employee health and productivity.

Medical research has made numerous breakthroughs as the Human Brain Project reaches completion, modelled on the wildly successful Human Genome Project. Large governmental databanks provide new insights leading to more evidence-based care. In medical practice,

accurate diagnostics are widely available as very specific, effective and inexpensive biotech driven assays and probes are employed. New scanning technologies are utilised almost universally by 2010. Gene therapies are in common use for both the treatment and prevention of cancer and other chronic conditions.

A somewhat streamlined Ministry of Health oversees the collection and maintenance of these data banks. Included in their mandate is the maintenance of comprehensive on-line medical records for all citizens to insure maximum portability of health care. These records are kept strictly confidential though aggregate data collated from them are sold to research institutions to help offset costs. Some have charged that this means a (mostly benevolent) Big Brother is always watching. The health protection division has assumed most of the functions of the former department of the environment, including the strict enforcement of emissions guidelines and waste treatment and disposal legislation that many fear has come too late to completely reverse our impact on the planet.

In this rationally planned and orderly society there are some groundswell movements of opposition. In some instances people react with civil disobedience to what is seen as invasive monitoring. For some others the response is a call to anarchy and violence.

3.2.3 Healthy Communities

Several environmental disasters of the late 1990s and earlier 21st century have led to massive global groundswell movements against corporatization, and economic development for its own sake. The new emphasis is truly one of acting locally while thinking globally as many super-states are replaced by smaller semi-autonomous communities. Cascadia, consisting of Northern California, Oregon, Washington and British Columbia, declares autonomy from the North American Union in 2015. Several similar regional confederacies follow suit. The city-state of Toronto is formed in 2017. Government beyond the regional/municipal level, including a greatly expanded UN, is largely charged with maintaining adequate telecommunications and transit links between local communities. Such high technology is used to further communications in the global village and to assist local citizens' councils in collectively working on trans-regional projects. Halting environment degradation and reducing the ecological footprint of the Western world are paramount among these projects.

In some communities the move to localisation has been a tremendous advance. In these communities wage-based economies and consumerism have largely disappeared. People work on various projects throughout the year, in exchange for their share of the Citizen Fund. Government within the regions is by direct democracy, with tele-voting in virtual town halls supplementing actual physical participation on regional maintenance and oversight committees. The justice system has largely been replaced by mediation services as crime has virtually disappeared. The values of these societies are similar in many ways to those of the First Nations, and thus representatives from those autonomous groups are often utilised as social resources and facilitators. Health care has changed dramatically with the majority of effort being expended on lifestyle promotion, lifelong education, reduction of economic disparity, improved environmental conditions, and increased self-esteem and autonomy within one's chosen life paths and civic work. Medical interventions are provided at wellness centres, which incorporate the 20th century notions of hospitals, as well as libraries, galleries and community recreation centres. Multimedia and VR holography allow for distance

diagnosing and treatment when the resources of the local community are inadequate to a particular case. In general, the focus is on adding life to years rather than years to life, and a healthy death is seen as the natural and desirable conclusion of a healthy life.

In other communities, life is not as good. Individual rights and freedoms are virtually abolished in favour of collectivist planning and decision making. Eco-police enforce draconian laws designed to promote community welfare, but many feel they have exchanged liberty for security. In these communities decisions are made on a cost benefit analysis with the survival and integrity of the community as the only end value. Even decisions such as when or if to have children, and how long the elderly should be maintained are made by the community for the individual. Some neighbouring communities are appalled at these totalitarian republics, but, in the absence of any centralised authority, isolationism and turning a blind eye are the only course of action possible.

3.2.4 Harder Times

The worst fears of the pessimists of the late 1990s have come true. Widespread environment degradation, global warming and the collapse of the world markets in the face of crippling Third World debt, and depletion of key resources lead to the Resource Wars of the early 2020s. The last of these largely North-South conflicts ended with the United States detonating tactical nuclear weapons over the troops of the Central American League, massing along the Texas/California borders. The retaliatory release of anthrax by the terrorist group Golden Dawn has blighted most of America's cropland.

Most multinational treaties, to say nothing of World Government, have disintegrated in the wake of localised conflicts in the Balkans, Scotland, South East Asia, and along the Sino-Indian border. Protectionism, mutual distrust and a siege mentality are the watchwords as a new arms race, and nuclear proliferation deplete national treasuries.

In North America the inner cities have collapsed under two more decades of neglect. Unemployment soars as many companies declare insolvency and most engage in radical downsizing in light of the global depression. The chronically unemployed, de-institutionalised, waves of eco-refugees and criminals are everywhere. The well-off remain sealed in their gated communities, which have taken on the appearance of medieval fortified towns. The underclasses have increasingly banded together for mutual protection in the form of street gangs, vigilante groups or the neighbourhood watch, which have become increasingly difficult to tell apart.

Canada reels in the wake of the internecine civil war that followed Quebec's sovereignty declaration of 2017. Most basic public services, including transfer payments to the provinces, have had to be eliminated as the federal government is forced to declare bankruptcy in 2020.

Health care is for those that can afford it. A sizeable proportion of the percentage of our GDP spent on it is in the form of grey-market donor organs, and pharmaceuticals. Privately funded hospitals within the gated communities provide adequate if not spectacular care for the well-off. The urban poor have to make do with what they can beg, borrow or steal from chronically under-funded and frequently closed mobile health clinics. Back alley abortions have been joined by back alley appendectomies. Almost farcically, cardiovascular morbidity has declined as people have been forced to eat a more locally produced, lower meat/fat diet.

3.3 The Workshop

The one-day workshop brought together futurists, information technology professionals, health care professionals and policy experts from a wide spectrum of organisations (see agenda and list of participants, Appendix C). The workshop began with a brief presentation of the framework for the "Towards a New Perspective on Health Policy" project, which was followed by a presentation by Joe Flower, based on his article in the *Health Forum Journal*. This was followed by a "fishbowl" discussion featuring several participants from the IT sector who discussed among themselves and with the rest of the group: "Where will the technology be in 25 years and what will it enable us to do?"

Following this, four small work groups considered the following question for one of the four scenarios: "How will IT be developed and used in this scenario, and what will be the implications for health and health care?" Each group reported back its discussion, following which common themes were identified that seemed to crop up in several, if not all, the scenarios (see below).

After reflecting on the reports from the four small scenario-based groups, four differently formed small groups then considered what were the generalisable implications for health and health care, and in particular the interaction between the individual and his or her social context. The reports from these small group discussions then led to a general discussion on the implications of IT for health and health care, and for the interaction between individuals and their environments.

Following this, a brainstorm session among the entire group considered "What do we have to do now to prepare for these futures?," followed by a second "fishbowl" discussion on the policy implications of all this. (The notes from the two fishbowls and the brainstorming session can be found in Appendix D.)

3.3.1 Scenario Implications

The ways in which the small groups anticipated that information technology would be developed and used, and the implications of this for health and health care, are summarised below.

Scenario 1: The Market Triumphs

In this scenario, information technology will be proprietary and fragmented, with a huge knowledge creation industry that will patent and own databases and tools. The industry will focus on making a profit out of better health and the provision of health care, which will mean focusing on specific market groups and targeting treatments to specific populations. The benefits will include a rapid pace of innovation and a more intense and sophisticated use of IT, but the costs will include reduced access for those with a low income. (One way to understand the reduced access is to compare the difference today between use of medical care and dental care in low-income populations – the latter is used much less, even though the need is high, because it is a direct cost to the family.) The potential also exists for an increase in the use of monitoring, genetic profiling and so on by employers to ensure their employees lead healthy lives.

The government's role in this scenario will be reduced to providing the bare minimum for low-income groups and playing a "public watchdog" role. The industry will be mainly self-

regulating, with the minimum standard of information quality applied. Even the Cochrane Collaborative will be privatised! The focus on individuals will mean that the data set will not be inclusive of external factors (living and working conditions, etc.) and the amount of public interest research will be limited by the proprietary nature of the databases.

Scenario 2: Evidenced-based Government

The good news in this scenario is that there is only one database – the bad news is that it is controlled by the government! Patient- and practice-specific decision-support systems at the community level will be linked to global systems, and cost controls will be applied. The electronic patient record will be a key to this.

Public information access points, which will be aided by more complex and sophisticated search engines, will help to reduce class disparities in access to information technology. The networking of communities will enable information to be exchanged more easily.

As not only information but opinion, expertise and treatment advice and consultation becomes transnational, an important issue for the government and society will be how to regulate professionals across borders, when IT does not recognise borders.

The databases will pay greater attention to external factors that underlie inequalities, which will enable more complex research enquiries and a broader focus on population health. There is a large potential for abuse of data and information in this scenario, both in terms of privacy and in terms of governmental control and filtering of knowledge.

Scenario 3: Healthy Communities

In this somewhat utopian scenario, there would be a seamless continuum of services and information in health and health care from the individual level to the population level. Local communities would be empowered to take control of health care locally – including paying for it – and the collective would be more important than the individual.

The good news is that there would be universal distribution of information and increased education in these healthy and smart communities. There would be more social cohesion, a focus on wellness and an open, pliable and less bureaucratic system.

The bad news is that such a high degree of local control may lead to a polarisation between communities that are successful, wealthy and healthy and those that are not. In addition, there may be less privacy and a loss of individual rights as prevention becomes community-driven. It is also not clear who would pay for the seamless information system, and indeed there are a number of issues about local versus global management, control, payment and so on. In such a system, who would be responsible for liability, payment, control of information and measurement? How would global access, global information standards and global treatment standards be developed and maintained?

Scenario 4: Harder Times

In this depressing scenario, inequalities would be heightened and IT would be used as an instrument of social control. Those who through their status, income and privilege have access to e-technology (the e-class) would have considerable benefits over those who do not. The result would be a hierarchy among countries (e-endowed countries) and among people (e-empowered people) and a form of social triage.

Sophisticated IT-based high-tech health care would be available to those who could afford it. Where services were in short supply, they might be auctioned on e-commerce systems. There would also be a black market in health care and other services. To protect themselves from the three key health threats of infectious disease, toxicity and violence, the elite would use the "health police," genetic information, screening, implanted biochips, gated communities and controlled access to information as a means of protection, which would further heighten inequalities.

In reaction to this depressing and oppressive scenario, it is likely that there would be pockets of resistance – "information freedom fighters" – who would try to use IT to enable participation and social reform. IT could be used for ensuring effective prevention and treatment of conditions that affect public health, and to provide information and knowledge to every home, school and life setting on how to raise healthy children and healthy families. Such e-enabled health promotion and health care could be individually tailored to be very effective. Enhanced citizen participation would be an antidote to depression.

3.3.2 Common Themes

Following the presentation of the four scenarios, a brief discussion identified common themes in all four scenarios. Subsequent analysis added a few additional common themes to the initial list, yielding the following common themes:

- continued technological change
- a tension between local values, control, etc., and global values, control, etc.
- continued social inequality
- Big Brother (could be the government or the private sector)
- IT as liberation
- cannot look at health IT in isolation, it reflects the social and economic context, it is all values-contextual
- is there a "commons" and who is responsible?
- are we attributing too much to IT?

3.4 Key Themes

The second part of the workshop considered the implications of IT for health and health care in a broad sense. An analysis of the reports from the small groups, the subsequent brainstorming and the final policy-oriented "fishbowl" suggests a set of issues that are discussed below in two broad categories; socio-cultural issues and health care system issues.

3.4.1 Socio-cultural Issues

The implications of information technology for health – as opposed to the delivery of health care – are primarily socio-cultural in nature. Thus they are concerned with values (such as equity); with social cohesiveness and connectedness; with knowledge and the use of knowledge; with the role and power of the market (and the government); and with the way society may use or abuse information technology.

Access and Equity

The potential for information technology to heighten inequality was a recurring topic of discussion and an underlying theme for the workshop. The danger is that the "e-empowered" will be able to use the technology to increase their power and wealth, and that those who do not have ready access to the technology will fall further and further behind – this is what some futurists have referred to as the "gods and clods" scenario.

At the same time, IT holds out the potential – already being realized in some degree – to increase access not just to health care but to knowledge and information generally, in remote rural and northern communities.

The antidote to this potential heightening of inequality is both to ensure that the infrastructure (or the "info-structure") is put in place so that everyone can have access to it and that IT access and IT literacy are universal. Indeed, one important revelation from the workshop is that the maintenance of a universal health care system in the future will *require* universal access to information technology, since IT will be the backbone of the future health care system.

Connectedness

Information technology is redefining the concept of social connectedness and community. Today's young people are constantly in touch through pagers and cell phones, while e-mail and the Internet enable family, friends and colleagues to be in touch almost instantaneously across the world. In the future, that high degree of connectedness will only increase. This redefines the concept of community, which increasingly may be non-spatial and virtual.

Such virtual communities should not be dismissed as less real than spatial communities; they can offer high degrees of social support, particularly for those who are isolated by virtue of age or disability as well as those who are living in remote settings. These virtual social support networks can have positive health impacts. In addition, as more and more people work at home, it will be important to ensure that the social networking and support that work often provides – and that is one of the most important benefits of work – are maintained. Whether this is done through virtual communities or through "telecommute centres" or other means, it will be important to avoid isolation of workers.

Indeed, one of the paradoxical aspects of this increased connectedness may be increased isolation, at least for some people, in the sense that they have only virtual rather than real social connections. Particularly as television and computers become synonymous, the potential to sit at a screen all day and feel connected while actually withdrawing from social connections in the local physical community is very real. In addition, the potential for "group think" and e-cults to arise is significant, particularly in the absence of modifying opinions and diversity, which can easily be excluded in the virtual world.

On the positive side, there is a potential for IT to increase the tailoring of information to local settings, which may lead to enhanced local engagement, participation and action. Used wisely and well, IT could enhance local participatory democracy.

Knowledgeable, Empowered People

Fundamental to enhanced local participation and action is the need for a knowledgeable public – since knowledge is power, enhancing knowledge is a contribution to empowerment. The potential for information technology systems to increase awareness and knowledge is massive, though how it will be utilised remains to be seen. People certainly could use IT to increase their knowledge and awareness of local issues as well as global issues, and to make links to others so as to take collective action. However, there is a danger that information overload will simply serve to overwhelm and dis-empower people. How we deal with this as individuals and as a society is an important area of concern.

Within the health area, knowledgeable and empowered people can increase their personal responsibility for what Vickery (1995) refers to as "self-health care" – making choices and taking actions so as to maintain and improve their own health. They can also increase their potential for what he calls "self-medical care" – self-diagnosis and self-treatment. As expert systems become more sophisticated and more widely available, the potential for patients to take a far more active role in their own disease management increases, which has significant implications for the role of professionals in the future (see below). Already, learning about health and health care is one of the most common reasons for people to turn to the World Wide Web, and sales of health-related information technology and home-based health care tests and services are a major growth industry. While the potential for abuse exists (see below), quality control should ensure that such technology is beneficial in the future.

Role and Power of the Market

It seems clear that the private sector will play an increasing role in health care because of its domination of the information technology sector. The combination of the industry pressure in terms of product innovation, development and marketing together with consumer demand for services and products will continue to create a thriving market sector. The potential for IT to increase choice while at the same time making it possible to customise products and services to individuals will make IT an increasingly powerful part of the health sector. Indeed, as noted above, IT will in many ways be the backbone of the health care system of the future, which means that those who produce and market health-related IT will assume a more dominant role.

Another aspect of this issue is the balance between private and public interest. As the market develops the technology and databases, it may have a proprietary interest in restricting access to such technology and information, in the interests of profit. On the other hand, the public interest may be to maximise access to technology and information. How this is resolved will be an important policy issue. On the other hand, there may be more common ground and less competition between these interests than there initially seems to be. Government initiated discussions between private IT providers and public policymakers should prove useful.

This increased role of the private sector brings with it a potential threat to the universality of health care, partly because of the need to ensure universal access to IT and partly because of issues of cost. As more and more health services become available through the Internet and in a global market, who will pay for their use? Those who can afford to purchase high-quality IT consultations with providers on the other side of the world will presumably do so. A related concern is who will pay for physician and other health professional activity related to

services provided in conjunction with or through the Internet or other IT products and services. At the moment, there is no obvious mechanism for reimbursing health care professionals for the time they devote to such activities, even though these may be crucial aspects of their practice in the future.

Use and Abuse of Information Technology

As with many other technologies, information technology can be used both for good and for harm. Of particular concern is the potential use of extensive databases for manipulation or even control of individuals, a practice that may be used both by the private sector and by governments. While individuals may need their privacy, the private sector needs access to information for marketing purposes, and both the government and business require access to information for system management and control. Both of these have the potential for abuse. In the workplace, this may amount to surveillance and monitoring of employees both in their work lives and in their private lives; in the market, it may mean knowing in great detail what people do and how they spend their time and money and this can amount to intrusive marketing; in the public sector, this may at its worst become a form of "health police," using surveillance and monitoring to control populations and individuals.

Another disturbing issue is the need for high levels of security for clinical management systems to prevent "hackers" tampering with them, with potentially fatal consequences for the individuals whose care is managed via such systems.

3.4.2 Health Care System Issues

There are a number of issues that are specific to the health care system and its use of information technology. Chief among them is the need to know what is happening and what works, for which extensive electronic databases and the provision of real-time information are of vital importance. The results of such knowledge may include both better outcomes and lower cost – in short, better system management. At the same time, the system has to be concerned with issues of the quality of the information, not merely within the system itself but also the information provided to the public through the Internet and other sources; how valid and reliable is the information, and who decides? This also raises issues of liability – in a global system, how is it possible to manage and control liability and ensure accountability within provincial and national contexts? All of this points to significant shifts in power and control within the system and to changes in the ways that health professionals do their work.

Knowing What Is Happening and What Works

> Information technology produces information chaos unless it has the capacity to filter and seek information based on individual characteristics. Developing the technological capacity to deliver the right information at the right time in the right form is critical for ensuring that society makes good use of the ever-expanding knowledge about health and health care. (Kendall and Levine, 1998)

While there was a wide range of opinion in the workshop as to how soon a fully integrated comprehensive patient-based information system would be universally available nationally, there was no question that such a system is both desirable and – ultimately – feasible. Knowing what is happening in the system and what is happening for individual patients should greatly increase our ability to make better decisions, be they clinical decisions or policy decisions. The combination of sophisticated real-time information, sophisticated

analytic capability and expert systems will likely greatly increase the effectiveness of the system – improving outcomes while lowering costs.

However, the massive and pervasive nature of this information system will raise troubling concerns – who owns the information, how is it to be used, how is confidentiality to be maintained, how will public accountability be maintained? These questions will be particularly difficult if significant segments of the information system are developed and owned by the private sector.

Better Outcomes

Clearly, knowing what works for particular procedures, particular physicians, particular clinics or in particular communities is of enormous value – and knowing what does not work may be of even greater value. But better outcomes are not simply a matter of reduced mortality and morbidity, they also include greater patient satisfaction and improved quality of life. The provision of the right service in the right place at the right time, improvements in scheduling and delivering services, improved time management, improved product quality control – all of these contribute to better outcomes as well.

One area where information technology holds out enormous promise of better outcomes is for people with disabilities. The potential for information technology, allied with robotics, to increase their ability and independence in areas of mobility, speech, hearing, sight and communication is dramatic. They may truly become fully engaged, participating and contributing citizens as a result of IT.

Costs

The potential for information technology to reduce overall costs is already apparent, as indicated in the literature review earlier. As the costs of many aspects of IT become trivial, this benefit will become even more apparent, even if unit costs for some forms of IT-enhanced technologies increase. But as with any technology, there may be an initial investment cost before the benefits are reaped. How this initial cost is paid – and by whom – is an important issue.

Quality Control

There are several troublesome aspects of quality control with respect to information technology in health care. These include quality control for information on the Internet and in other public information systems; quality control of databases and record keeping; and quality control in terms of professional regulation across provincial and national borders. Tensions between centralised compared to decentralised and global compared to local control is very apparent.

As the amount of health information available on the Internet and through other IT-based systems explodes, a vital question becomes one of the validity and reliability of that information. Who should consumers believe? How much should information be controlled? What is the danger of over-control and the exclusion of alternative perspectives? Generally speaking, it seems that the approach will be one of "branding" rather than regulation of information. In other words, respected organisations (e.g., the Canadian Medical Association, Health Canada, the Canadian Nurses Association, etc.) will provide some form of quality "seal of approval" and/or will link to those sources and Web sites that they consider to be

reliable, thus providing some assurance to the general public as they look for information. In addition, we are likely to see the emergence of new "intermediaries" – individuals or organisations that will undertake to work with consumers to digest, analyse, interpret and present useful and meaningful information or will help them to navigate the increasingly complex and sophisticated world of health information. These intermediaries (or info-mediaries) may also come to play a role "between" the individual client/patient and the provider/system. But how will they be paid, and by whom?

A second aspect of quality control is concerned with the quality of information collected and stored in databases. Clearly, if the data are to be useful, they need to be of high quality, to be collected in a standardised way, and to be comparable both nationally and internationally. Establishing standards for such data systems must be an important priority if the information is to be of any value to individuals, to professionals, to health care systems and to society as a whole.

Finally, not only will information be available from around the world but increasingly so will advice, services, even treatment. It is entirely conceivable that someone with diabetes may have their condition monitored and managed by an expert system based in another country halfway around the world and may receive both advice and treatment direction from professionals working with that expert system. This will make it increasingly difficult to regulate professionals in terms of licensing, competence and so on within the confines of a provincial or national health care system, and suggests the need for some sort of global system of professional recognition and accountability. The struggle to do this within the European Union may provide a useful pointer here.

Liability Concerns

The issue of quality control raises issues of liability concerns. Who is liable for the provision of false, inaccurate or misleading information on a Web site hosted in India? Who is liable for a misdiagnosis by an expert system based in Chile? Who is liable for incompetent or inappropriate treatment recommended or provided by a physician or other health professional working in Australia? These are problematic issues that will have to be addressed as information technology makes health information and health services globally available.

Shifts in Power and Control

Many of the issues discussed above carry with them profound implications with respect to shifts in power and control. These include a shift in the balance of power from

- professionals to empowered consumers
- professional knowledge to knowledge based in expert systems
- physicians to other professionals, including "info-mediaries"
- institutional and clinic settings to the home
- central to local control but, at the same time, for some aspects local to central control
- government-funded and provided services to market-funded and provided services.

These and other shifts in power and control that result from the application of information technology in our society and our health care systems – and there are others not listed here –

have profound implications for the way our societies and health systems operate, and for the role of professionals and their clients/patients within those systems.

Professional Change

Physicians and other health care professionals are going to experience dramatic changes in their work and in their training over the next decade or two, as a result of information technology. The power shifts identified above may prove threatening to some of those professionals, while providing opportunities for others. Knowing what works and being highly connected with information systems, other professionals, other services and their clients will have important implications for the ways in which physicians and other health professionals work. Will professionals become the new "info-mediaries" and knowledge brokers for their patients and clients, or will a new class of professionals emerge to do this? Will the prevalence of expert systems and other sophisticated technology displace physicians and nurses, or will it in fact provide them with the time and opportunity to do the caring, the touching and the healing, because they will be less dependent upon knowing and doing everything? Finally, how will medical, nursing and other health professional education adapt so as to prepare physicians for this new world of information technology?

3.5 Policy Considerations

It is clear that information technology poses significant policy challenges. The development of information technology is unquestionably going to happen, indeed it is likely to accelerate beyond anything we currently experience or can even imagine. The issue, then, is how we choose to use it. Thus the policy implications for information technology have more to do with how it is used, to what end, and guided by what values and principles. Some of the key implications and the policy issues that they raise are discussed here, in the broad categories of IT and its implications for health and well-being, as well as the implications for the use of IT in health care.

But above all, there is a need for an informed public and professional debate about the information technology developments that are on the horizon and the implications of these technologies for health and health care in the 21st century.

3.5.1 IT and Health

In this area, the key issues relate to the underlying hypothesis of the "Towards a New Perspective on Health Policy" project, namely that "the most significant contributor to health is a robust relationship between an individual and his or her social context." The new information technologies have already begun to redefine the meaning of community and to establish forms of social network never before seen. The principal impacts of information technology on health, it seems, will be the result of the impact of these technologies on social context, social connections and mental and social well-being. A key policy issue is how well we are able to assist people to make effective, productive and "healthy" use of IT.

Impact on Mental and Social Well-being

Information technology has the potential both to increase isolation and alienation and to increase social networks and social support. The potential also exists to increase exposure to violence, with potentially serious effects.

It has taken 40 years of the widespread use of television for its ill effects on children to become an accepted health problem (American Academy of Pediatrics, 1995). The concerns raised by pediatricians and others with respect to the impact of television on health – both in terms of the medium in and of itself and in terms of its content – may well apply equally to information technology.

Information technology also holds out the prospect of enhancing access to information and to decision-making processes that might lead to increased participation and an enhancement of the democratic process. Increased involvement and participation may lead to a greater sense of empowerment and self-esteem, with implications for not only mental and social but also physical well-being. On the other hand, if our social networks are increasingly global in nature, this might lead to a reduction in involvement and participation in local networks, to the detriment of local democratic involvement.

Policy responses to these issues may include, among others,

- education of the public, and particularly children, about the Internet and other forms of IT, their benefits, their costs, how to use them effectively and wisely and so on. (Existing media awareness and education programs in the schools may provide a useful template for this purpose.)
- how to use IT to enhance local democracy
- promoting the use of IT for enhancing social networking and social support
- regulation of some aspects of the content on the Internet

Impact on Work Life

Participation in the workforce provides a number of health benefits over and above income, including, in particular, social networks and social support, and a sense of meaning and self-worth. On the other hand, work can also be a source of stress, with adverse effects on physical and mental health.

Information technology is likely to impact on all these aspects of work and health. There will be job loss, more frequent changes in job activities, higher mobility and turnover, and in some cases a reduced work week while for others there will be longer and more stressful work weeks. While IT will enhance innovation and creativity for some, it may also be used to harness and control other workers.

The introduction of information technology into the workplace will continue to generate a wide range of health impacts. Public policy needs to ensure that information technology enhances rather than harms the health of the workforce. Labour policy, occupational health policy and related policies all have to take into account the health impacts of information technology in the workplace.

Impact on Income

If, as some foresee, information technology leads to a reduction in the amount of time spent doing work, will this also lead to a reduction in income? If, for example, robots displace workers in wide areas of industrial production (or for that matter home care) yet at the same time wealth creation continues, how will the benefits of that wealth creation be redistributed

in the society? Will there be a need for some form of guaranteed annual income or reverse income tax? How will public policy avoid the further polarisation of income in society, a polarisation that not only adversely affects the health of the lowest income groups but affects the health of the population as a whole.

Public Education

A major effort is required to educate the public as to how to make effective use of the vast range of information technology that is already available and the even more vast range that will soon be available.

Mechanisms need to be established for the legitimisation and "branding" of health information provided on the Internet or by other means. This is preferable to regulation, since it allows diversity, innovation and choice to flourish.

3.5.2 IT and Health Care

There are numerous policy issues to be addressed as information technology is introduced in the health care sector. First and foremost is the issue of access to IT and the use of such technology by the public at large to enhance their health, well-being and self-care capability. Secondly, there is the need to effectively manage access to information, both to protect the individual and to ensure that information needed to effectively manage the system and ensure high-quality outcomes is available. This depends to a fair extent on the extent to which information technology is used by health professionals, which in turn depends upon their education and training, as well as how well the technology fits their work culture and the incentives or barriers to its use that are created. Information technology also has implications for professional roles and for the regulation, accountability and liability of providers in a world where IT, in effect, removes or ignores provincial and national borders. Finally, there are policy issues with respect to how health IT services are paid for and the research that is needed in the use of IT in health care and its implications for health and well-being.

Access to Information Technology

Maintaining a universal health care system in the future will require universal access to information technology. This may mean amending or re-interpreting the *Canada Health Act* by adding this as an aspect of universal access. This obviously has profound implications not only for health services but for information technology policy. It may also result in conflicts between issues of public good and market values, to the extent that access to information technology is currently a private market issue, not a matter of public benefit and the public good.

The infrastructure for health and health care IT must be created in a way that ensures universal public access to the system. Ways must be found to ensure that people are not excluded because of price, lack of infrastructure, or because of such personal attributes as disability, age or infirmity.

At the same time, for the full potential of IT to be realised, the market must be encouraged because of its ability to innovate, to provide flexible and diverse choices, and ensure rapid dissemination.

IT and Self-care

There is enormous potential for information technology to increase the capacity of Canadians to undertake self-care, including maintaining and improving their own health and well-being and diagnosing, treating and managing their own minor and/or chronic illnesses. But this potential can only be realised if the mechanisms are put in place to support self-care, an area that the health care system and health care policy has by and large neglected (with the exception of an emphasis on lifestyle behaviours).The potential for information technology to enable people with all forms of disability to live more independently in the community is another important form of self-care that must be supported.

A wide range of public policies is needed to enhance the potential of Canadians for self-care. These include:

- encouraging the development of the appropriate software (including expert systems) and hardware (including communication/transmission systems, diagnostic kits, robotics and so on);
- widespread public education, starting in the early years of school, in self-care and the use of self-care systems;
- the "branding" of information and the development of "info-mediaries";
- the funding of self-care programs as part of the publicly funded system so that funds can be shifted from the professional care funding envelope.

IT and Quality of Care

Information technology holds out enormous promise in enabling us to know what works and what does not work. However, this requires the establishment of national (and preferably international) databases that have common standards for content, encoding and so on so that valid and reliable data can be generated. This requires the development of national standards (probably while providing sufficient flexibility for adaptation to the local situation) and support for academic and research institutions as well as health management systems that can analyse and make use of these data in a timely fashion.

Ultimately, however, improving the quality of care and the outcomes of clinical practice depends upon the application of that knowledge by providers. This calls for mechanisms both to educate those providers and to provide incentives (and/or penalties) to ensure that such knowledge is effectively applied. This needs to be accompanied by a system of public accountability so that they can be seen to be doing what works.

Access to Information

Legislation regulating privacy and access to information about the health of individuals – be they users or providers of health service – is essential if the potential for health information systems is to be fully realised.

Use of IT by Professionals

Incentives are needed to enable and encourage providers to use information technology to its maximum potential. These incentives include the creation of simple, easy-to-use technology,

as well as education and training in its use. It is also important to develop financial payment systems and incentives that will encourage providers to use IT, and to use it appropriately.

Education and Training of Providers

Provider education and training about the effective use of information technology in all aspects of their work, and perhaps even more important re-education and re-training for providers who have been in practice for a number of years, is essential.

Providers also need training and preparation for a career in which change will be constant and flexibility in roles will be essential.

Professional Roles

All we can say with confidence is that information technology may lead to dramatic changes in professional roles, both within and between professions. This suggests that regulation and accreditation needs to be flexible and adaptable, not rigid.

Regulation, Accountability and Liability

Regulation of professionals across provincial and national boundaries, issues of regulation and of control of quality and competence beyond such boundaries, and definitions of scope of practice are important issues that need to be addressed by Canada's health professional licensing and regulatory bodies. Issues of trans-boundary liability also need to be considered and addressed.

The regulation of software, including expert systems, may require new legislation; this is an issue that needs to be addressed now, and in collaboration with US regulators in particular.

Research and Development

A priority for research funding is research into how best to use information technology to find out what works in the clinical setting. An additional priority for funding is research into ways in which IT can be effectively applied in the health care setting. Research is also needed into the impacts of IT on health status and the determinants of health.

Support is needed for the development of information technology for health and health care tailored for the unique Canadian situation. Otherwise, reliance on US software and expert systems may mean, in effect, importing the US model along with the IT, since it will be geared to the US system of delivery.

Paying for Services

The issue of payment may be one of the most difficult policy issues we face. Currently, health care providers are not paid for telephone advice, but in the future much of their work may be through electronic rather than personal contact and visits. Time spent undertaking research to find information for patients on the Internet and/or tailoring software and other programs for individual patients may also need to be reimbursed.

An even more thorny problem is how to ensure universal access to information technology so as to maintain universal access to health care. How will such technology be paid for? How will it be possible for people living in poverty to nonetheless have access to the information technology, software, communications technology and hardware that they require, even if these costs do become "trivial"?

In the realm of self-care, how will the costs for such things as home-diagnostic kits or home-treatment kits – currently often paid for as part as the costs of doing business in hospitals, clinics, physicians' offices or home care programs – be paid for?

If an increasing amount of care will be provided by nurse practitioners or other non-physician providers, or even by info-mediaries or robots, how will they be paid? And by whom?

Finally, in the realm of federal/provincial relations, how much of this new technology will be considered as covered under the *Canada Health Act*? To what extent will the *Canada Health Act* have to be amended in order to ensure that the federal government pays its contribution in this new, IT-based health care system?

4. Discussion of Lessons Learned

The future is not what it used to be. The physical sciences used to promise a world of complete predictability and control. A clockwork machine that despite its complexity could ultimately be completely understood and reliably manipulated. Recent advances in physics, statistics, meteorology, biochemistry, genetics, systems engineering and many other fields have shown us that increased knowledge of the physical world actually does little to reduce uncertainty and the role of chance. Complexity is not merely an impediment to our eventual understanding of the nature of the universe, it is the nature of the universe. The shift from the old to the new physics has had profound implications on our understanding of ourselves, the universe and our place in it. This change in the physical sciences has understandably had a profound impact on the way we view health and the nature and role of health care. Where once it might have been imagined that perfect health was as attainable as some state of efficient equilibrium in a clockwork mechanism, we now realise that health is complex, shaped by numerous, perhaps countless, forces from many different spheres of influence ranging from the molecular to the socio-economic.

A similar change is occurring in the realm of information. Each advance in the history of information: the evolution of language; the development of writing systems; and the eventual replacement of scriptoria with printing presses has resulted in an explosion of available information in human society. This increased ease in the production and transmission of information helped to create everything from large national governments with bureaucracies spanning whole continents to vast libraries of medical and other scientific lore. Today an even more profound change has been brought about by the development of the microcomputer chip and the proliferation of telecommunications networks. Never before in human history has there been such ability to generate, store, transmit, process and analyse information. The technologies collectively known as information technology or IT, and the people who employ them are the fastest growing sector of the world economy. The instruments of this technological revolution are themselves increasingly powerful, affordable, and accessible. It seems only natural, then, to consider the future of health and health care in light of this explosion of IT.

The traditional view of the dawn of the information age, like the traditional view of the physical sciences, would be that more information and greater access to information will automatically result in increased precision of prediction and facility for control. However,

when thinking about the future of health, the transition to the new information age seems to raise the spectre of some apparent contradictions or antinomies. There are apparent contradictions in the maintenance of public sector involvement in health care and, simultaneously, forces pushing toward increased private sector involvement. There is the tension between individual privacy and confidentiality of information and the public need to know, through access to aggregate data. There is the tension between the old primacy of location and geographical determinism on the one hand and the fact that cyberspace is not geographically located or clearly demarcated with borders. There is the thrust of the information explosion toward increased democratisation and empowerment, paired with the threat that greater informational access leads to greater potential for social control, either by government, big business or both. Finally, there is simply the tension between the old view of information as the opposite to uncertainty, opposed to our growing understanding that increased information, while often leading to greater depth of understanding, does not necessarily lead to precision or certainty. All of these antinomies are visible both within the area of health care, and also in the general context of health and social well-being. Further, many issues raised, and ideas explored both during the workshop and subsequently seem to involve several of these antinomies simultaneously.

Our look at the possible alternate futures through the building of the scenarios for this project, as well as our scan of the literature of forecasters and consultation with the current users of IT in the health field has revealed that these contradictions will likely not be resolved. Instead, the future of information technology will for some of these antinomies create new perspectives, from which vantage point these apparent contradictions will disappear, while in others it will actually foster both horns of the dilemma, increasing the apparent contradiction and perhaps even creating new ones.

For one example of these tensions, it would seem that increased networking of systems would promote centralised databases, perhaps even national registries of permanent health records, while, paradoxically, the proliferation of small, cheap yet powerful information storage media, such as smart cards, would promote local, perhaps even personal storage of records. This would seem to encompass three of the above antinomies, that between public and private sector involvement, that between geography and cyberspace, and perhaps most obviously, that between democratisation and centralised control.

A centralised system would allow for continual examination of aggregate data on resource utilisation and population health status and thus foster more evidence-based budgeting and health promotion. Personal storage of records would allow for increased personal autonomy and empowerment of patient/consumers, and allow for immediate, reliable access to a patient's entire history in an emergency situation. Both approaches can meet the goals of universality and portability for the health care system.

The answer that information technology may supply is to use both or, indeed, a whole multiplicity of records. As different records meet different needs, it seems unlikely that any one type of record could achieve hegemony. Such an alternative raises the twin concerns of synchrony and integrity. A centralised database of health records that is integrated with cheap, personal records allowing the user to access and update their records personally whenever they seek advice or treatment will allow for synchrony, but raises questions of integrity as it is uncertain who owns the record, and is responsible for its maintenance.

For another example, as the costs of computers and computerised appliances decline, there will be a corresponding decline in the unit costs associated with incorporating information technology into the health care system. Specifically, the cost of each transaction will decline in direct proportion to the number of simultaneous transactions possible within a given health care organisation. An example of this phenomenon is already taking place in diagnostic laboratories where sophisticated multi-testers perform numerous chemical assays on each blood sample provided. However, this very success will encourage the increase of throughput in each system. The multi-testers make it cheaper and easier for the physician to get the results they want, but they also provide dozens of results that the physician did not order. The increased numbers of transactions will increase the total costs of providing high-tech medicine as additional "free" data chokes the system, and additional unanticipated positive results require follow-up diagnoses and treatments. This is further aggravated by the fact that as all test results are based on comparison to statistical norms, the more tests that are performed the greater the number of false positive results and, perhaps worse, false negative results that will have to be sifted through. It would seem that the more information available, the more resources must necessarily be consumed. This would be an example of the tension between the old view of information and the new.

Such paradoxical trends have long been noticed outside the health field, in the realm of business, where today's increasingly computerised workplaces are not operating "paper-free" as promised, but instead are consuming even more paper than ever before. These tensions in the workplace have in recent years been spotlighted as a tremendously powerful force for ill health, through increased incidence of job stress related illness, longer work days, and skyrocketing levels of absenteeism and requests for mental health days.

Balancing the supply of information and the demand for it in such situations will be crucial in order to maintain sustainability of the health care system on the one hand, and the health of the typical office worker on the other. Here again IT provides a solution without resolving the dilemma. By using expert systems to monitor the flow of information in the system, and to sort it for relevance, re-route it or temporarily commandeer additional resources, both technological and human, to process it, it should be possible to improve efficiency and thus at least somewhat attenuate the potential for runaway costs, both financial and human. However, this is precisely a situation where the advances of IT may facilitate new tensions or exacerbate old ones, as most pundits cite the increasing use of "labour saving devices" as the reason for the declining quality of the work environment.

A further area of apparent contradiction involves the role information technology will play in mediating the public/private split in investment in the health care field. The greater the penetration of the health care market by information systems the greater the potential for publicly funded care, over greater distances and with greater speed and responsiveness. This is due to the fact that cyberspace is not real space. Thus there is the potential for IT to bring high-quality health services to outlying regions of the country. In this sense, increased investment in integrating IT with health care is in the best interest of government. However, if the existence, for example, of a national electronic database of medical records is good for physicians and policymakers, it is also good for private insurers, alternative practitioners and pharmaceutical researchers.

Improvements in databases and networks can provide patients with important customised health information, reminders and warnings, but can also be used for targeted advertising and even more market-driven research. Further, in order to integrate IT with health services, numerous jobs will have to be contracted out to private analysts, programmers, systems administrators, hardware providers and technicians. Thus the incorporation of IT into the provision of health care services by the public sector will automatically bring growth to the private sector around the health field. Additionally, there are already private services vying to be the first comprehensive on-line database of medical records – allowing their customers worldwide, password-secure access to those records when they travel. The first company to reach market dominance in this field will in all probability become the model, if not the outright partner, in any attempt by the public sector to offer such a service.

Outside the field of health care there is the potential for increased involvement of the private sector in all aspects of our traditionally public social safety net. Increasingly, governments are relying upon contracts with the private sector to collect, process and interpret data necessary to the provision of social services, and already there are trends toward the use of the private sector in the actual provision of some of these services. Increased dependence on high-end information technology, and thus dependence on experts in fields such as telecommunications and information science that would be too expensive to keep in permanent government employment, insures that these tensions between the public and private sectors will continue, and likely increase. To the extent that this is interpreted by the public as the government abandoning its role as a social safety net, there may be increased incidence of stress-related health concerns.

The expansion of both not-for-profit and profit-based activity in the information technology surrounding the health field is nowhere as apparent as in the proliferation of Internet sites on health issues. Recent surveys have shown that these sites are the fastest growing and most sought after sector of information on the World Wide Web. Such availability of information and the resultant empowerment of individual patients and consumers is part of the democratisation of knowledge that has historically accompanied each advance in the history of information, from language through writing and printing to the current electronic revolution. While this increased availability of information can be liberating, it can also be destructive as the erosion of professional boundaries and barriers to expertise can also foster the erosion of confidence in medical science and health care. It can also be exploitative as, increasingly, reliable health information becomes a commodity to be traded on-line, rather than advice dispensed from a professional. There is also the issue of accountability and quality control. As the Internet fosters access to the whole global village of opinions on each issue, who does one hold accountable for misinformation acquired from or distributed to a computer half a world away.

Finally, there is the concern that persons responsible for the production of new, quality information may not receive adequate compensation, just as there have been recent developments in the music and publishing industries where the focus is shifting from maintenance of copyright to alternative schemes for compensating artists. The technology itself will foster increased democratisation and proliferation of health information, but will also allow for increased monitoring and accountability for the health information that is provided to people by both the public and private sector, as evidenced by the recent FBI

investigation of Internet health sites – an investigation only made possible through the use of intelligent search engines and high-speed network connections.

As suggested earlier, there is a tension between the old and new view of information, which will doubtless surface in the realm of health research. The ability to process more data, on more variables, and to analyse it with greater precision will yield new insights into the multifaceted causes of health and disease. The ready availability of desktop computers capable of creating and testing the most sophisticated regression models has helped to fuel the current interest in epidemiology, while sophisticated meta-analytic techniques and the databases they utilise have made such innovations in evidence-based medicine as the Cochrane Collaboration possible. However, increasingly, the results of multivariate analyses of risk factors has served to highlight the complexity of the web of health determinants. Thus the new statistical techniques made possible by the growth of IT have increased our knowledge but also our uncertainty.

As well, the division of labour in the acquisition of knowledge made possible by IT has brought about a recent explosion of knowledge in medical science. However, this very division of labour also promotes specialisation and fragmentation of that science, with each researcher's knowledge being increasingly constrained by narrowing professional and methodological boundaries. While not resolving this dilemma, IT is able to reduce its impact by the provision of smart search engines, and electronic indexing and abstracting services able to provide synopses of recent developments in quite diverse fields directly to the researcher's desktop, customised for their use. Thus IT provides a force for integration as well as a force for fragmentation, a new antinomy.

There were many concerns expressed about the more direct health impacts of our increasingly technological society. Concerns about social isolation, segregation along lines of information access, and the future of privacy in an increasingly networked world were all raised. The potential of networks to facilitate social contact over vast distances is entwined with the often socially isolating nature of the use of such networks. Networking through cyberspace has enabled the creation of linkages and communities that are not geographically based but rather can focus quite specifically on the idiosyncratic interests and personalities of those involved. This is tremendously liberating for those that feel isolated or marginalised within their geographic setting, however, it also raises concerns about isolationism and intolerance for differences in one's community. As developments in networking bandwidth and multimedia, virtual reality telecommunications occur, we may again see the technology providing a bridge between the horns of this dilemma.

Finally, a concern was raised, initially during our search of the literature, but echoed throughout the workshop's deliberations, about the tension between policy and planning on the one hand and market-driven innovation on the other. This project has been concerned with contemplating the best policy mix to foster the potential benefits of increased use of information technology in the health sphere, while retarding its potential for harm. However, it is necessary to remember that the history of the rapid advances in the information age has not primarily been one of rational planning. Information technology has grown so tremendously at least in part because of a climate of freedom for innovation, constrained only by market forces. Any policy concerned with maximising the benefits of IT for health and health care will have to have at its core sufficient allowance for freedom of innovation.

In conclusion, we are living in interesting times. Famously, this is both a blessing and a curse. Our world seems to be transformed, at times almost daily, by new innovations in the computer field. At the same time, health policy is felt to be at something of an impasse. Our work on this project has in part demonstrated that this is not merely an unfortunate historical pairing of events but, rather, that there are subtle and profound connections between these two states of affairs. If there exists any hope of planning for whatever role health care will play in whatever social context the future provides, we will have to grapple with the power of information technology to reflect and shape that context. This report represents one effort to do so. We do not anticipate that we have accurately forecasted the future in any of our deliberations, nor have we offered the only or even the best sets of alternatives. It is hoped that interested readers, upon reading the literature review presented in Section 2 of this report and the description of the conference presented in Section 3, and having considered the future of IT and health from some new perspectives, may wish to add their own chapter of interpretation and analyses on the challenges and opportunities that that future affords. Hopefully this exercise has helped to provide some new perspectives: the future is not what it used to be.

Appendix A: Scenario Matrix

WORLD POLITICS AND DEMOGRAPHICS 2025

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Comparison scenarios				
w **Four Scenarios for the Americas**	"Flight of the Condor"	"Wounded Dolphin"	"Rising Phoenix"	"Caged Jaguar"
w **CNA Scenarios**	"Technology Eclipses Caring"	"The Return of Caring"	"The Transformation"	"Control, Manage and Measure"
w **Bezoid in "The Futurist"**	"Buyers Market"	"Business as Usual"	"Healthy, Healing Communities"	"Hard Times"
w **CMA Futures**	Market Triumphs	Official Future	The fourth path	In failing health
w **Change Foundation OHA**	"Free market forces"	"Evidence-based Health Care"	"Healthy Communities"	"Pessimistic Future"
w **WHO Health Promotion Scenarios**	"Healthy Communities/Healthy Markets"	"Health for Many" (Modest Growth)	"Healthy Communities / Healthy Markets"	"Health for a few"
w **IAF Scenarios for Healthcare Innovation**	"Paradigm Shifts Accelerate Innovation"	"Steady Innovation Based on Outcomes"	"Innovation that Moves Beyond"	"Innovation Stagnates"
w **STG (Dutch) "Futures of Medicines"**	"Free market unfettered"	"Technology on Demand"	"Sobriety in Sufficiency"	"Risk avoidance"
Exemplar	United States	Canada/Sweden	First Nations/Traditional	Parts of Latin America, Africa, Asia
Futures **Perspective**	Rapid short-term change, opportunistic	Hold steady, maintain stability, adapt	Long-term sustainability	Doom and gloom
Societal ethos	The "creative destruction" of the free market	"Peace, order and good government."	Sustainable human development	Hang on grimly
Urban form	Grows by profit-centre, suburban sprawl, gated communities	Urban planning, mega-complexes	Neighbourhoods rule, co-housing, experimental housing	Urban decay, *Bladerunner*

Pax Americana	Proceeds by Coca Colonization. Disney, *Baywatch* and McDonalds are more influential than the American government	World government becomes stronger. America is a major player along with a stronger Europe	Regional governments declare inter dependence. Arizona separates, Cascadea separates: including Washington, Oregon, British Columbia, Alaska, and Northern California	Pax American is destroyed in North South conflicts and resource wars.
Sustainable development	Economic sustainability rules: and affordable long-term environmental consequences continue to be ignored until the economy is affected	Government regulated development becomes evidence-based and includes social environment as well	Sustainable development is seen to be the key to maintaining local sufficiency and inter-regional planning	Development is halted altogether, focus is on crisis management and slowing the potential decline
Development model	Economic	Sustainable	Human	Survival
Risk management	Manage to maximise profit. Pinto managed by business	Maximise risk reduction by government	Risk avoidance. Decisions are made by group process	Individual risk calculation. Game theory
Population flows	Population follows money	Regulated immigration, emigration	Local migration	Eco-refugees
Birth/death rates	Medium/medium	Medium/low	Low/low	High/High
Social equity	Medium to high inequity	Standardised equalisation mechanisms	Internal equity but some blindness to the outside with a desire to equalise. Selective partnering to reduce inequity	High inequity
Techno-philosophy	"If we can do it, we should."	"If we can afford it, we should."	"Maybe we could, but should we?"	"We wish we could."
Physical environment	Protected to a fair extent locally; high global impact	Protected to a fair extent locally; high global impact	Valued and protected locally; declining global impact	Devastated
Technology	Relatively uncontrolled. Ever higher technology in demand	Controlled. High technology used in rational application	Used when it liberates. Focus is on high touch	Limited resources available. Focus is on seeking appropriate applications

CANADIAN POLITICS AND DEMOGRAPHICS

	Free Market Forces	**Evidence-based Government**	**Healthy Communities**	**Harder Times**
National unity and Quebec	Weak government at both the federal and provincial levels	Federalism grows	Canada decentralizes with strong regions and local authorities	Canada breaks up in a messy divorce
First Nations	Assimilated	Land claims settled within Canada	Homelands succeed with alliances with other regions	Hired by Disney, further marginalized
NAFTA/EU	AFTA is created	NAU modelled on EU	Regional federation with local sustainability as a core value	Protectionism and smuggling
% GDP on health	8% public; 7% private	8% public; 2% private	9% public; 3% private	3% public; 4% private + grey market
Unemployment	Moderate	Low	Low	High

SOCIAL ENVIRONMENT

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Focus on lifelong education	Emphasis is on technical skills and traditional education	Emphasis is on managerial and life skills	Education is for capability and self actualization	Emphasis is on training for work opportunity
Research is driven by	Industry and entrepreneurs	Major university and government projects	Enhancing capability and independence	Product development
Nature of work	Outplacement. Retire at 50. Contract work and contingent work increases	Voluntarism goes up, before and after retirement	Fee earning more than salary. Barter is widespread. More work from home	Lots of contingent work in slimmed down corporations
Motivation	Money	Respect	Self-development	Survival
Unemployment	Fairly high, poor employment insurance	Fairly high, good employment insurance	Everyone can play a meaningful role. Citizen income available	Very high, little employment insurance
Women equal pay	By 2015	By 2005	2005	By 2020, if at all
Equal opportunities	Plutocracy	Meritocracy	Within the community but not necessarily between	Exclusion of the weak
Seniors	RMSPs for the well-off	Cared for	Engaged in self-care and mutual aid	Neglected
Child care	Tax credits	State provision	Community provision	Extended family/find a friend

SOCIAL CHANGE

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Class movement	Economic success highly valued. Status of entrepreneurs and small business people rises	Some movement between classes due to equal opportunities	New values raise the status of previously undervalued groups (e.g., teachers)	Some groups (e.g., out of work professionals) fall in status; difficult for anyone to rise
Class disparity	Increases as it becomes measured by affluence	Decreases	Importance of class decreases generally	Class divisions exacerbated; everyone protects their group
Distribution of wealth	There are more rich who get relatively richer	Minimum wages and bureaucratic structures reduce the inequalities	Societal values compress the extremes	Everyone gets squeezed. The poor suffer most
Nature of crime	White collar crimes of greed by corporations and individuals. Crimes of envy by the "have nots"	System fiddles involving significant numbers of employees Crimes of cheating to advance one's self	Generally decreases across the board	Property related: looting, car theft. Violent crime: mugging, etc.

LIFESTYLES: HEALTH PROMOTION

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Government policy	Slight movement. Public health uses better advertising. Smart Risk Foundation has become a major advertising agency	Population health research convinces government. Income equalization programs introduced by 2010. Results are positive	Extensive efforts. Some effect on morbidity. Social marketing is differentiated at community level	Health promotion shifts blame to individuals, reduces services. No effect on morbidity
Employer actions	Short-term efforts to enhance productivity use experts and technology. Fewer accidents, more stress, more control	Significant efforts both in behaviour change and in providing technologies that promote health. Regulatory emphasis on increased worker control	Reinforce healthy behaviours through "soft technology" and sophisticated bio-electronics. Emphasis on stress reduction	All efforts are to enhance employee productivity. No significant effect on health
Individual	Some effort; slight increase in exercise. Emphasis on therapeutic medication and intervention. Use of individual electronic medical record to market preventive services	Much effort; health and environmental programmes. Social marketing is more targeted	Healthier lifestyles as values and society evolve, including diet, exercise, personal growth, and community concern	Some effort; lower calorie intake in hard times, though more stressful. Costly health promotion technologies and services only for the well-to-do
Exercise	Corporate fitness programs, mandatory for employees	Science-based physical education implemented in schools from kindergarten on	Neighbourhood Tai chi clubs, active living gardens, bike use replaces automobiles in many contexts	Running for the bus and running for your life. Martial arts studied as a survival skill
Smoking	Tobacco companies sell health insurance to smokers Cigar bars continue to flourish Corporate marketing of cannabis as a successor to tobacco	Cigarettes heavily regulated. Tobacco companies face a new wave of suits from employers claiming reduced productivity of workers who smoke No public smoking anywhere	Personal economic responsibility for lifestyle choice, which includes marijuana Smoking ban in public; you can only smoke in one room of your own home	Key economic sector along with marijuana
Safety	Insurance companies	Public policy	Community action	Personal responsibility
Diet	Engineered foods. Some good, some junk. Successful brand names gain market share	Better diets. Less heart disease and cancer. Regulation of smoking and drinking	Healthier eating reduces most diet related disease. Relaxation replaces smoking and drinking	Fewer calories means a better diet for many, malnutrition for some

HUMAN BIOLOGY: LEVEL OF KNOWLEDGE

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
"Science of dying" advances and is widely used in care for the elderly	A common alternative for those who can't afford expensive life extension and symptom suppression treatments	Legalities and ethical concerns are under consideration by a royal commission	Care moves in this direction by mid-1990s; becomes common practice shortly after 2000	Occurs by default due to cost constraints; this emphasis yields guidelines by 2020
Impact of biochemical uniqueness of individuals on therapy	More complex targeting and delivery of drugs; therapies adjusted to genetic types	More complex targeting and delivery of drugs; therapies adjusted to genetic types	Therapies adjusted to genetic and mental types	Little, if any
Pharmacogenetics (genetically related differences in drug metabolism) and co-morbid factors known and used in drug development and prescribing	By 2005	By 2005	By 2005	Not significant by 2020

HUMAN BIOLOGY: DIAGNOSTICS

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Diagnosis	Earlier and more accurate diagnosis by 2005	Accurate diagnostics widely available	Accurate diagnostics widely available	Some advances
Biotech driven assays and probes	Effective and widely used by 2005	Very specific, effective and inexpensive	Very specific, effective and inexpensive; great aid to home self-care expert systems	Some advances where more expensive diagnostics displaced
"Super scanners"	Insured use by 2005 for periodic body check-up. Home appliance by 2015	Universal controlled use by 2005. Periodic whole body check-up by 2010	Widely available after 2010	Limited availability after 2005. Widely available after 2015

HUMAN BIOLOGY: TREATMENT BREAKTHROUGHS

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Cardiovascular				
w **Deplaquing agents**	Effective by 2005	Mechanical and hormonal/genetic approaches used	Both mechanical and systematic approaches used	Effective after 2000; not widely distributed
w **Understanding metabolic/genetic origins**	Some understanding; few therapies	Important advances	Important advances	Few advances
w **Behavioural/ attitudinal therapies**	Some advances	Some advances	Well-developed attitudinal approaches, in therapy	Slight advances
Cancer				
w **Targeted delivery, effective, widely used**	By 1995 for 1980s drugs; by 2000 for next generation drugs	By 2000	1980s drugs by 1995; next generation drugs by 2005	By 2005, where it reduces costs
w **Definitive treatment through cellular molecular expression**	By 2005	By 2010	By 2010	Still being developed
Central Nervous System				
w **General approach**	Identify and mimic brain chemicals involved in disorder	Identify and mimic brain chemicals involved in disorder	Use mind to generate chemical involved in disorder	Treat symptoms
w **Alzheimer's**	Genetic and viral components identified and treated effectively by 2005	Genetic, viral and psychogenic components identified and treated effectively by 2010	Genetic, viral and psychogenic components identified and treated effectively by 2005	Some improvement in diagnostics
w **Schizophrenia**	Genetic and viral components identified and treated effectively by 2010	Genetic, viral and psychogenic components identified and treated effectively by 2015	Genetic, viral and psychogenic components identified and treated effectively by 2015	Side effect profile improved somewhat

HEALTH CARE ORGANIZATION: MEDICAL PRACTICE

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Primary care	Some increase in community services to prevent expensive admission, facilitate early discharge. Community health providers sell social care to local authorities	Some increase in community care with much greater emphasis on health promotion – including use of legislation and tax incentives	Significant increase in holistic community services and health promotion	Reduction of treatment and services in the community
Long-term care	Smaller inpatient units. Use of private and not-for-profit long-stay units. Just enough community support to prevent increase in admissions	Most residential provision by the state – smaller units. Some increase in community teams	Significant increase in community support. Smaller institutions and residential care run by voluntary non-profit sector, commissioned by the state	Less community support and long-stay provision. Patients/families must make own arrangements. Beds in acute hospitals compensate for lack of community care
Hospital care	Increased quality of focused range of cost-effective treatments. More private sector cold surgery. Extensive use of high-tech non-invasive treatments	Slower improvement in cost-effectiveness and quality. Little private surgery. High-tech available at regional centres. There are protocols for relations with primary care	Increase in quality and (to a lesser extent) effectiveness. High-tech available. Seamless interface with primary care	Slow improvement in cost-effectiveness and quality. Long waiting lists for cold surgery and high-tech services. Weak interface with primary care
Birth	High-tech, low-tech, natural – whatever you can afford to choose	High-tech birthing suites available in hospitals and clinics	Natural and home-like approach	Good basic midwifery is available if you can find it
Death and dying	Denied, fought against, postponed as long as you can afford it	Reasonable efforts made to extend life, but not heroic	The quality of life, not its length, is paramount	Not much effort to postpone it, a relief to some
Euthanasia	Available at a price	Being debated	Available to those who wish	Unofficially encouraged
Pharmaceuticals and biotech	Enormous variety available at a price. Increased competition in this sector of the economy	Extensive but not excessive availability; research and development is controlled	Moderate availability of prevention-oriented drugs/tech, renewed focus on natural/ traditional remedies	Moderate availability, much of it protection-oriented
Transplants	Expensive organ cloning, so not needed for the wealthy	Generally available organ cloning, so not needed at all	Generally available organ cloning, so not needed at all	A black market operates
Mental health	Psychopharmacology	Care plans	Community care	Bedlam/asylum care
Home/self-care	Wide variety of self-diagnosis kits available. Powerful IT systems analyse and monitor home treatments. Increased home nursing. Increased high-tech treatments in the home managed by hospital outreach teams	Less self-diagnosis. Significant increase in home nursing. Some increase in high-tech home treatments managed by specialists in the community	Extensive use of self-diagnosis kits and home IT systems for managing one's health. Major increase in home nursing and high-tech treatments in the home managed by primary care teams	Few self-diagnostic kits available. Little nursing and advanced technology treatments in the home

HEALTH CARE ORGANIZATION: PROVIDERS

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Societal health care ethos	The best care your money can buy	Decent care for all	Healthy people in healthy communities	Protect health, provide the basics
General practitioners	Many independent groups/ practices form HMOs	Many are salaried members of primary care teams	Independents in practices that include alternative medicine	Independent. Increase in single-handed practices
w **Role**	GPs become purchasers of acute and long-stay services	Constrained to more proven therapies. Use powerful diagnostic aids in surgery	Patterns of service determined by GP, user, state. Nurses and other non-GP providers active	Tightly constrained to cost-effective therapies and drugs
w **Number**	Up by 15%	No growth	5% more. Primary care focus	10% less
Specialists	Management buy-out of some hospitals. Specialists on performance related contracts. Widespread high-tech	Salaried. Follow strict protocols. Rationed high-tech. No private work	Act as consultants to GPs. Few restrictions on practice. Access to high-tech is not limited, but used discriminately. Many based outside hospitals in diagnostic polyclinics or surgicentres	On non-tenured contracts. Activity curtailed by cost and very limited access to high-tech
w **Number**	Up by 10%	10% fewer	5% less. Sports medicine grows	10% less
Nurses	Fewer well-paid qualified nurses leading health care assistants and auxiliaries. Multi-skilling	Some retention of expensive skill mix. Fewer nurses in acute. Nurses seen as best deliverers of primary care for many	Better paid nurses. Trained nurses have a more skilled and clinical role	Fewer, better paid nurses. Increase in auxiliaries
Patient attitudes	Consumer savvy	Bureaucratic responsive	High-tech, high-touch	Get what you can
Alternate care	Big new market, caveat emptor	Accepted where shown to be cost-effective	Encouraged, widely used, part of the total approach	Traditional/folk remedies widespread
Hospitals	Multiple funding – GP HMOs, insurance companies and government. Strong management; compete on price and quality	98% government funded. Managed by clinicians. Weak competition. Unfunded activity not performed	Multiple funding sources. Majority of patients are day cases. Strong managements compete on quality	85% government funding. Major rise in day cases. Management function is to contain costs. Little competition
w **Acute beds**	20% fewer	40% fewer	60% fewer	30% fewer

HEALTH CARE ORGANIZATION: ORGANIZATIONAL CHANGE

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Overview of health care system	Private > public, tight control except for elites	Government managed, fully integrated	Local health and health care systems, community-based	Core government public health and primary care; on your own for the rest; self-care
Provider model	Medical model. Focus on treatment. Physician-orientated	Public health policy. Chiefly concerned with the health care system	Holistic healthy public policy. Chiefly concerned with creating a healthy society. Focus on prevention	Medical model. Chiefly concerned with keeping costs down
Leader in health care change	Business	Government	Consumers and professionals	Government
Planning principles	You can have anything you can afford	Our “Reasonable expectations” committee makes decisions	We create healthy communities and healing environments to contain cost	We can only afford the basics
Medical organizations	Corporate HIS, salaried MDs	CHCs, Regional clinics, public HMOs	Community-based HIS	Public clinics, private FFS is a struggle
Hierarchy/flatness	Balance of flat organization with increased hierarchical demand for bottom line	Inertia of hierarchy resists drive for flatness	Flattest. Driven by values	Survival key issue. Organisations remain hierarchical. Change regarded as too risky
Customer/patient centred	High: driven by commercial incentives	Medium: consumer rights are better protected	Mixed: a core value, at times observed in the breech	Moderate. Some effort made in attempt to survive
Increase in workers’ knowledge	Highest: regarded as essential for adding value	Medium: expertise compartmentalised. Procedures important. Senior scientists rule	High: driven by general recognition	Moderate: forced by economic necessity
Professional rivalries	Increase as market segments. Deprofessionalization of nurses in 2005; of pharmacists in 2010	Continue unchecked. Professional boundaries remain	Decrease as commitment to collaboration increases	Slight increase in struggle to survive
Patient power	Powerful, if informed	Tolerated, fairly well informed	Encouraged, highly informed	Threatening
Role of managers	Managers are in charge	Managers serve professionals	Managers and professionals collaborate	Managers and professionals at loggerheads

HEALTH CARE ORGANIZATION: SYSTEM

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Health care as % of GDP	12%	10%	7% of NDI on illness care, 2% on health enhancement	6%
Government spending on health as % of GDP	5.5%	7.1%	6.5%	5.8%
Public private mix	8% public; 7% private	8% public; 2% private	9% public; 3% private	3% public; 4% private + grey market
Funding allocation	Weighted capitation	Weighted capitation plus allowances for various specialities	Very sophisticated capitation allowance that takes case mix and primary interface into account	Weighted capitation
Clinical education	Total finance falls. Sponsorship from industry. Number of undergraduates constant	Central funding increases, but limits placed on numbers. More time in day care and outpatients	Funding increases but spread over a wider spectrum of health practice. More time in day care, outpatients and community	Funds fall. Number of undergraduates falls
Health professional/ medical education	More high-tech, more cost-oriented, more politically correct, more students enrolled	Not much change	Prevention/health oriented education, focus on non-MD providers	Smaller numbers, focus on primary care
Postgraduate training	Compulsory. Increased use of computer simulations	Compulsory. Some use of computer simulations	Compulsory. More computer simulations. Holistic approach	Compulsory. Minor use of computer simulations
Health research funding	Predominately funded by equipment and pharmaceutical companies	Government funded	Funded by government, industry and non-profit organisations	Diminished funding from all sources
Teaching hospitals	Mergers reduce teaching hospitals	Increase their research function	Teaching function adds community	More smaller teaching hospitals
General hospitals	30% fewer. More stand-alone clinics	25% fewer. More community and rehab hospitals	30% fewer. Community hospitals with multi-professional admitting	10% fewer. Acute bed used for many purposes
w **Acute beds**	20% lower	40% lower	60% lower. Beds not critical	10% lower
w **Average LOS**	2.5 days	3 days	2.5 days	4 days
w **Long-term care**	5% more beds mostly private	15% less. Higher threshold of admission. More home care	30% less. More home care. More alternative supports	No change

Community care	Slight increase in services	Moderate increase	Major increase	No change
Consumers are	Marketed to	Managed	Informed	Discouraged
Co-payments	Yes	No	Patient service accounts	Yes
Coverage	Incomplete in coverage and scope	Universal but limited somewhat in scope	Broad range of services and providers	Core services, means and lifestyle tested
Public expectations	High/excessive (resigned if poor)	Reasonable	Reasonable	Low
Ministry of Health	Deregulation limits role	Central policies and control	Facilitative, clearing house	React to crises

HEALTH STATUS: MORBIDITY AND OUTCOME MEASURES

	Free Market Forces	**Evidence-based Government**	**Healthy Communities**	**Harder Times**
Health status	Good for most, poor for some	Good/adequate, for almost all	Good for almost all	Poor for all except the elite
Cardiovascular	New drugs prevent illness to some extent. Emphasis is on reduction of effects of illness on daily living	Large reduction due to prevention	Large reduction due to lifestyle	Slight reduction due to diet
Stroke	Slight reduction through prevention. Larger pharmacological success	Significant pharmacological and behavioural prevention	Significant reduction through nutrition and stress management	Little change
Cancer	Slight reduction through immune system boosters. Some preventive services sold through electronic media	Significant impact through universal adoption of evidence-based predict and manage techniques	Significant impact through lifestyle and environmental changes	The well-off get the immune enhancing drugs
The elderly	Control of morbidity due to better new drugs and improved lifestyle. Compression of severe morbidity coupled with increased use of long-term medication. Breakthroughs in anti-plaque and anti-cancer preventative treatments	Dramatic reduction due to lifestyle change but much resulting from breakthroughs such as anti-plaque drugs and anti-cancer preventative treatments	Dramatic reduction primarily due to lifestyle change; aided by breakthroughs such as anti-plaque drugs, anti-cancer preventative treatments; and social and emotional interactions	Negligible lifestyle increase in morbidity as some over 65 live slightly longer and are sicker. Worsening social and environmental conditions
Doctor and hospital outcomes available	By 2005	By 2005	By 2010. Extended to alternate medicine	Cost-effectiveness only consideration by 2015
Quality of life (QOL) factors used	Yes	Yes	Yes	No QOL, only cost-effectiveness

INFORMATION TECHNOLOGY

	Free Market Forces	Evidence-based Government	Healthy Communities	Harder Times
Global network	International fibre-optic links give access to rare expertise and expensive diagnostics, as well as 4,500 TV and computer cable channels	International fibre-optic links allow centres of excellence to communicate	Fibre-optic links used locally as well as internationally	Network accessible to medical practitioners
Health IT impact on individual				
w **Biomedical**	High-tech products widely available for high-tech diagnosis and treatment. Major new technology introduced. Whatever can be sold	Products slower to reach the market. Research driven. Evidence-based appropriate technology	Products widely available. Great importance placed on user-friendly interfaces	Few new developments. Existing products are updated
w **Patient records**	Microsoft Web site holds most recent full electronic diagnostic data. Medical record is used as a check for scanner. Reminders of need for doctor visits come up on TV	Comprehensive medical history stored centrally for access by doctors and audit by authorities	Comprehensive portable medical and social history forms basis of home appliance that monitors life habits	Basic medical record stored electronically
w **Self-care**	“Doc in a box." "My own MRI" A machine that will set your bones	Nurse on line	Prevention focused, healthy lifestyle, less invasive info	Quack in a box, pyramid health schemes
w **Remote/distance services**	Treatment from the Mayo clinic including surgery on-line at home	NHS Direct becomes the universal standard and can treat as well	Surgery on-line at a local clinic supplemented by virtual massage and with acupuncture anaesthesia	Unregulated surgery on-line
w **Education**	Commercial certified Edutainment	HC-SC.gc.ca grows	Health and disease on-line creating virtual communities	Stale less reliable Edutainment health on the Web today gets bigger
w **ADL**	Many bionic appliances available	The adaptive home	The responsive community	Less available, slower to come
IT impact on social health	Widespread medicalization. Disease management rules and everybody is sick	Population health horizontal governance	Community health local governance	Better mechanisms for survival in adversity
w **Media and communications**	Whatever the market demands. Isolation and hook-up violence	National interest standards and regulation	Local interest community building	
w **Databases larger, deeper, more precise**	Used as marketing tools	Reduce inequalities in health	Local knowledge. Techno-shamanism, Sage Femme, individual response and on-line relationships	Hackers rule. Unfortunate gaps
w **Privacy**	Preserved at a cost	Regulated for the greater good	Very little by choice	Vulnerable. Electronic shadows

w **Surveillance**	Condition of employment	For the common good	A neighbourly activity	Locator chips
w **IT in the workplace**	Increased automated monitoring surveillance by fewer supervisors. Robots for production	Reduced work week, increased minimum wage, graduate retirement	End of work as we know it	Machines replace workers. Cheap labour replaces machines
w **Mutual help**	Consumer protection e-Nader.Web.org vs consumer tips.com Commercial mutual support à la introduction service. Virtual Group therapy on the Web League tables in detail	Cochrane for everything. Evidence-based mutual support. ISO 2025 covers everything including whatever you like. Databases available	High-tech, high-touch mutual help. Physical contact, people still meet. Cochrane writ small and broad	In the context of cyberwars. Protection, gated communities Gangs grow. Vigilantes thrive
Physical Environment				
w **Modelling**	Helps exploit to the max. Short term	Government regulated development. Regulated sustainable development medium and long term	Reducing footprints modelling for local action	Modelling in response to crisis
w **Monitoring/remote sensing**	Big Business is watching (for opportunity). A commercial environmental channel	Big brother is watching big business. Environment watch as a public service	Global expansion of local sensing. Eco-fascism Expanding the weather channel to become an environment channel	Identification of personal risk of environmental illness Fresh water and other resources are national security issues
w **Built environment**	Smart homes: environmental conditioning. Locally treated air water and food Smart personal traffic	IT monitored housing standards and urban living for health. Smart mass transit	Smart neighbourhoods. The cyberbike	Cybersecurity at home. Secure transport armoured taxis
w **Electronic village**	Electronic market place	Virtual Laboratory	Virtual communities are connected to real ones	Cybergang. And Cypervigilantes
w **Democracy**	Corporate democracy. Voting by shares	e-referenda virtual parliament. Large technocratic element	Town hall supplemented by town hall on-line. Proportional representation everywhere	Vote early, vote often. Pseudo-democracy in a semi-police state
w **Horizontal governance**	Corporate dominated horizontal information and decision flow	Weak as IT fosters further bureaucracy. Struggle between vertical and horizontal continues	Round tables and shared concerns in a society with fewer levels	Police can cross all lines, as can criminals

Appendix B

Other IT Scenarios

At least two other groups have considered IT within the context of alternative scenarios, one with a focus on international development, the other focused on health care.

IDRC/UNCSTD Scenario Workshop

This workshop, organized by IDRC and the UNCSTD in 1996, had as its principal objective the building of "a common understanding among the participants of the complexities facing developing-country governments as each seeks to formulate policies for accessing and using information and communication technologies (ICTs) for development objectives" (Howkins and Valantin, 1997). The workshop organizers noted that

> We are experiencing a tsunami of innovation characterized not so much by any single technology or science but rather by the intermingling of several cross-over technologies and services.

and that

> . . . While it may be true that ICTs affect everything from working hours to home movies to the balance of trade between some countries, such a grand statement is only true at such a high level of generalization as to be meaningless. We need to be more precise.

Major areas of uncertainty with respect to ICTs include:

- their role in governance and the political process
- their role in work, employment and wealth creation
- their impact on the social sector, including health and education
- their impact on localism
- vulnerability and crime.

The four scenarios developed in this workshop were based on two key themes:

- the global community, and whether it would become more inclusive and open or more exclusive and closed
- individual countries, and whether they will have a proactive or reactive response to the acquisition and use of ICT.

The one certainty that was at the core of each of the four scenarios that were developed based on this 2 x 2 framework is that "technological innovation will continue for the foreseeable future," because the corporations in the ICT industries are "focused, aggressive, and visionary," and this rather than public policy will be the key driver of change.

Having constructed four scenarios based on these assumptions, the participants concluded that:

- it is in the interests of both North and South to have active, learning-based policy responses

- it is in everyone's interests to move toward a more inclusive global system
- uncertainty about the future does not justify a "do nothing" policy. Rather it is important that countries create both an information society and an information economy that reflect their culture and needs and play an active role in developing the global information society
- given that ICTs are driven by the private sector, it is important for developing-country governments to develop appropriate relationships with global and local ICT companies, in the interests of both short- and long-term development.

Andersen Consulting

Richard Smith, editor of the *British Medical Journal*, reported on the deliberations of a work group convened in Singapore in early 1997 by Andersen Consulting to consider how the world's health care systems might develop (Smith, 1997). The group concluded that "no health care system in the world is stable, and . . . all systems would undergo considerable change in the next ten years." The key drivers of change that they anticipated in the developed world are

- reaching the limits of the welfare state
- exhausting traditional methods and tools for containing cost
- experiencing increased consumer sophistication and demands.

The group considered six alternative health care scenarios, in each of which IT played a significant role.

- *Socialized medicine*, with the increased use of managed care tools such as advice lines to patients, consumer education, disease management systems and telemedicine.
- *Managed mandatory systems*, which would use the same managed care tools.
- *Mandatory personal savings for health care* such as in Singapore, where again the tools of managed care may be helpful for cost containment.
- *A multi-tiered health service* with "private, fee-for-service medicine at the top; American-style managed care funded from social insurance in the middle; and lower quality, government-funded care at the bottom." Here too, the managed care tools are likely to be used in all three tiers.
- *An integrated and virtual system* in which new players (e.g., Disney and Microsoft) become involved in health care and, through the "transformational use of information technology," make it possible for services to be provided anywhere, at any time.
- *The informed consumer* scenario, in which people use information technology "to access information and control their own health care, consulting professionals much less often." This form of health care might in fact operate within any of the other systems described above, and in it "professional care would be viewed as the support to a system that emphasizes self-care."

As Smith concludes:

> Doctors think that they have been living through years of uncomfortable change, and they have. But the pace of change is unlikely to slow, and our health systems will probably see more changes in the next 20 years than in the past 20.

Appendix C

Workshop Agenda and Participants

Just for the Health of IT!

Oakham House – Ryerson Polytechnic University
63 Gould Street, Toronto
October 18, 9:00 am to 5:00 pm

9:00 am	Welcome and Introductions Overview of the project – Sholom Glouberman
9:30	Presentation – "The future of healthcare" Joe Flower
10:00	Fishbowl – "Where will technology be in 25 years and what will it enable us to do?"
10:25	Discussion
10:45	**Coffee Break and Form Groups**
11:00	Small Group discussion I – "How will IT be developed and used in this scenario, and what will be the implications for health and health care?"
12:00	Report back to large group
12:45 pm	**Lunch in Remixed Groups**
1:30	Small Group discussion II (Remixed groups) – "Based on the report backs, what are the generalizable implications for health and health care, and in particular, the interaction between the individual and his or her social context?"
2:00	Reports back
2:15	General discussion – implications of IT for health and health care and for the interaction between individuals and their environments.
2:45	**Coffee Break**
3:00	Brainstorm – "What do we have to do now to prepare for these futures?"
3:45	Fishbowl – "So what do you think about the policy implications of all this?"
4:05	Discussion
4:15	Questions and wrap up
5:00	Close
5:00	Wine and cheese
6:30	Early Dinner at La Bodega (30 Baldwin St.)

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Appendix D

Workshop notes

FISHBOWL #1: WHERE WILL THE TECHNOLOGY BE/TAKE US?

- who pays, who controls
- how to change (physician) behaviour
    - how to pay for their time on the Web with patients
- Internet infrastructure is free
    - but how to control quality of information
    - especially due to commercial/marketing links
    - it's very confusing out there at present
- development is in the hands of the market
    - so there must be a bottom line
- requires medical/health *teams*, multidisciplinary approaches
- *ethical issues*
    - liability issues, e.g., software writers, the Internet providers
    - no fault system needed?
- *Who is in charge?*
    - how do we screen knowledge
    - knowledge management
    - role of government?
- knowing what works
    - but not easy to apply in the short term and in real time
- how to make the data entry/information technology *accessible and easy to us*e
    - *and not be expensive*
    - (but see Joe Flower's point about costs becoming "trivial" in many areas)
- need simple, plain language clinical guidelines
- *in 20 years we may be actually using the technology that is already available today such as voice recognition, interactive capabilities*
    - how will IT help ordinary folks?

FISHBOWL #2: WHAT ARE THE POLICY IMPLICATIONS?

* 1. The collision between the public good and the market
    - public good = health care and is slow, deliberate and rigid
    - the market place = IT, and is rapid, flexible and innovative

*2. Beware inequalities, there is the danger of a shift to a two-tier system

3. OMOH is not looking at this, they are very backward

4. Public accountability and public access to data for personal and community accountability

5. Genomics and the human genome is the sleeper here!

*6. Much broader and better informed public debate

7. Use IT to work smarter
    - especially with long-term and chronic care

8. Do we need an integrated, comprehensive pilot project of the best of IT (e.g., Celebration Health model)

9. Use information to define key health determinants in the broader societal/policy fields

*10. Need to re-write the *Canada Health Act* to cover
    - new technologies
    - community care
    - population health

Brainstorming Session

- Coherent information standards
- Insure literacy and access to information among different groups
- Training social marketing
- Information appliances
- Free Internet
- Educate the public about what the new world is going to look like – the end of the health care system, as we know it
- The system does not encourage people to use IT
- Robust privacy without excluding public good uses
- Incorporate outcome measures, specific ones
- Policy debate about genomics
- Growth in knowledge development therefore need for knowledge brokers
- Implementation of incentives to help providers take advantage of IT
- Development of payment and outcome incentives to allow providers to keep savings they make
- Universal health care system requires universal access to IT
- Avoid stovepipe systems
- Provide tools so that public can assess quality of Internet information
- Accreditation, filters branding
- We will use technology more. We can use it well or badly: we need consumer friendly technology rather than Big Brother monolithic solutions
- There is a challenge to get an evidence base without Big Brother
- Using IT to manage the diffusion of new technology
- Improve Return on Investment strategies: make them more saleable
- We should look through system and look at incentives and rationalize policy
- Modify policies to improve incentives
- Health is emotional (e.g., violence, diseases): get a robust set of policies that allows investment in health to be sustainable through the storms
- It should not be looked at in isolation for people and processes
- Use IT to teach wellness and how to be more healthy and not be ill

- Changes in scope of practice: teletriage will allow nurses to do more
- Telemedicine will allow physicians to do more
- Change the scope of professional practice
- Good pilot studies on the impacts of the IT applications before we generalize them
- Research around the necessity of social connections as opposed to tech substitutes through IT
- IT as the gluing mechanism for integrated service delivery
- Federal cost sharing of community care
- Rethink human resources we need for health and health care. (A very rigid system now.)
- What happens if schools go on line? Who will see if the child is in trouble?
- What do we mean by health and what do we mean by a person in the future (pig parts)
- Genomics: temptation to focus on more tractable and profitable narrow problems. Fund research in genomics that are not only narrow. Fund things outside genomics because they are not so narrow
- Balance between social research and bioresearch
- Amazon.com as an example of gaining market share applied to health care. LA robotics takes over Canadian surgery industry
- Commercial vs. university-based basic research: a caution
- The public policy issue about intellectual property rights about genes
- Cost-effectiveness of various interventions will be better known and so we will have to make decisions on the basis of being better informed
- Risk management in this new environment
- Most expensive risk reduction is in airplanes and nuclear reactions
- Guarding against the use of IT for societal control by government or for private sector discrimination
- "How do I get rid of junk mail on my implanted Internet appliance?" (Michael Wolfson)
- Research on health implications of widespread use of IT. Social consequences of being at the computer for 3 hours a day. (TV and childhood only known after 20 years)
- IT and other technologies should not become the tail that wags the dog in the case of health and the values associated with it. What will be the meaning of health in our society 25 years from now?
- What is the difference between medicine and cosmetics? And performance augmentation, anti-aging longevity enhancement

- The boundary of what is medically necessary
- What is coming down the road will put much more pressure on this boundary
- three of four groups predicted that inequalities will increase – we must watch out for this. Is it a result of IT?
- Homeless people have no voice mail. Giving them voicemail gave them jobs and housing
- As technology proceeds, we might be able to help the bottom tier of society
- Information for the general public has to be culturally appropriate and accessible to them

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