

# Is the •Cyberspace RevolutionŽ Really a Revolution? A Case Study: Healthcare and Modern Scienti“c Thought

Yoneyuki SUGITA

## INTRODUCTION

Frederick Jackson Turner found great significance in the frontier for the development of American society, believing that the open spaces of the West nurtured American democracy. Space, in the form of foreign markets in the early twentieth century and outer space in the 1960s, has been important to American society in many eras and in many ways. Now, many believe cyberspace is transforming industrial society into an information-oriented society in the United States.

This paper first demonstrates that a large number of previous studies exist on the information-oriented society, but that these studies differ in their interpretations of information technology (IT) and in whether IT has precipitated a revolution. As a concrete way of examining this controversy, this paper focuses on healthcare as a case study, defining modern scientific thought and then using it as a criterion to judge whether IT has brought about a revolution in this field. Third, it presents a brief history of medicine in the United States, especially the great developments in medical science after World War II. Fourth, it demonstrates how the current healthcare system adopts IT in the United States, and its significance. This paper concludes that because IT does not transcend modern

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scientific thought, it cannot be considered a revolutionary force in health-care.

## I “CYBERSPACE REVOLUTION” REVISITED

IT has affected society greatly, but there is disagreement as to what extent IT has *changed* society. Many observers believe that IT has, at least to some extent, revolutionized society. Russell Ackoff and Sumio Koike expect that technological developments will change society in fundamental ways, including value systems and the philosophy of life.<sup>3</sup> Alvin Toffler regards the present era as the third wave in which the information revolution affects not only technology and the economy, but also other aspects of society such as ethics, culture, philosophy, institutions, and political structure.<sup>4</sup> Douglas Robertson argues that the computer may be a fourth innovation, after language, writing, and printing that would create a new civilization.<sup>5</sup> Robert Posch, Jr. claims that IT alters every phase of society including law, commerce, culture and citizenship.<sup>6</sup> William Martin believes that the impact of IT on society will be as significant as that of Industrial Revolution.<sup>7</sup> Yoneji Masuda claims that IT transforms existing society into a fundamentally different information society.<sup>8</sup> Toshihiko Hayashi and Eisho Ohmura insist that IT should be transforming the principle of human relations from a tree-structure into a network structure, which is revolutionary progress in the history of mankind.<sup>9</sup> Tetsuo Kogawa suggests that electronic individualism may transcend modern European individualism.<sup>10</sup> Tadao Umesao optimistically contends that human beings may lead more humane lives with the coming of an information industrial age.<sup>11</sup> Kazufumi Orisaka indicates that today is a transitional period from an industrial society into an information society where people will lead spiritually rich and satisfactory lives.<sup>12</sup> Frances Cairncross, another optimist, writes that the rapid development of communication technologies will increase human contact, leading the world to a better place.<sup>13</sup> Many other observers, such as Daniel Bell,<sup>14</sup> Peter Drucker,<sup>15</sup> and John Naisbitt,<sup>16</sup> draw bright pictures for the future with the development of IT.

In contrast to these opinions, some people feel pessimistic about the future of an IT-oriented society because of the increasing gap between rich and poor or they still question whether IT has fundamentally changed the existing industrial society. Tom Forester warns that too much reliance on computers may undermine the process of discussion

and persuasion among people that underlies democratic society.<sup>17</sup> Langdon Winner poses a serious question about the optimistic view that widespread access to the Internet will automatically create a better world. He regards this kind of dogmatic view as religious conviction.<sup>18</sup> Accepting the importance of information, Katsuhiko Matsuishi criticizes the optimistic argument that an IT-oriented society is a post-industrial or post-capitalist society. Instead, he concludes that it is still a high information-oriented industrial society.<sup>19</sup> Nobuyuki Takenaga claims that because an information society is still within the capitalist economic system, it is not a post-industrial society but a high-intensive (ultra) industrial society. Consequently, the so-called "information revolution" will not bring about utopia, and severe competition will continue among highly developed industrial nations.<sup>20</sup> Clifford Stoll points out the emptiness of virtual reality on the Internet.<sup>21</sup> A collection of essays in *Cutting Edge* critically insist that as long as the existing power structure continues, technological developments will be more likely to worsen the problems of poverty and misery.<sup>22</sup> Shunpei Kumon believes that the current age is the beginning of the information phase of industrialization in modern civilization. In short, his viewpoint holds that IT has not yet changed society fundamentally.<sup>23</sup> According to Tadamasu Kimura, information and knowledge are closely related to industrial society; he calls society after the 1970s "the high consumption society."<sup>24</sup>

Since IT's impacts on society are multi-dimensional, it is difficult to bridge the gap between these differences in opinion through a generalized consideration of this issue. Moreover, it is necessary to apply clear criteria to judge if IT truly has revolutionized society. Thus, this paper adopts a case study, focusing on the meanings and significance of IT in healthcare, and uses modern scientific thought as the criterion to evaluate IT's effects on society.

## II BIOMEDICINE AND MODERN SCIENTIFIC THOUGHT

This section defines modern scientific thought and examines the process by which it was applied to healthcare. This will help us examine whether IT has precipitated qualitative differences in healthcare in a later section. From ancient times through the Middle Ages, people did not consider pathological cause-and-effect relationships within individual bodies. Instead, they believed in the existence of supernatural powers beyond human control. Suffering from illness was an indication of

punishment for misconduct such as defying divine will or other inappropriate behaviors. People accepted illness as human fate. In order to deal with this fate, they prayed for cures and conducted exorcisms.<sup>25</sup> Since the concept of healthcare originated from religion, it developed historically as a part of religious activities.<sup>26</sup> Because people did not recognize the causal relationship between etiology and illness, they regarded illness as an imbalance of the four bodily humors, based on the ancient Greek understanding. Doctors emphasized the importance of environment to restore and maintain a natural balance.<sup>27</sup> In short, disorder of the humors was the only illness, and physicians concentrated their attention on each individual patient, not on disease per se, to restore health.<sup>28</sup>

The mode of social life and structure that emerged gradually in Western Europe in the seventeenth century rapidly spread worldwide. This was the beginning of modernity. In the modern era, the speed of change is quite rapid, and is most prominent in science and technology.<sup>29</sup> Modern medical science began with anatomy, physiology, and classification of symptoms into disease categories established by Andreas Vesalius, William Harvey, and Thomas Sydenham, respectively, in the sixteenth and seventeenth centuries. These disciplines were the origins of biomedicine, which regarded human beings merely as living organisms.<sup>30</sup> From the end of the eighteenth to the beginning of the nineteenth centuries, modern science gradually organized illness as scientifically explicable physical conditions. The rise of clinical medicine eliminated religious perspectives of illness and systematized various symptoms based on a rational, scientific way of thinking.<sup>31</sup> The introduction of the stethoscope and ophthalmoscope into medical diagnosis in the nineteenth century made it possible for physicians to listen to and observe illness. Development of these medical technologies precipitated the rise of an anatomical view of illness in place of the humoral theory.<sup>32</sup> Based on bacteriology advanced by Louis Pasteur, Joseph Lister, and Robert Koch, the theory that germs precipitated most infectious diseases began to prevail in the mid and late nineteenth century. In the late nineteenth century, the development of laboratory, graphic, and x-ray diagnosis technologies further facilitated objective clinical analysis.

Biomedicine, the main paradigm of modern Western medical science, has four major characteristics. First, human beings have both physical and mental dimensions. These two dimensions are inseparable. Many cases demonstrate that mental health treatment can contribute to progress on the physical level. Especially during the growing stage of childhood,

kindness and tenderness are reported to have a more effective influence on the increase of IQ advancement than nutritious food.<sup>33</sup> Modern Western European medicine, however, artificially separated these two dimensions and paid attention only to the physical aspect of healthcare. Modern medical science clearly separates "mental health" and "physical health."<sup>34</sup> Just as Descartes' doctrine of the duality between physical and mental worlds furnished the basis for the development of natural science, medical science deals solely with human bodies, especially after the late nineteenth century.<sup>35</sup> In other words, modern biomedicine was established by separating humanity from illness.<sup>36</sup>

Second, the basic assumption of modern biomedicine is that the human body is a machine that medical science can manage and fix.<sup>37</sup> Physicians seek causes of diseases in biological changes, neglecting environmental, social, psychological, and emotional factors. They use all the technologies available to find causes in the "machine," and once they find the cause, they use all the means available to "repair" the problem. Consequently, physicians naturally believe that using more advanced technology and increasing interventions are good by nature and are necessary for the successful management of diseases. Science and technology make forward progress as time goes by, which makes it possible to find the cause and the cure of diseases faster, more easily, and with less pain. Physicians believe in the linear progress of modern science and technology, a belief that scientific progress continues in a linear way, and that more is better in the medical field. The more physicians use technologies for diagnoses, the more they see their patients through the lenses of indirect data and objective experts' opinions.<sup>38</sup>

The third characteristic of modern biomedicine is that it has been extremely specialized and segmented since the late nineteenth century.<sup>39</sup> The anatomical view of illness where a specific part of the body rather than the entire person, suffers, became popular. Physicians are categorized by their specialties, such as internal medicine or surgery. Internal medicine is further subdivided into cardiovascular, respiratory, and digestive tract internal medicines. Currently, there are more medical specialists than general practitioners in the United States. Physicians deal only with specific internal organs according to their specialties, losing sight of the totality of human beings and their non-physical demands.

Finally, modern scientific thought brought about by the Renaissance excludes concepts of ambiguity, probability, or subjectivity, explaining phenomena in the world by objective principles.<sup>40</sup> In medicine, these

changes took place slowly. In the seventeenth and eighteenth centuries, physicians still relied on patients' own explanations and discourse about their illnesses. This situation changed with the emergence of physical diagnosis technology such as pathologic autopsy and stethoscopy. Physicians no longer relied on patients' ambiguous, subjective explanations, but on elaborate and objective analyses of physical symptoms acquired by direct examination of patients. In other words, physicians gradually moved away from subjective to objective evidence, which was produced by advanced technology.<sup>41</sup>

### III BRIEF HISTORY OF MEDICINE IN AMERICA

In order to understand the impact of IT on current healthcare, it is helpful to look at a brief overview of the history of medicine in the United States. In the antebellum era, Americans demonstrated a strong tendency toward self-reliance and turned to their personal religious faiths to deal with illness because they believed that individual moral failure brought about illnesses. Physical and mental dimensions were not clearly separated. Consequently, Americans then believed that strong emotions such as anger, fear, grief, and envy would lead to ill health.<sup>42</sup> Clergymen primarily took care of the sick. Not only relatives but also ministers and family church members visited the sick to mitigate their painful experiences.<sup>43</sup>

In 1847, the American Medical Association was founded in order to set standards for medical practice and raise the status of American physicians. Most American physicians were general practitioners, but because of the development of the anatomical way of thinking, professionalization of clinical medicine began in the late nineteenth century.<sup>44</sup> At the end of the nineteenth century, Americans began to rely on professional physicians outside their family and close friends' circles for medical treatment. Healthcare had been a private matter for most Americans, but the market mechanism gradually prevailed in this field, which resulted in increasing the emotional distance between patients and physicians.<sup>45</sup> This is characteristic of modern scientific thought: researchers (physicians) must take a neutral, independent, and objective stance toward the subject of research (patients). Physicians seek the specific cause of illness in the specific organs, which leads to fragmentation of the body.<sup>46</sup> Professionalization means that physicians rely on objective results of medical laboratory tests for their diagnoses and ways of treatment, and

deal with the specific organ as if it were a part of a machine to be fixed. Patients became dissatisfied with this kind of impersonal healthcare delivery.<sup>47</sup>

Before World War II, the U.S. government adopted ambivalent and inconsistent attitudes toward supporting science and technology. Vannevar Bush, director of the wartime Office of Scientific Research and Development (OSRD), argued in his report to President Harry Truman in July 1945 that the United States had "no national policy for science. . . . There is no body within the Government charged with formulating or executing a national science policy. There are no standing committees of the Congress devoted to this important subject."<sup>48</sup> The war, however, drastically changed this attitude. The government came to support science and technology actively in the postwar era.<sup>49</sup>

World War II was a watershed in medicine. During World War II, many medical innovations came into existence. In June 1941, the Committee on Medical Research (CMR) was established under the OSRD. CMR concluded 600 contracts with universities, research institutes, and other organizations, and employed about 5,500 scientists and technicians. This Committee successfully developed penicillin, DDT, serum albumin as a blood substitute, immune globulin against infections and, with the help of the Army and the Allied Powers, improved malaria therapy through new drugs.<sup>50</sup> Anesthesiology and surgery made great strides, and the U.S. government helped the expansion of medical education. During the war 15 million Americans in uniform and their dependents tasted advanced healthcare. Their expectations for healthcare were raised, and they demanded more and better healthcare in the postwar era.<sup>51</sup> Americans believed in continuous progress in medical science, its application to treatment, and increasingly demanded more effective medical care. This way of thinking is based on the concept of linear progress.<sup>52</sup>

Taking advantage of these innovations, especially sulfonamides and antibiotics in the 1940s, physicians regularly cured diseases. Sulfa drugs had been used to treat infectious disease since 1936. The military began to use penicillin, which was more effective than sulfa drugs, in 1942, and mass production for the general public became successful in 1945. A wave of optimism and expectations about the future of medical treatment prevailed in American society.<sup>53</sup> After World War II, the American government spent an enormous amount of money on biomedical research, second only to the military budget.<sup>54</sup> Biomedical research took the

overwhelming share of the basic research fund provided by the Federal government in the postwar era.<sup>55</sup> The government poured funding primarily into developing insecticides, chemotherapeutics, and vaccines. Spending for biomedical research amounted to 87 million dollars in 1947, which rose to 161 million dollars in 1950, 2 billion dollars in 1966, and jumped to 14 billion dollars in 1986. The Federal government accounted for over half of these funds. In particular, the government gave priority to assisting acute care hospitals, training medical specialists, and providing subsidies for biomedical research.<sup>56</sup> Congress took the initiative to assist small towns and rural communities by implementing the major construction of hospitals through the Hill-Burton Act of 1946.<sup>57</sup> In May 1950, Congress established the National Science Foundation, an independent U.S. government agency, for promoting science and engineering and the organized development of a national science policy. Congress also demonstrated its renewed interest in medical research by providing assistance for the National Institute of Health (NIH), which is a major governmental medical research center, and was a source of research funding in the postwar era.<sup>58</sup>

Americans believed that mass production and cutting-edge weapons based on science and technology were primarily responsible for their victory in World War II. After the war, they were convinced that continuous success would be dependent on their scientific progress.<sup>59</sup> According to Vannevar Bush, “without scientific progress no amount of achievement in other directions can insure our health, prosperity, and security as a nation in the modern world.”<sup>60</sup> In order to maintain its hegemonic power in the postwar world, the United States kept its leading position in science and technology. The concept of linear progress and its status as the hegemonic power in the postwar era drove the United States to promote science and technology. The emergence of IT is the result of this progress-oriented society. In the 1960s, the Department of Defense realized the idea of a computer network, which was designed at RAND Corporation as a project of its Advanced Research Projects Agency (ARPA). This was the origin of the Internet, which was first devised as a tool to secure a military communication network in case of nuclear attack.<sup>61</sup> The current advanced stage of the Internet comes from the postwar drive for scientific progress.

## IV IT AND CURRENT HEALTHCARE IN THE UNITED STATES

Americans are increasingly turning to web pages for healthcare information for several reasons. Internet connectivity has been increasing dramatically in the United States. As of January 2000, the United States possessed more than 53 million Internet host computers, about 73 percent of the host computers in the world. In 2000, over 104 million people used the Internet in the United States. Rapid and widespread development of IT also popularized the Internet among Americans as a means of obtaining health-related information. It is estimated that more than 100,000 web pages provide health care information.<sup>62</sup> A recent survey indicates that more than 60 million U.S. residents searched the web for health-related information, 70 percent of these searchers report that information acquired by their research influences their healthcare decisions.<sup>63</sup> Americans access these health-related web pages for more information about their illnesses and symptoms, and for second opinions from other physicians about the diagnoses, treatments, and medications they receive.

Secondly, those who are dissatisfied with managed care utilize the Internet to fulfill their healthcare needs. Managed care is a method of controlling healthcare decision-making to contain medical expenditures. According to the American Medical Association, managed care companies cover more than 90 percent of U.S. medical practices, and 85 percent of employees covered by job-based insurance are enrolled in some kind of managed care program.<sup>64</sup> Managed care companies normally do not permit their members (patients) to seek specialists' care directly if their cases may be treated for less expensive fees by primary care providers. A survey conducted by the Kaiser Family Foundation and the Harvard School of Public Health indicates that 87 percent of doctors believed that managed care companies restricted the services needed by their patients.<sup>65</sup> The Independent Doctors of California representing about 300 physicians and the Association of Independent Physicians, which mobilized approximately 80 physicians in New York, encouraged their patients through the Internet to abandon managed care and return to the traditional system, where only doctors and patients can make healthcare decisions.<sup>66</sup> According to a Harris Interactive poll, favorable assessments of managed care companies dropped drastically from 51 percent in 1997 down to 29 percent in 2001.<sup>67</sup> As these figures show,

many Americans have complaints about the managed care system.<sup>68</sup> In response, Americans have increasingly assumed responsibility for their own and their family's health by turning to the Internet.<sup>69</sup>

Patients in the United States complain about the lack of close communication with their physicians. Physicians are quite busy consulting with as many patients as possible. Managed care companies encourage physicians to shorten the consultation time with patients so that they can schedule more patients each day. Consequently, patients and their family members do not have enough time to discuss thoroughly their symptoms, diagnoses, and treatment. Moreover, most patients simply do not have the appropriate medical knowledge or information to communicate effectively with their physicians. In addition, physicians focus on biological changes and explain the analyses of medical tests to their patients, leaving little time to discuss non-biological, social, emotional, or personal matters that may be indirectly associated with patients' illnesses. Patients may also have many questions about medical jargon, alternative treatments, effectiveness, and side effects of medication they receive. When patients consult with their family doctors, it is quite difficult to ask detailed questions without becoming a nuisance. These patients have become increasingly frustrated with the current lack of communication with their physicians and have turned to the Internet for supplemental information. The Internet provides them with MEDLINE plus, a popular version of MEDLINE which is one of the best databases of medical and healthcare information derived from thousands of biomedical journals, and a catalog of information concerning specific diseases and symptoms with a search function prepared free of charge by the National Library of Medicine (NLM). The NLM is the largest medical library in the world and is located on the campus of NIH. Cyberspace also offers newsgroups in which those who suffer the same illness can share useful information, chat rooms and bulletin boards to network with other people and exchange health-related information, and other convenient features. In addition, healthcare providers sometimes voluntarily provide health information and answer questions on the web. In short, the lack of communication between physicians and patients and patients' quests for more information drive patients to rely on the Internet.

In the medical field, because of the profound information gap between suppliers (physicians) and consumers (patients), the suppliers have normally decided the type and amount of service consumers should have.

Consequently, a paternalistic relationship between physicians and patients came into existence. This relationship is now changing into a partnership because of patients' easy access to recent medical findings and to information about various kinds of treatments.<sup>70</sup> Making use of the wide variety of information about their particular diseases available on the web, patients can now contribute to clinical decisions affecting their own health.<sup>71</sup> According to a Harris Interactive poll, these people are most interested in getting information about specific diseases such as depression, allergies, cancer, and high blood pressure.<sup>72</sup> When patients suffer incurable diseases or medication is not available in the market, they may use the Internet to look for clinical trials conducted all over the world.<sup>73</sup> Obtaining medical information on the web privately and at any time may empower people to make better-informed decisions and to enjoy greater participation in the healthcare process.

The increasing costs of healthcare also encourage Americans to take advantage of the power of the Internet. In 1997, the annual healthcare expenditure per capita accounted for approximately 14 percent of the Gross Domestic Product, the highest ratio in the world. Patients look for information on economical health insurance, preventive care, improvement of health, and more cost-effective treatments and medicine.<sup>74</sup> In addition, approximately 43 million Americans, about 16 percent of the population, had no health insurance in 1997.<sup>75</sup> One of the ways these people get medical information is through the Internet.<sup>76</sup> Access to IT is inexpensive, and there are many free terminals available in public facilities such as public schools and libraries. Accessing most of the information on web pages is free of charge. The Internet provides the uninsured with a way to obtain free medical information.

Containing medical expenditures is also one of the most important themes in healthcare. Databases and computer networks are used for this purpose. In 1983, the U.S. Federal government introduced the Diagnosis-Related-Group-based Prospective Payment System (DRG/PPS) to Medicare to control rising healthcare expenditures.<sup>77</sup> DRGs are "small integers ranging from 0 to about 500. These integers represent inpatient classifications on the basis of diagnosis, procedure, age, gender and discharge disposition. These groups were constructed to control Length-of-Stay, which in turn correlates to resource consumption and severity of illness."<sup>78</sup> DRGs are categorized into nine tiers based on required resources. This classification system reflects actual cost more accurately.<sup>79</sup> In addition, former Vice President Albert Gore proclaimed that the

National Information Infrastructure (NII) would save between 36 to 100 billion dollars a year in healthcare expenditures. Gore believed that the NII would enable Americans to obtain necessary healthcare services anywhere, anytime, in more efficient ways. The NII was also expected to be beneficial for preventive care, which would help to contain medical expenditures.<sup>80</sup>

Because of the size of the United States, people in rural areas live far away from major medical centers. For example, the area of Arizona is more than 113,000 square miles, but only Tucson and Phoenix provide cutting-edge medical services. Approximately 300,000 people living in the rural areas spend hours driving to come and consult specialists when necessary. Arizona introduced telemedicine to help address this issue. According to the American Telemedicine Association, telemedicine is defined as “the exchange of medical information on the health and education of patients and/or health care providers via electronic means for the purpose of improving patient care.” Although telemedicine was technically available even in the 1960s, rapid development of IT in the 1990s put telemedicine into practical use.<sup>81</sup> In 1993, only about 1750 telemedicine consultation cases were reported in the United States; however, this figure jumped to approximately 58,000 cases in 1998.<sup>82</sup> In Arizona, the state legislature established the Arizona Telemedicine Program as a part of the Arizona Rural Telecommunications Network in 1996. This program has been saving the patients’ time and money by providing them with the opportunity to gain specialized medical treatment without traveling hundreds of miles.<sup>83</sup> Telemedicine technologies also provide healthcare providers in rural areas with training programs and continuing medical education credits.<sup>84</sup>

Recently, acute care has been giving way to chronic disease management. According to the Centers for Disease Control and Prevention, an agency of the Department of Health and Human Services for protecting the health and safety of people, chronic disease is defined as “illnesses that are prolonged, do not resolve spontaneously, and are rarely cured completely.”<sup>85</sup> Chronic diseases include high blood pressure, diabetes, arthritis, cardiovascular disease, and others. More than 90 million Americans suffer from chronic diseases, and their medical care expenditure amounts to approximately 400 billion dollars, accounting for more than 60 percent of overall healthcare costs.<sup>86</sup> Telemedicine proves to be profitable for healthcare providers to manage home healthcare patients with chronic diseases. Installing a small device using phone lines at home

establishes a daily line of communication between healthcare providers and home healthcare patients. Utilizing IT, healthcare providers may send daily reminders to their patients with chronic diseases, including information such as reminders about taking their medications or listings of foods they should avoid. Home healthcare patients, in turn, can measure their blood pressure, body temperature, pulse, and other indicators, and send this information to the hospitals that will accumulate the data in an orderly fashion. Telemedicine helps the patients control eating habits, medications, and other facets of their lifestyles, all of which are indispensable elements of effective treatments for chronic diseases. A report by Cyber Dialogue, a private company, reveals that one-third of chronic disease patients confirm that the Internet helps them to comply with prescribed medications.<sup>87</sup> Another source indicates that 79 percent of chronic disease patients carry out online searches for useful information.<sup>88</sup> Telemedicine and other IT-related measures will be useful for monitoring home healthcare patients with chronic diseases.<sup>89</sup>

Computer-based patient records (CBPR) are one of the most important factors in providing effective and efficient medical services and in controlling medical expenses.<sup>90</sup> CBPR promote the comprehensive compilation and storage of patient records, including clinical data, administrative information, and medical history. CBPR allow healthcare providers to include many important elements that paper medical records cannot include, such as medical resources, graphic files, and links to medical references like MEDLINE.<sup>91</sup> The advantages of digitalizing diagnostic information include building a database to search and display the information swiftly, to make it easier to implement statistical work, and to transfer the information rapidly via computer networks. As a result, whenever and wherever people suffer from illnesses, physicians can access patients' medical histories, which can help prevent redundant medical tests, inappropriate prescriptions, and dangerous combinations of medication.<sup>92</sup> CBPR improve the efficiency of healthcare, because this innovation can shorten the time needed to find and distribute the patients' records, and multiple healthcare providers, including administrative clerks, can work on the same patient records simultaneously in different places.<sup>93</sup>

CBPR may also reduce the amount of medical malpractice. According to the National Academy of Science, a private and non-profit organization of scientists engaged in the research and promotion of science and technology, medical malpractice kills between 44,000 and 98,000

Americans each year. In order to minimize human errors, Massachusetts General Hospital in Boston adopted web-based electronic medical records and clinical transaction monitoring systems. These systems effectively maintain and disseminate patient information, send alerts when medication needs to be changed, and collect and distribute up-to-date medical findings and promising treatments.<sup>94</sup> CBPR can also be linked to a useful decision-making support tool like Arden Syntax Medical Logic Modules (ASMLM). ASMLM are decision-making support tools that provide physicians with warnings according to the medical logic input in the system. For example, if a physician orders a CT scan for a patient with a record of kidney failure, ASMLM warn the physician of possible complications that might arise.<sup>95</sup>

Different physicians may use various diagnoses and treatments to deal with the same symptom and disease. Consequently, Evidence-Based Medicine (EBM) has become popular to help convince patients that they are receiving proper, well-accepted treatment. EBM is defined as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.”<sup>96</sup> The most common use of EBM is the combination of the individual physician’s professional judgment with objective evidence from available literature concerning specific symptoms. EBM tries to demonstrate objective evidence for the best course of treatment by referring to the compilations of scientific data concerning the results of specific treatments and medications.<sup>97</sup>

Even with the multi-faceted promise of technology in the medical industry, the adoption of IT in the medical field faces many serious obstacles. As for introducing telemedicine, high-resolution video-imaging transmission technology and fast broadband Internet connections are indispensable to the effective implementation. The initial cost of installing the necessary IT equipment, approximately 100,000 to 120,000 dollars, as well as the running costs for implementing telemedicine, can be overwhelming.<sup>98</sup> To complicate matters, few health insurance companies cover telemedicine.<sup>99</sup> In addition, because IT develops rapidly, the constant upgrading of equipment and software is also necessary.

Obtaining, managing, and utilizing various kinds of information is quite complicated and requires systematic operation. In order to organize operational CBPR and DRG/PPS, the compatibility of different machines and equipment must be ensured.<sup>100</sup> Moreover, medicine codes,

disease identification codes, and medical practice codes must be uniformly defined and applied. Standardization is yet to be introduced at the IT application level.<sup>101</sup> Computerization in healthcare requires rigid quantification and standardization.<sup>102</sup> Both of these issues complicate the implementation of IT in the medical field on a larger scale.

It is difficult to assess the accuracy and effectiveness of the medical information found on the Internet. For example, a group of physicians at the University of Michigan examined web pages concerning Ewing's sarcoma. Approximately 6 percent of those web pages examined gave incorrect information, and almost half provided questionable treatment.<sup>103</sup> Moreover, the sheer volume of information available on the web may overwhelm online users. For example, MEDLINE indexed approximately 920,000 entries in 1998, and is continuing to increase at a rate of 31,000 entries a month.<sup>104</sup>

Healthcare providers using the Internet are most concerned about assuring security and privacy. For example, in the summer of 1999, a hacker illegally accessed the internal network of the medical center of University of Washington and succeeded in downloading several thousand patient records, including personal information such as names, addresses, and clinical data. In addition, while many healthcare providers post privacy policies on their sites, according to a survey conducted in January 2000, the companies' willingness to enforce these policies is questionable. Privacy policies include restrictions on who collects personal information, what kind of personal information is collected, who has access to the information, and the rules around sharing the collected personal information with a third party. In 1996, Congress enacted the Health Insurance Portability and Accountability Act (HIPAA), which provided basic legal safeguards for the security and privacy of Americans' personal health information.<sup>105</sup>

No matter how complicated and difficult these obstacles may seem, most of these issues could be solved by financial investment, technical advancement, managerial reorganization, and legal protections. These obstacles may not hinder a revolution if IT truly has the potential to bring about a revolution in society. The fundamental nature of IT must be reviewed to evaluate the truth of the concept of the "cyberspace revolution."

## V IT AND MODERN SCIENTIFIC THOUGHT IN HEALTHCARE

Modern scientific thought consists of four primary factors. This methodology is based on the doctrine of duality of human beings with both physical and mental dimensions. Modern scientific thought focuses only on the physical dimension of the human condition, and believes in linear progress. Consequently, the modern viewpoint holds that the development of science and technology is inherently good, and it welcomes more intervention of science and technology into human life. This way of thinking makes much of objective evidence and devalues ambiguous subjective judgment. Finally, it requires quantification and standardization.

Because of the doctrine of duality between the physical and mental worlds, modern biomedicine concentrates its attention on the physical nature of human beings, regarding only biological changes as causes of illness. The anatomical view that regards a certain biological change as a symptom of a specific disease prevails in modern biomedicine. IT is compatible with the anatomical view because they share a one-to-one specific cause-and-effect mechanism; a specific input automatically leads to a specific output in the IT realm. As long as medical science focuses its attention on humankind's physical dimension, IT works well with it. However, neither IT nor the anatomical view can successfully deal with the mental or the emotional dimensions of human beings, because this subjective realm is more complex, and shifts intricately and unexpectedly rather than linearly. IT has been developing quite rapidly, but its basic principles remain the same, and it remains less suited to the non-physical aspects of healthcare.

Telemedicine and CBPR sound quite revolutionary, but they are just the latest stages of technological development; the essence of modern scientific thought about healthcare remains the same. Telemedicine and CBPR utilize IT extensively to collect, analyze, organize, and disseminate scientific data to provide efficient healthcare services. They, however, handle objective biomedical data such as changes over time of blood pressure, blood sugar levels, electrical brain waves, the results of other medical tests, prescribed medications, and other data. The very information IT deals with falls in the realm of the physical dimension. Telemedicine and CBPR have increased the speed and efficiency of the currently-used process enormously, but they have not, and will not, change the fundamental content of the information. IT dramatically

changes the methodology, but not the substance of medicine. Consequently, the more physicians use IT, the further their modern scientific thought based on the doctrine of duality may be accelerated. With the development of IT, physicians may come to rely even further on objective, scientific data that deals only with the physical dimension of human beings. As a result, physicians will become increasingly isolated from humanity's emotional and spiritual health issues. A true medical revolution would expand medical science to incorporate the mental dimension of human beings, and this sort of revolution is simply impossible through the development of IT.<sup>106</sup>

Americans continuously seek more powerful medicine and believe in medical progress, while at the same time fearing that too much professionalization and segmentation in the medical field and the knowledge gap between physicians and patients threaten their autonomy in dealing with illness. In addition to this paradox, the growing number of uninsured people, the rise of medical costs, and the increase in malpractice cases in the United States in the 1980s precipitated a healthcare consumer movement that demands some control over the healthcare decision-making process. This movement is rooted in the general consumer movement in the 1960s started by Ralph Nader, which promoted consumer rights and individual autonomy.<sup>107</sup> In other words, the movement emerged as a way to control the linear progress of modern scientific thought.

Adoption of IT in the healthcare field is an extension of this consumer health movement.<sup>108</sup> IT is a tool for health service consumers to recapture their autonomy, but since IT is an infinite frontier, people continuously demand more, faster, and better technological development, assuming that technological intervention in healthcare is inherently good. This is the same kind of linear progress mindset found in modern scientific thought. Health service consumers seek simple text information at first. Then, they request multimedia information, more elaborate information, online direct communication with healthcare providers, and then continue to demand more and more information. Setting aside any value judgments of the concept of linear progress, the underlying concept of the current healthcare consumer movement based on IT remains the same as that of modern scientific thinking. Even though the healthcare consumer movement emerged as a countermeasure to the development of modern scientific thought, these two phenomena ironically share the same concept of linear progress. Hence, there is no fundamentally

qualitative difference between modern scientific thought and the healthcare consumer movement based on IT.

One of the characteristics of modern scientific thought in the healthcare field was the movement away from relying on subjective information and toward a reliance on objective evidence. Because of technological developments, physicians now obtain objective figures by medical tests, set the healthy standard levels for particular tests, and judge patients' conditions according to these established levels. In order to make objective decisions, quantification and standardization of the results of medical tests are indispensable. The introduction of IT into healthcare also promoted a wave of quantification, standardization, and regimentation, all elements of modern scientific thought.<sup>109</sup> Research on medical outcomes requires high-quality, coherent documents about diagnoses, treatments, and their outcomes. High-performance computers swiftly accumulate, quantify, and standardize these documents to build a database. This database enables effective research on medical outcomes, which provides information on the most cost-effective treatment. Without this development, neither DRG/PPS nor EBM would be possible. Objective quantification, standardization, and regimentation, some of the essential elements in modern scientific thought, are also prerequisites for the emergence of DRG/PPS and EBM.

No matter how rapidly and extensively IT develops in the healthcare field, its basic concept mirrors modern scientific thought. The development of IT is compatible with this way of thinking. Therefore, the application of IT in the healthcare industry will not bring about revolutionary transformations in this field.

#### CONCLUDING OBSERVATIONS

In these times, people take the "cyberspace revolution" or "information revolution" for granted without serious examination of the fundamental nature of IT. This case study has demonstrated that IT is simply an extension of modern scientific technology and that there is no qualitative difference between the concept of IT in the healthcare field and that of modern scientific method. IT in healthcare shares the doctrine of duality with modern scientific thought. Both IT and modern scientific thought are predicated on the concept of linear progress. IT drives physicians to rely further on objective, scientific data and to isolate themselves from patients. IT further promotes quantification, standardization, and

regimentation of health-related data. IT has not brought about any fundamental changes in healthcare. It is not from the substance but by the method that IT has dramatically altered the healthcare field.

### NOTES

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<sup>25</sup> Shizu Sakai, *Igakushi heno Sasoi* [*An Invitation to Medical History*] (Osaka: Shinryo Shinsha, 2000), 3; Heinrich Schipperges, *Chusei no Igaku* [*Medicine in the Middle Ages*] (Kyoto: Jinbun Shoin, 1988), 98.

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